Proceedings of Forum for University Scholars in Interdisciplinary Opportunities and Networking
Graduate School, Universitas Terbuka
https://conference.ut.ac.id/index.php/fusion

Scientific Reading Based Project (SRBP) through Inference Skills: an Exploratory Analysis in Natural Sciences Learning

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Abstract
Inference skills are fundamental to science process skills and play a vital role in fostering critical thinking in elementary science learning. However, many students struggle to integrate information and draw evidence-based conclusions. The Scientific Reading-Based Project model integrates scientific reading with project-based activities, offering students opportunities to interpret texts, design investigations, and communicate findings collaboratively. This study aims to explore the potential of SRBP in developing inference skills through an exploratory literature review. Relevant publications from 2018 to 2025 were collected from Scopus, Web of Science, ERIC, Google Scholar, and Garuda, and analyzed qualitatively by mapping SRBP syntax to inference indicators. Findings reveal that each SRBP stage contributes in distinct ways: Orientation supports pattern recognition, Science Reading enhances information integration, Design and Create develops hypothesis formulation, Progress of Project encourages data analysis, Analyze strengthens evidence-based reasoning, and Discussion and Communication promotes argumentation. SRBP offers a structured approach to developing conceptual inference skills in science learning. This review provides a conceptual framework for linking SRBP to scientific reasoning and highlights the need for future empirical studies with standardized instruments to validate its effectiveness.

Keywords:
Scientific Reading Based Project,
Inference skills,
Science process skills,
Natural Sciences Learning

1. Introduction

Inference skills, as an essential part of the science process, are vital for the development of critical and analytical thinking in elementary school students. Inference is the leading indicator of critical thinking, along with analysis, interpretation, and evaluation (Jusniar et al., 2025). This ability facilitates the drawing of data-driven conclusions and, theoretically, supports problem-solving and the understanding of complex issues (Geng et al., 2024). Relevant to science literacy, this skill conceptually enhances the quality of science learning. Teachers have a crucial role in guiding students through collaborative learning and challenging problems (Sutama et al., 2022).

Inference also plays an important role in reading comprehension and reasoning processes. Inference-making enables learners to integrate textual information with prior knowledge (Shepard-Carey, 2021) and to connect ideas across different parts of a text to construct coherent meaning (Freed & Cain, 2021). This ability functions as a higher-order cognitive skill that interacts with other components of comprehension, including syntactic knowledge and comprehension monitoring (Kim, 2020), Empirical studies further indicate that inference skills mediate the relationship between logical reasoning and problem-solving and serve as a significant predictor of both reading success and scientific reasoning (Schlatter et al., 2021).

The Scientific Reading Based Project is a learning model that combines scientific text reading activities with project-based investigation. This model emphasizes an in-depth understanding of concepts through science literacy activities, experiments, and collaborative discussions (Chrysti et al., 2021). Several studies report that SRBP has the potential to theoretically support students' critical thinking, problem-solving, and scientific skills (Nurrahman et al., 2025; Suryandari et al., 2021a; Suryandari & Sajidan, 2019). However, SRBP's specific contribution to the development of inference skills is still rarely comprehensively examined.

Science learning in elementary school plays a crucial role in shaping the understanding of natural and social phenomena. Increased effectiveness is achieved through the development of science process skills, specifically inference skills, which train students' critical and analytical thinking skills (Angelopoulos et al., 2023). Through this learning, students not only gain factual knowledge but also develop 21st-century skills such as independent learning and collaboration (Krajcik et al., 2023). Interactive, project-based, and technology-based learning models (mobile learning, augmented reality, and educational games) have been proven to be effective in increasing students' interest, motivation, and learning outcomes in understanding IPAS concepts (Suryandari et al., 2023; Syawaluddin et al., 2020; Wu & Sung, 2023).

Science learning can be integrated with the Scientific Reading-Based Project model, which incorporates scientific reading skills through project-based activities. This model encourages students to read scientific texts in depth, understand key concepts, and relate them to experiments or projects (Suryandari et al., 2021b). Students not only acquire information passively, but are also active in exploring and constructing their own knowledge through various sources, such as scientific journals, digital teaching materials, field experiments, and group discussions (Suryandari, 2019). This learning model conceptually supports the development of inference skills by engaging students in meaningful reading, investigation, and knowledge construction processes.

This article aims to explore the relationship between SRBP syntax and inference skill indicators based on findings from existing literature. The analysis maps how each stage of SRBP potentially supports the processes of identifying patterns, connecting information, drawing conclusions, and comparing data. This study provides a conceptual contribution to the discussion of science learning strategies that support students' scientific thinking skills.

2. Method

This study uses an exploratory literature review to examine the contribution of the Scientific Reading-Based Project to inference skills. This study was chosen because empirical research specifically linking SRBP to inference skills is still limited, so theoretical synthesis and empirical findings from the available literature are needed (Bahadoran et al., 2022).

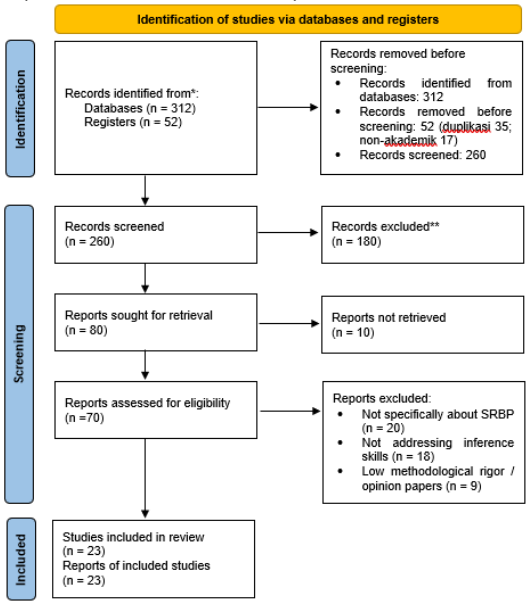

Figure 1
Prisma Flow Diagram

Literature was obtained from the databases of Scopus, Web of Science, ERIC, Google Scholar, and Garuda using the keywords "Scientific Reading Based Project", "SRBP model", "inference skills", "science process skills", and "elementary science literacy". The search was limited to publications from 2018 to 2025, while still considering relevant seminal sources prior to that period. Inclusion criteria include empirical or conceptual articles discussing SRBP, research related to inference skills, publications in Indonesian or English, and available in full text. Exclusions are given to non-academic articles, irrelevant publications, works without full access, and duplication of search results.

The selection process follows the PRISMA stages: identification, title/abstract filtering, full-text review, and final article selection. The analysis was carried out qualitatively, using article categorization, mapping the relationship between SRBP syntax and inference indicators, and thematic synthesis. Validity is maintained by using literature from indexed journals and triangulating sources.

3. Results and Discussion

3.1 Results

A literature review shows that the Scientific Reading-Based Project model is closely related to the development of inference skills in science learning in elementary school. Mapping is carried out by connecting the stages of SRBP syntax with identified indicators of inference skills, namely: (1) identifying patterns and relationships, (2) connecting information from various sources, (3) drawing data-based or observational conclusions, and (4) analyzing and comparing information.

Table 1
The Relationship of SRBP with Inference Skills

Syntax SRBP	Inference Skill Indicators	Supporting Literature
Orientation	Identify patterns and relationships from early phenomena	Mayhew et al. (2020); Yraguen et al. (2024); Feller et al. (2020)
Science Reading	Connecting information from multiple sources	Hartono et al. (2023); Cromley et al. (2020); Cheung et al. (2024)
Design and Create	Formulate initial inferences in the form of conjectures or hypotheses that can be tested.	Brüssow (2022); Nurrahman et al. (2025); van Dijke-Droogers et al. (2022)
Progress of the Project	Analyze and compare information from different data sources.	Zhang et al. (2024); Umisaroh (2022); (Ekici & Erdem, 2020)
Analyze	Conclude validly, distinguishing correlation and causality	Chakarvarti (2023); Hayati (2023); Roy (2022); Wagenmakers et al. (2023)
Discussion & Communication	Connecting information, building and evaluating evidence-based arguments	Wale & Bishaw (2020); Mukherjee (2024); Guest & Martin (2021)

The **Orientation stage** builds students' initial understanding of the concepts to be learned by introducing real phenomena and contextual problems. In this phase, students are invited to observe, identify, and describe patterns and relationships arising from environmental phenomena. This activity is the starting point in practicing inference skills, as students begin to learn to recognize the relationships between variables and connect apparent symptoms with scientific concepts (Mayhew et al., 2020). Research shows that providing authentic problems in the early stages of learning can enhance cognitive awareness in interpreting phenomena (Yraguen et al., 2024). Orienting towards tasks, media, or learning contexts can strengthen students' inference skills (Feller et al., 2020).

The **Science Reading stage** emphasizes the ability to understand scientific literature from various sources, such as research articles, textbooks, and digital media. This reading process encourages students to integrate information across sources to strengthen their ability to connect different perspectives in composing understanding (Hartono et al., 2023). Reading scientific texts in depth has been shown to improve the ability to identify important information, interpret implicit meanings, and synthesize ideas (Cromley et al., 2020). Learning interventions that emphasize content comprehension, critical

assessment, and epistemic evaluation can also improve students' ability to interpret implicit meanings and synthesize ideas from scientific texts (Cheung et al., 2024).

The **Design and Create stage** provides students with the opportunity to design projects or experiments based on the results of previous readings and discussions. This activity trains students to formulate initial inferences in the form of conjectures or hypotheses that can be further tested. According to Brussow (2022), preparing literature-based hypotheses helps students develop an evidence-based understanding. Project-based learning also provides students with space to express creativity while strengthening their ability to formulate logical, verifiable hypotheses (Nurrahman et al., 2025). Experiment-based learning designs help students understand the concepts of inference and develop hypotheses that can be tested systematically (van Dijke-Droogers et al., 2022).

The **Progress of Project stage** focuses on implementing the investigation or project design, involving data collection, observation, and initial analysis. This process trains students to compare various sources of information, sort relevant data, and test the consistency of their findings (Zhang et al., 2024). The ability to compare information from various data sources aligns with indicators of inference skills, as students are required to evaluate the validity and reliability of data (Umisaroh, 2022). The results of the study show that active involvement in scientific investigation improves science process skills, including data analysis and inference skills (Ekici & Erdem, 2020).

The **Analyze stage** is an important phase in concluding the data obtained. At this stage, students learn to integrate the results of observations with the theory or literature previously read. This process strengthens the ability to draw valid conclusions while also practicing critical thinking in evaluating findings (Chakarvarti, 2023). Biological Research (2023) shows that analytical activities encourage students not only to present data but also to interpret emerging patterns and trends. The analysis process must also distinguish between correlation and causality and quantify uncertainty so that the findings can be interpreted appropriately (Roy, 2022; Wagenmakers et al., 2023).

The Discussion and Communication stage provides a space for students to present findings, discuss arguments, and evaluate other perspectives. This process requires students to connect information from various sources, compare results with theories, and construct evidence-based arguments (Wale & Bishaw, 2020). Scientific discussions are known to be effective in developing inference skills, as students must interpret data, draw conclusions, and remain open to input from others (Mukherjee, 2024). In discussions, students should be able to build arguments based on available data, test the validity of models or hypotheses, and adjust their conclusions when new evidence or relevant viewpoints emerge (Guest & Martin, 2021).

3.2 Discussion

The results of the literature review show that each stage of the Scientific Reading Based Project contributes to a distinct dimension of inference skills. Table 1 shows how inference indicators can be mapped to each learning stage, and is reinforced by findings from various studies. The Orientation stage lays the foundation for the development of inference skills, as students are introduced to real phenomena that encourage them to identify patterns and initial relationships. Previous research has confirmed that orientation to context, media, and tasks can support cognitive awareness and the formation of initial inferences as a basis for critical thinking (Feller et al., 2020; Mayhew et al., 2020; Yraguen et al., 2024).

The Science Reading stage trains the skills of connecting information from various sources. The process of reading the scientific literature reinforces the integration of knowledge, both explicit and implicit, needed to interpret the text's implicit meaning. Studies show that learning that emphasizes content comprehension, epistemic evaluation, and critical judgment improves inference abilities in scientific reading (Cheung et al., 2024; Cromley et al., 2020; Hartono et al., 2023).

The Design and Create stage facilitates students to formulate initial inferences in the form of hypotheses or conjectures based on literature and discussion results. This activity is important because a hypothesis is an early form of inference skills that can be tested systematically. Research shows that experimental project design activities help students understand the relationships among variables while developing evidence-based thinking skills (Brüssow, 2022; Nurrahman et al., 2025; van Dijke-Droogers et al., 2022).

The Progress of Project stage emphasizes field investigation and initial data analysis. In this phase, inference skills are developed through activities such as comparing information, sorting relevant data, and testing the consistency of findings. Active involvement in investigations has been shown to

conceptually contribute to science process skills, including inference skills related to data validity and reliability (Ekici & Erdem, 2020; O'Neill, 2022; Zhang et al., 2024).

The Analyze stage is the core of inference development because students are asked to draw a final data-based conclusion, distinguish correlation from causality, and consider uncertainty in the research results. Studies show that critical analysis activities encourage students to interpret patterns, trends, and relationships between variables in more depth (Chakarvarti, 2023; Hayati et al., 2023; Roy, 2022; Wagenmakers et al., 2023).

The Discussion and Communication stage strengthens inference skills through discussion, presentation, and evaluation of arguments. This process requires students to integrate information, defend conclusions with evidence, and adjust their understanding if new data or perspectives emerge. Scientific discussion has proven to be an effective means of developing argumentative and inferential skills, as students must test the validity of the proposed model or hypothesis (Guest & Martin, 2021; Mukherjee, 2024; Wale & Bishaw, 2020).

Overall, these findings confirm that SRBP has strong potential to support elementary school students' inference skills. However, limitations persist in previous studies that tend to highlight creativity, collaboration, or critical thinking in general, while inference measurements are rarely conducted with standardized instruments. This gap underscores the need for more targeted empirical research, using valid instruments and experimental designs, to directly test the effectiveness of SRBP on inference skills.

This study does not aim to empirically test the effectiveness of the Scientific Reading Based Project model. Instead, it provides an exploratory conceptual analysis based on existing literature to map the potential contribution of SRBP to the development of inference skills in natural sciences learning. Therefore, the findings should be interpreted as a theoretical foundation for future empirical investigations.

4. Conclusion

This literature review shows that the Scientific Reading-Based Project model has strong potential to support elementary school students' inference skills. Each stage of the SRBP syntax makes a different contribution, from building an initial understanding through the introduction of phenomena, to strengthening the integration of information from the scientific literature, to formulating hypotheses in projects, to analyzing data and communicating evidence-based results. This mapping confirms that SRBP can train students to identify patterns, connect information, draw conclusions, and critically evaluate data. SRBP provides a conceptual contribution in the form of a framework of relationships among inference skills, as well as a basis for developing a more systematic science-learning strategy to build students' scientific thinking skills.

The results of the study also revealed limitations in previous studies that tended to focus on creativity, collaboration, or general critical thinking skills, while inference skills have not been widely researched with standardized instruments. These findings open the door to further empirical research to test the effectiveness of SRBP on inference skills, using experimental designs and valid instruments.

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