

Implementation of Scientific Inquiry Approach for Enhancing Scientific Literacy among Elementary Students

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Abstract: This study aims to determine how scientific literacy in elementary school students is in science learning using the scientific inquiry approach. The method used in this research is library research or literature study that relies on bibliographical sources from various literature bases, books, and scientific articles. The results of this study show that scientific literacy through a scientific inquiry approach can deliver students to have scientific process skills and scientific attitudes and be able to communicate a problem scientifically. Scientific literacy is needed in science learning for elementary school students. In the Merdeka curriculum, the scientific approach emphasizes student-centered learning and emphasizes the process of inquiry through the stages of the scientific approach. The scientific inquiry approach is an activity where the teacher still determines questions and processes, but students produce an explanation that is supported by the evidence that has been collected. This approach can train students to become scientists in discovering the studied concepts.

Keywords: *scientific literacy, elementary students, scientific inquiry approach*

INTRODUCTION

Education is one of the keys to life, so basically, everyone needs education. The training aims to create qualified people. The acquisition of knowledge in the 21st century is a benchmark for the progress of the nation (Martinez, 2022; Meyer & Norman, 2020). In Indonesia, science is one of the subjects at the elementary level. Scientific learning is one of the most important lessons taught to students because, through science, students can become scientific. The goal of science education is to create young people who have adequate scientific literacy skills (Al Sultan et al., 2021; Ding, 2022; Marmoah et al., 2022). In learning science, the achievement of meaning must be obtained at this stage. The ability to use science and technology will lead to scientific literacy. Literally, science education consists of the words *literatus*, which means literacy, and *scientia* which means knowledge (Dragoş & Mih, 2015; Lawless et al., 2018). Scientific literacy can be defined as scientific knowledge and skills that can identify questions, acquire new knowledge, explain scientific phenomena, and draw conclusions based on scientific problems (Bauer & Booth, 2019; Udompong et al., 2014)

Literacy is critical and necessary for elementary school students in the 21st century. Scientific literacy makes it easier for students to adapt to the ever-evolving advances in science and technology.

According to Valladares (2021) and Wen et al. (2020), scientific literacy is knowledge and understanding that enables people to use their knowledge to make decisions by understanding scientific concepts and processes. Based on some of the opinions above, scientific literacy is an ability, skill, and competency possessed by students with knowledge and understanding of scientific concepts and processes to identify, master scientific phenomena, explain scientific phenomena, and draw conclusions regarding nature based on changes in nature through human activity. Based on the Programme for International Student Assessment (PISA) survey results from 2000 to 2018, Indonesia is one of the countries with low scientific literacy. In 2015, Indonesian students' PISA scores were below average (Beatty et al., 2021; Marmoah et al., 2022).

The average score for scientific literacy in Organisation for Economic Cooperation and Development (OECD) countries is 493, while Indonesia's score is only 403. This shows that there is a gap in the treatment of science education (Sánchez et al., 2019). Scientific literacy has begun to be accommodated in the curriculum, namely the Education Unit Level Curriculum (KTSP), the 2013 Curriculum, and the Merdeka Curriculum. The Indonesian national curriculum uses a scientific approach, where learning is student-centered and emphasizes the inquiry process through the stages of a scientific approach. Therefore, applying scientific literacy in education, especially in learning science is essential. The low student learning outcomes in science are, of course related to the science learning process which does not provide opportunities for students to develop their critical thinking skills. Learning science, which is still memorizing, has not been able to show aspects of science as learning that is in accordance with the nature of science. According to Moutinho et al. (2015) namely science is a way of thinking, science is a way of investigating, science is a body of knowledge, and science and its interactions with technology and society.

Scientific literacy ability is a fundamental skill that students must have, especially when studying science. Students' scientific literacy skills can be developed through student-centered learning, thus enabling students to apply scientific concepts learned to solve problems in their daily lives. Learning in schools is expected to develop into scientific learning with a scientific inquiry approach to student skills (Smith et al., 2022; Suduc et al., 2015). Cultivating students' scientific literacy in elementary school science teaching is an inevitable requirement of the development of the times. Elementary school students are the country's future and the nation's hope. Teachers should grasp this period of education in elementary school, penetrate scientific ideas in teaching management, guide students to develop a scientific and rigorous learning attitude and clear, logical thinking, fully integrate theory and practice and lay the foundation for ensuring students' learning effectiveness (Kaya, 2012). In elementary school science teaching, teachers should integrate various factors, summarize successful experiences in practice, use flexible and diverse means to enrich teaching content, expand teaching ideas, add vitality and vigor to the elementary school science classroom, cultivate students' optimism and good habits, gradually cultivate and enhance students' scientific literacy, let students' abilities be shown, personality be carried forward, guide students to a relaxed and happy It will guide students to learn knowledge and expand their thinking with a relaxed and happy attitude, enhance the comprehensive ability of elementary school students, promote their overall development, and better cultivate their core literacy.

METHOD

This type of research is descriptive qualitative research. The methods used in this research are literature studies, field observations and interviews. Data were obtained by reviewing articles from journals indexed by Google Scholar, ProQuest, Scopus, and Copernicus, as well as other sources related to research and also through observation and then concluded. Processing and analysis of data is done qualitatively with the help of descriptive descriptions. Literature study is a study conducted by researchers through a

collection system of a number of articulations related to research constraints and expectations. This method aims to identify various concepts related to the results discussed as reference material. Literature research is the most important stage of all types of research. Sources in this study cite books, journals, and research that has been completed. Literature review is a type of research that aims to find out the application of scientific literacy to elementary school students in science learning with a scientific inquiry approach..

RESULTS AND DISCUSSION

Perspective of elementary teachers towards science teaching

Based on the results of observations and interviews with classroom teachers at several elementary schools in Gunungsitoli, it was found that science learning in the classroom did not contribute to the development of students' scientific literacy. The lack of student assistance in developing scientific literacy can be seen from several things. First, learning science in schools does not depart from scientific phenomena that students are already familiar with. Second, science learning is not taught through scientific research in the form of meaningful experimental activities. Experimental activities carried out so far are generally in the form of verification experiments. Students are not taught how to design experiments to be carried out and how to define variables in experiments. Students try to carry out experimental activities, namely tests, according to the teacher's instructions. Third, science learning tends to emphasize aspects of understanding based on memory. Science education is still very rarely designed to develop analytical skills in the form of the ability to translate, connect, interpret and apply information based on scientific data sources. those taught to explain natural phenomena, as well as draw conclusions based on observed facts. Fourth, students are less trained to work on questions that foster scientific literacy skills. The instrument questions used in assessing students' skills have little to do with real life, so students are not given the opportunity to use the knowledge and science processes they have learned optimally.

In addition, teachers complained about changes in the curriculum that occurred. Curriculum changes that occurred in a short time had a confusing effect on teachers. This forces teachers to tend to be material oriented. Weaknesses of Indonesian students must be addressed immediately so that students have better scientific knowledge. One solution that is considered to be able to overcome these problems and improve students' scientific literacy skills is the application of an inquiry approach. The application of the inquiry approach in science learning should be carried out in a systematic, logical, coherent and gradual manner in accordance with the students' intellectual abilities and the content of the material being taught. The inquiry approach is applied systematically.

Science learning systematics in elementary schools

Science learning is one of the most important subjects because science can equip students with the ability to deal with advances in science and technology in the 21st century. Therefore, science learning in schools needs to be applied or implemented in learning. Science is essentially a product, process, attitude and technology. So that in science learning, students cannot just acquire knowledge, but students must actively participate in learning, such as finding out what needs to be known, proving that knowledge through a practicum or experiment then concluding and finally being able to create tools or technology that will later can solve problems in society. Science learning is used as an activity that has an impact on students' low scientific literacy abilities. This situation requires changes and improvements in the science learning process so that the achievement of meaningful learning outcomes for elementary school students prioritizes the achievement of context aspects, content aspects, process aspects and attitude aspects. Learning that focuses on achieving scientific literacy is learning that is in accordance with the

nature of science learning, where learning does not only emphasize rote knowledge, but is also process-oriented and achieves a scientific attitude. Therefore, learning must be carried out through scientific investigation to foster the ability to think, work and behave scientifically and communicate it as an important aspect of life skills. Providing hands-on experience through critical investigation helps students gain a deeper understanding of the natural world around them. There are several alternative learning models that are quite effective in building scientific literacy for elementary school students in the context of 21st century education. One of these learning models is inquiry learning with a scientific approach.

Cultivating students' scientific literacy in elementary school science teaching can help them develop the right attitude toward science (Mihladić & Duran, 2014). As the saying goes, "thought determines behavior", only when students have an interest in scientific knowledge and scientific activities and the desire to explore, they can consciously enter the depths of the subject, under the guidance of teachers and actively cooperate with their classmates, learn scientific knowledge, participate in scientific experiments, and feel the fun and charm of science in the experiment. In science literacy, scientific attitude is the most basic element, which can largely determine the direction of students' future development. By cultivating students' scientific literacy can implicitly influence students' learning attitude, provide guarantee for promoting students' overall development, and let students deeply cognize the meaning of learning scientific knowledge.

Scientific approach with inquiry model

In general, the scientific approach consists of many sequential steps, namely: observing, asking questions, gathering information, conducting experiments, processing data, and communicating results. The application of a scientific approach in learning is supported by the opinion Şimşek & Kabapınar (2010) and Suduc et al. (2015), that with a scientific approach students understand material using a scientific approach and learning is not just transferring knowledge from teacher to students. Learning with a scientific approach brings direct experience to students so that learning is more meaningful for students. Several learning activities that can be classified as learning with a scientific approach are inquiry-based learning, problem-based learning, project-based learning and authentic assessment of applying Inquiry learning in a scientific approach which will have a better impact on curriculum improvement and development (Pedaste et al., 2015). In a scientific approach must pay attention to learning. In this context, the scientific approach includes three learning domains, namely, knowledge (know that), attitude (know why), and skills (know how) (Kinchin, 2018; Spernes & Afdal, 2021). The syntax of the Inquiry learning model is as follows: 1) Problem orientation, this stage is the stage where students are first introduced to the community, 2) Formulating problems, this problem formulation includes challenges to find answers related to the issues raised, 3) Formulating hypotheses, the teacher asks students to temporary answers or temporary conjectures related to the problems discussed together, 4) Data collection stage, after students have a temporary suspicion of the cause of the problem, the next step students are asked to look for supporting data as a process of proving the hypothesis, 5) Testing the hypothesis, from the data collected, then used to test the hypothesis to be able to prove that the hypothesis is right or wrong, and 6) Draw conclusions, conclusions are obtained after all the steps of proof have been carried out. The conclusions that have been obtained can then be communicated to other students through presentations.

Scientific literacy assessment

Scientific understanding is divided into several dimensions, based on the OECD 2000 scientific understanding is divided into three dimensions, namely the dimensions of science content, science processes, and science context (Zheng et al., 2022). Content in scientific literacy includes material

contained in the curriculum. Process science refers to the mental processes involved when students solve problems. While the context is the field of application of scientific concepts. In accordance with this view, the assessment of scientific literacy is not merely a measurement of the level of understanding of scientific knowledge but also an understanding of various aspects of the scientific process and the ability to apply scientific knowledge and processes in real situations faced by students. By developing science process skills, then students will be able to find and develop a fact or concept on their own and cultivate the attitudes needed in scientific discovery (Gai et al., 2022; Ploj Virtič, 2022).

CONCLUSION

Based on this description, it can be concluded that scientific literacy is an ability, skill, competency possessed by students with knowledge and understanding of scientific concepts and processes to identify, master scientific phenomena, explain scientific phenomena, and draw conclusions regarding nature based on changes in nature through human activities. The results of the PISA survey from 2000 to 2018, Indonesia is one of the countries with low scientific literacy. In 2015, Indonesian students' PISA scores were below average. The average score for scientific literacy in OECD countries is 493, while Indonesia's score is only 403. This shows that there is a gap in the treatment of science education. Scientific learning invites students to observe various phenomena they are familiar with in everyday life. Based on the current development situation of education, teachers should strive to promote the simultaneous development of cultural teaching and quality education, pay attention to the cultivation of students' scientific literacy in elementary school science teaching, let students participate in rich and diverse scientific experimental activities based on solid mastery of theoretical knowledge, and fully integrate theory and practice. In order to achieve the teaching goals and ideal teaching effects, teachers should improve their own abilities, accurately interpret the connotation of scientific literacy, combine with elementary school students' learning. The teachers should analyze the current situation and summarize the successful experiences and scientific methods of cultivating students' scientific literacy in practice. In order to ensure the quality of teaching, teachers need to improve their ability to accurately interpret the meaning of scientific literacy, analyze it in the context of elementary school students' learning status, and summarize successful experiences and scientific methods for developing students' scientific literacy in practice. Through this observing activity, students are expected to be able to find problems related to the concept of knowledge they will learn. So it can be concluded that all learning activities in a scientific approach have the potential to increase students' scientific literacy.

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