

Improving Science Process Skill in Science Subject in Elementary School

Novia G. Siagian, Sri Wardani, Nuni Widiarti, Agus Yuwono

Elementary Education, Postgraduate School, Universitas Negeri Semarang, Indonesia

*Corresponding author, e-mail: noviasagian@students.unnes.ac.id

Abstract

Elementary school plays an important role in shaping the mindset and skills of students, especially in developing science process skills. This review aims to identify and analyze research findings related to improving science process skills in elementary school students. This research is a literature review that aims to identify pedagogical approaches in improving the science process skills of elementary school students. The 15 articles analyzed, published between 2020-2025, were sourced from credible databases such as Google Scholar and Publish or Perish. The methods used included a quantitative approach to synthesize numerical data, as well as a qualitative meta-synthesis to integrate descriptive findings. The results of the study show that IPAS learning is still dominated by science aspects, with the application of scientific activities that are not yet optimal. Approaches such as discovery learning, ethno-STEM, inquiry-based learning, and simple practicum proved effective in improving science process skills, critical thinking, scientific argumentation, and learning motivation. The success of these strategies is strongly influenced by teacher efficacy, readiness of 4C-based assessment instruments, and policy support. This study recommends strengthening teacher competence and developing contextual learning as the key to optimizing science process skills in the Merdeka Curriculum.

Keywords: elementary school, IPAS, Merdeka curriculum, science process skills



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Introduction

Education is a shortcut to the future. The quality of society in the future is determined by how education is practiced. The future society is expected to be a society of excellence, character and culture. To shape it, education is carried out in stages. Each level of education has developmental tasks that must be achieved and related to the next level of education. So education is a long process, throughout the human life. The definition of education according to John Dewey is a process in forming basic abilities, both thinking / intellectual, feeling / emotional with the ultimate goal of forming human behavior. The basic abilities formed in education form skills for the continuity of life in the future (Darmayanti & Setiawati, 2022). To form it, education is carried out in stages. Each level of education has developmental tasks that must be achieved and related to the next level of education. Education in elementary schools has an important role in shaping students' mindsets, attitudes, and skills. Students are given the opportunity to develop critical and creative thinking skills, as they must think analytically and make decisions based on existing evidence (Kwangmuang et al., 2021).

Similarly, education around the world is constantly evolving to integrate modern pedagogical approaches that emphasize critical thinking, creativity and adaptability. Current educational practices in primary schools also integrate technology in the provision of materials and assessments. The most widely used platforms are Canva, Quizizz, goggle form. In other words, learners are already tech-savvy or digital natives. Technology presents opportunities for learning, it is important to address the underlying literacy challenges to ensure equitable access to educational resources. However, according to the PISA (Program for International Student Assessment) assessment of various countries' education systems. Based on the PISA rankings for 2022, Indonesia is ranked 69 out of 81 countries. This means that the level of interaction between Indonesian

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students and literacy is not in line. The Indonesian government through the Ministry of Education and Culture presents the Independent Curriculum as a solution.

The independent curriculum has significantly shifted educational practices, including a more autonomous and technology-integrated learning environment, especially in science education (Rahim et al., 2023). The main concepts implemented in the Merdeka Curriculum are phase-based learning, differentiated learning, and the application of the Pancasila Student Profile.

One of the learning that exists at the elementary school level is Science. Science learning in elementary schools is integrated in the curriculum structure under the name of Natural and Social Sciences (NSP). More specifically, IPAS subjects have one learning outcome in each phase which is divided into two learning outcomes based on IPAS learning elements (Waseso et al., 2024). Science lessons at the primary school level aim to equip students with the ability to think logically, analytically, systematically, critically, creatively, and be able to work well together. Science skills at the elementary level as a foundation for ability to further education (Muniroh et al., 2022). the purpose of learning science in elementary school, among others, aims to make students: 1) Develop curiosity and a positive attitude towards science, technology and society. 2) Develop process skills to investigate the surrounding nature, solve problems and make decisions. 3) Develop knowledge and understanding of science concepts that will be useful and applicable in everyday life. 4) Develop an awareness of the role and importance of science in everyday life. 5) Transfer knowledge, skills and understanding to other teaching fields. 6) Participate in maintaining, protecting and preserving the natural environment. Appreciate the various forms of God's creation in this universe to learn (Priyani & Nawawi, 2020).

Natural science can be divided into three categories, namely based on content, method, and process. The content category in science is divided into several aspects, namely facts, ideas, concepts, theories, and laws, while methods and processes are the main things used to build and develop attitudes and values based on scientific knowledge through scientific experiments and the need for student involvement and activeness during learning so as to produce a balance between skills and student learning interests (Inkinen et al., 2020). The aspects of process skills referred to in this study are limited to several indicators of basic skills and integrated skills. The basic skill indicators include observing, predicting, hypothesizing, calculating, and concluding skills. Integrated skills consist of identifying variables, tabulating data, presenting data in graphical form, describing relationships between variables, collecting and processing data, analyzing research, formulating hypotheses, defining variables operationally, designing research and conducting experiments (Syaifuddin et al., 2023). Science Process Skills are the ability of students to practice scientific principles to know correctly, gain and develop knowledge (Darmayanti & Setiawati, 2022).

Method

This type of research is a literature review. Literature review is a research method of identifying, evaluating and interpreting all relevant research results related to certain research questions, certain topics, or phenomena of concern. The journal articles used in this literature study were taken from several sources such as Publish or Perish and Google scholar with the condition that the publication year is in the range of 2020-2025, the journal is published in a credible source.

Literature review is the process of reading and analyzing various books, journals, and other texts related to the research topic to create writing related to the topic. (Pratiwi, Bella, Ichsan Budiarto, 2020). The population of this study is in the form of national and international journals that discuss improving science process skills in elementary school students. The research methods in this literature review are quantitative methods and qualitative methods. The quantitative method of literature review is used to synthesize research results with a quantitative approach. The qualitative approach in the literature review is used to synthesize (summarize) the results of descriptive qualitative research. The method of synthesizing (summarizing) the results of qualitative research is called meta sisntesis, a technique of integrating data to obtain new theories and concepts or a deeper and more comprehensive level of understanding. The steps for creating this review article are:

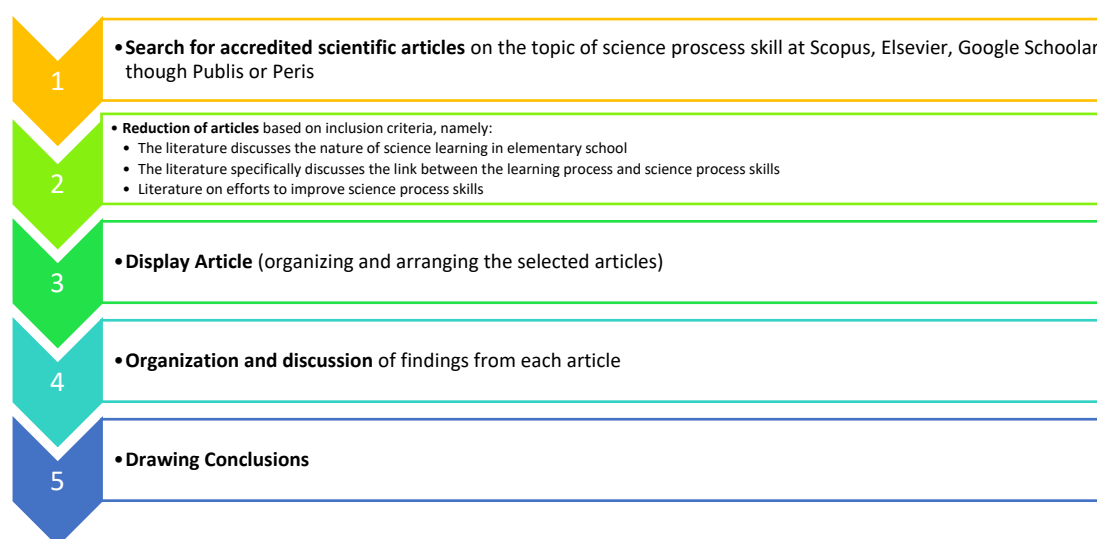


Figure 1. Literature study steps

Results and Discussion

a. The Nature of Science Learning in Elementary Schools

Science learning in elementary schools is better known as IPAS. IPAS learning is an integration of natural science and social science. In the IPAS subject, students carry out the science learning process in elementary school. More specifically, IPAS subjects have one learning outcome in each phase which is divided into two learning outcomes based on IPAS learning elements. The two elements are IPAS understanding and process skills that are adapted to the learner's learning phase. In Phase B, learners identify the relationship between the new knowledge they acquire and find out how the concepts of Natural and Social Sciences are interrelated in daily life in the surrounding environment. (Waseso et al., 2024)

Meanwhile, in fact, IPAS learning in schools is more inclined to science lessons and leaves out the social elements. IPAS learning also does not show a real difference in the practice of teaching science in the previous curriculum. This needs to be reviewed, otherwise learning will fail to achieve learning outcomes. In the current IPAS learning is also very minimal experimental activities for students.

b. Science Process Skills

In writing this literature review, 15 reputable national and international journals were obtained. The subject matter of the journals taken is about science process skills, and more specifically in elementary school students.

1. Improving Science Process Skills can be done with Discovery Learning

Research conducted by (Yuliati & Susianna, 2023). The results of the research that has been done show the development of improving students' science process skills. Students' insights and abilities are seen to develop and increase through direct student involvement in the learning process. Science process skills make students motivated to prove their curiosity with direct experience to observe, classify, and communicate the results of observations. Students also gain information and intellectual abilities through science process skills. In addition to the development of Science Process Skills, it was also found that the critical thinking ability and confidence of students increased.

Discovery learning directs students to learn from discovery activities. Science skills are strongly fostered in the implementation of discovery learning syntax. However, in practice in elementary schools, even though discovery learning has been implemented, the role of the teacher still dominates. So that the development of science skills is not maximized.

2. Science Process Skills can be improved with Ethno-stem learning.

Ethno-stem learning assisted by digital microscope makes the classroom atmosphere more fun and meaningful for students. The role of smartphone microscope can improve students'

psychomotor abilities or skills in assembling tools to help their understanding in optical material and smartphone microscope media is very suitable in STEM learning (Priyani & Nawawi, 2020). It was found that students have been able to recall the material. ethno-based learning can make it easier for students to understand concepts because students find examples in the surrounding environment.

STEM learning can be implemented at the elementary school level is a challenge for teachers in planning inventory-based learning to overcome the rampant lack of facilities in schools.

3. The influence of SCIENCE PROCESS SKILLS on the critical thinking skills of elementary school students.

The improvement of SCIENCE PROCESS SKILLS occurs through observation, the observation process requires accuracy to the surrounding environment, hypothesis formulation, experimentation, science process skills involve the design and implementation of experiments to collect data, analyze data, and conclude (Wiratman Arwan, Andi Muhammad Ajiegoena, 2023). The results of this study are corroborated that the development of students' critical thinking skills uses Constructivism theory which states that individuals build their knowledge through experience and interaction with the surrounding environment. the development of science process skills can help students to build knowledge and understanding of natural phenomena actively and interactively, so that they can develop better critical thinking skills. Also reviewed based on cognitive learning theory emphasizes that learning occurs through information processing and cognitive development.

The indicators measured in the form of critical thinking skills were also carried out by (Fitria, 2021) that science process skills are tools used by students to investigate the world around them and to build science concepts. The low level of students' science process skills is because students are rarely trained to discuss in learning subject matter or practical work.

4. Science Process Skills are related to students' argumentation skills.

The purpose of argumentation in science is to obtain the best idea or idea that connects claims and evidence clearly associated with existing theoretical principles and concepts. This research (B. Widodi et al., 2023) explains that students are able to argue well in line with their science process skills.

5. Striking Science Process Skills in Grade 6 Students

According to (Darmayanti & Setiawati, 2022), the most emerging science process skills based on student questionnaires one of which is asking questions. This can occur due to the responsive reciprocal interactions that learners establish with the teacher.

6. Science Process Skills Assessment Instrument

Development of 4c integrated Science Process Skills instruments. This development is necessary because the assessment of Science Process Skills can be used as a psychomotor assessment tool and 4c is used to answer 21st century challenges (Wardianti et al., 2023). The instrument is an observation sheet. The development steps include the first stage determining the purpose of instrument development, the second stage looking for relevant theory or material coverage, the third stage compiling instrument item indicators, the fourth stage compiling instrument items, the fifth stage validation, the sixth stage revision, the seventh stage, the eighth stage conducting analysis.

The instrument was developed against the background that science competence in primary school is the basis for student competence at higher levels (Muniroh et al., 2022). Students' competence on the theme of energy in elementary school needs to be known and measured so that students' competence can be better at the junior and senior high school levels. The discussion in the article aims to: (1) answer the formulation of problems and research questions; (2) show how the findings were obtained; (3) interpret the findings; (4) relate the research findings to the established knowledge structure; and (5) bring up new theories or modify existing theories.

7. The effect of teacher belief in inquiry learning on science process skills

The relationship between teacher efficacy and teacher belief in inquiry learning has a positive effect on students' science process skills (SPS) (Li et al., 2024). High teacher efficacy indicates

confidence in their ability to teach inquiry science, which can strengthen teaching effectiveness and improve students' learning outcomes, including their scientific process skills. In addition, teachers' trust in the inquiry approach (TSI) acts as a moderator, meaning that the higher the TSI, the stronger the relationship between students' creativity and their SPSs.

8. Improving science process skills in an independent curriculum

Phase B and C, they begin to relate scientific concepts to the phenomena around them and conduct experiments to test hypotheses (Waseso et al., 2024). The IPAS integrated learning concept raises challenges in improving science process skills in maintaining a balance between science and social studies materials. This finding shows that further adjustments are still needed so that the teaching of the two fields can go hand in hand and complement each other, without reducing the essence of each field. Phases A, B and C allow students to learn at their own pace, while gradually developing scientific process skills.

9. Improving Science Process Skills through simple practicum

Science practicum is carried out to improve students' science process skills, so that students can observe, classify, and conclude the results of observations to convey what students find. 1) observing is shown in the activities of students who have used their senses during the learning process, (2) questioning, can be seen a significant increase in student enthusiasm during teaching and learning activities so that students actively provide responses and questions after they observe practicum activities, (3) collecting information, in this section can be seen the activities of students who exchange opinions and look for information in books, (4) reasoning, in this section can be seen an increase in the activities of students who try to provide the results of their thoughts on the practicum activities, and (5) conveying at this stage students are asked to make a report on the results of the practicum activities as a whole and the teacher stimulates students to dare to convey their conclusions in front of the class. In this study, 4 simple practicums were provided that could be implemented in elementary schools (Ikhsan, 2020).

Conclusion

Based on the results of a literature review of various national and international articles, it can be concluded that science learning in primary schools, especially in the context of IPAS subjects, still faces various conceptual and practical challenges. Although IPAS is designed as an integration between natural and social sciences, the practice of its implementation in the field tends to focus on the science aspect, while the social dimension does not get an adequate portion. In addition, the implementation of learning that should emphasize scientific activities and science process skills is still not optimal, either because of limited media, teacher dominance in learning, or the lack of practicum activities.

The review shows that science process skills can be improved through various pedagogical approaches, such as discovery learning, ethno-STEM learning, inquiry-based learning, and simple practicum. These skills are not only important in building students' observation, classification and analysis skills, but also significantly contribute to the development of critical thinking skills, scientific argumentation skills, and increase learning motivation. In addition, there is a close relationship between teachers' efficacy and trust in the inquiry approach with the successful development of science process skill at the elementary school level.

The readiness of science process skill assessment instruments integrated with 21st century skills (4C) is also an important concern, considering that assessment is the main indicator in measuring meaningful learning outcomes. Therefore, it is necessary to improve teacher competence, develop adaptive learning tools, and support policies to integrate science learning practices that are more contextual, exploratory, and empower students as active learners.

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