

Implementation of Science Literacy in Science Study Courses for PGSD Students

Submitted: Arinta Rezty Wijayaningputri¹, Ima Wahyu Putri Utami²
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Accepted: arinta@umm.ac.id¹, imawahyu@umm.ac.id²
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Training and Education, University of Muhammadiyah Malang^{1,2})

Abstract: In the world of Science Education, Science Literacy plays an important role in preparing quality and competent students who are able to compete at the international level. To cultivate and improve science literacy in science education, lecturers must create a learning environment that actively involves students. Learning that is dominated by lecturer-centered methods, such as lectures and textbooks, produces passive learners, which can lead to boredom and lack of reasoning and knowledge in science literacy. This study aims to explore the implementation of science literacy in the Science Study Course for PGSD students. The methodology involves literature studies, field observations, and interviews. Data were obtained through reviewing articles, journals, and other relevant sources related to the research, supported by observations and interviews, and then analyzed qualitatively through descriptive descriptions. The results of the study show: (1) the implementation of science literacy facilitates students in understanding the material presented, namely the solar system through various activities such as reading scientific texts, writing scientific essays, creative activities or making posters, searching for information, reflection, presentations, discussions, and questions and answers, (2) supporting factors in the science literacy movement are the lecturers who teach, available facilities, scientific articles, and book references.

Keywords: Science Literacy, Science Study, PGSD Students

PRELIMINARY

The current Digital Era is experiencing very rapid development, especially. Science and technology (IPTEK) This has an impact on the development of education in Indonesia today. The rapid development of science requires humans to work to adjust to various aspects of life. In realizing increasingly advanced education, it must be supported by human resources (HR). One way to respond to this is with science literacy. In the 21st century, science literacy is thought to be the mainstay of education, because science and technology skills are the mainstay of citizen success (Asrizal et al., 2017). Science literacy skills are skills that must be created to face globalization, because they make students not only see, but also be able to apply scientific ideas appropriately to their daily activities (Rizkita, L., Suwono, H., & Susilo, 2016). Agree with the OECD that characterizes

science literacy as follows (1) individual logical information and the capacity to utilize information to distinguish problems, obtain new information, clarify logical wonders, and reach decisions based on truths identified with logical problems; (2) knowing the first quality of information that works from human demand; (3) being sensitive to science and innovation in forming materials, scientific and social climates; (4) the ability to be associated with problems and thoughts identified with science. So that logical ability is an expectation that must be obtained in subjects identified with science.

Scientific literacy can be interpreted as a person's ability to understand science, communicate science and apply scientific knowledge to solve problems, so that it can improve attitudes and sensitivity to the surrounding environment. Mastery and ability to understand science and technology in this digital era is an important role in the success of a nation's education. In Science Learning or science as one part of Education has an important role in producing and forming students who have the ability to think critically, logically, creatively, innovatively, and are globally competitive. Science learning is also expected to be the main foundation.

Education as a vehicle for students to get to know science more contextually and implement it in everyday life. So that scientific literacy becomes a must for every student. As stated that Natural Science (IPA) is one of the human ways that includes psychological activities, knowledge, and how to organize or measure, which can be tried again its validity is based on the behavior of curiosity, determination, and persistence carried out by individuals to embrace the secrets of the universe. Natural science deals with how to logically find out about the universe, so that science is not just a group domination of understanding in the form of facts, theories, and grounds, but also ways of discovery (van Noordwijk, 2021). Science teaching and learning activities focus on the real distribution of professionalism to students about development potential, allowing students to understand the natural environment through the process of discovery, which will help students gain experience about the natural environment. However, in a pandemic, science studies must be completed online or independently by students (Handayani & Jumadi, 2021). In science learning, science literacy has a very important role because it prepares students who are qualified, reliable, and able to compete with the international world. In order to create and develop science literacy in science learning, lecturers need to create learning conditions that involve student activity. Based on interviews with lecturers in

charge of elementary school science studies courses, it was found that learning that was only dominated by lecturers through lecture methods and textbooks only resulted in students becoming passive listeners and caused boredom for students. This boredom will later make students not have reasoning and knowledge about science literacy. The emphasis of science literacy is not only on the aspects of knowledge and understanding of scientific concepts and processes, but is also directed at the process of a person in making decisions and participating in community life. Science literacy in this century is no longer just the use of science and technology in understanding the universe. However, science literacy has levels, from the lowest science literacy called practical science literacy which refers to a person's ability in everyday life, as a consumer of science and technology products (Arief, 2015). This is related to basic human needs, namely food, health and housing or residence.

Scientific literacy can be interpreted as scientific knowledge and skills to be able to identify questions, acquire new knowledge, explain scientific phenomena, and draw conclusions based on facts, understand the characteristics of science, awareness of how science and technology shape the natural, intellectual, and cultural environment, and the willingness to engage and care about issues related to science (Narut & Supradi, 2019). According to Kristiyowati & Purwanto, (2019) stated that the series of scientific competencies needed in scientific literacy reflect the view that science is an ensemble of social and epistemic practices that are common to all sciences, which frames all competencies as actions. Scientific literacy according to PISA is defined as "the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity". According to Zuriyani, (2021), scientific literacy is a science and understanding of scientific concepts and processes that will enable a person to make a decision with the knowledge they have, and to be involved in matters of state, culture, and economic growth. According to Fitariya, (2018) stated that scientific literacy is the ultimate goal of science education in other words, science learning is given to students with the aim of forming students who are scientifically literate. Scientific literacy is the ability to use scientific knowledge, identify questions, and draw conclusions based on existing evidence in order to understand and make decisions regarding nature and changes made to nature through human activities. Noris and Phillip in (Cahyani &

Roviati, 2016) scientific literacy is used for various aspects including knowledge of the substantive content of science, understanding science and its applications, knowledge of science, freedom in learning science, scientific thinking skills, ability to use scientific knowledge in solving problems, participating intelligently in scientific issues, the nature of science, appreciation of science, the impact and benefits of science and critical thinking skills. Scientific literacy according to (Basam et al., 2016) is the ability to use knowledge, identify questions, and draw conclusions based on evidence in order to understand and make decisions regarding nature and changes made to nature through human activities. Based on several opinions above, it can be concluded that scientific literacy is an ability, skill, and competence possessed by students with knowledge and understanding of scientific concepts and processes to identify, obtain new knowledge, explain scientific phenomena, and draw conclusions regarding nature based on changes in nature through human activities.

Although science literacy learning develops following the direction of scientific development and social interaction, literacy-based science learning is not easy to do. According to Syofyan & Amir, (2019) put forward several common problems in science learning related to low science literacy skills, especially at the basic and secondary indicator levels. One indicator of dislike shown by students is the lack of connection between the content or material being studied, with things that happen in everyday life. In line with these conditions, future teachers will face major challenges in implementing global and quality indicators. Teachers must improve science literacy so that they can lead students to be oriented towards the construction of meaning, active learning, accountability, use of technology, increasing student competence, certainty of choice and living in a multicultural society (Syofyan & Amir, 2019). Science literacy is important for students to have for the following reasons: 1) understanding science offers personal fulfillment and joy, can be shared with anyone and 2) countries in the world are faced with questions in their lives that require scientific information and scientific thinking to make decisions and the interests of many people who need to be informed such as air, water and forests. Science understanding and abilities in science will also increase students' capacity to hold important and productive jobs in the future. Ownership of science literacy is very important, so it is also important to build students' science literacy from an early age, as the next generation in the future. One effort to do this can be done

by creating science learning that supports the creation of human resources who are scientifically literate. Science understanding and abilities in science will also increase students' capacity to hold important and productive jobs in the future. The business community needs ready novice workers (Setiawan, 2019).

Science literacy skills are basic skills that must be possessed by prospective elementary school teachers, especially in science learning. The scientific literacy skills of prospective elementary school teachers can be developed through learning that is oriented towards prospective elementary school teachers, so that prospective elementary school teachers are able to apply the scientific concepts they have learned in solving problems faced in everyday life. Based on the results of the PISA survey from 2000 to 2018, Indonesia is one of the countries with low scientific literacy. The PISA results for Indonesian students in 2015 alone were still below the average science score of OECD countries. The average science score for the scientific literacy domain in OECD countries is 493, while Indonesia has only reached a score of 403. This shows that there are several problems such as: (1) the low learning outcomes obtained by students are certainly related to the Elementary School Science Study course which has not provided opportunities for students to develop critical thinking skills, (2) at this stage the problems faced by prospective teachers in the application of scientific literacy are rarely trained to think at a high level in learning, weakness in conveying ideas, lack of insight in reading literature.

The objectives of the research to develop students' scientific literacy include: (1) Students have the ability to know and understand scientific concepts and processes needed to participate in society in the digital era, (2) Students have the ability to find or determine answers to questions that come from curiosity related to everyday experiences, (3) Students have the ability to explain and predict phenomena, (4) Students can identify scientific and information technology problems; (5) Students have the ability to evaluate scientific information based on the sources and methods used; (6) can draw conclusions and arguments and have the capacity to evaluate arguments based on evidence. Therefore, in the Elementary School Science Study course, it is expected to be able to apply or implement scientific literacy in learning. through the Elementary School Science Study course that integrates scientific literacy in it, it is expected to be able to develop students' abilities in facing advances in science and technology through scientific literacy learning.

Thus, from the background that has been explained, the author compiled an article entitled Implementation of Scientific Literacy in the Science Study Course for Elementary School Teacher Education Students.

METHOD

This type of research is descriptive qualitative research. The methods used in this study are literature review, field observation and interviews. Data were obtained from reviewing articles, journals and other sources related to the research and also through observation and then concluded. Data processing and analysis were carried out qualitatively with descriptive descriptions. Literature research is research carried out by researchers through a system of collecting the number of articulations related to obstacles and research expectations. This method is intended to reveal various concepts related to the results being discussed as reference material. Literature research is the most important phase of all types of research. Sources in this research cite from books, journals, and completed research. Literature review studies are this type of research, the purpose of which is to identify the implementation of scientific literacy in science learning.

RESULTS

Implementing scientific literacy in the Science Study course (Natural Sciences) aims to provide students with the ability to understand and master scientific concepts and processes needed to participate in society in the digital era. In addition, students are expected to be able to identify and overcome various problems that arise in their daily learning. With scientific literacy, students are expected to be able to meet the demands of the times by becoming competitive, innovative, creative, collaborative problem solvers, and have characters in accordance with the development of 21st century competencies.

Scientific literacy is considered a crucial element in determining the achievement of mastery of Science Education. However, its implementation must be supported by an interactive, inspiring, challenging learning process that is able to motivate students to actively participate in the learning process. Learning that prioritizes the application of scientific literacy is learning that includes the essence of learning, not only focusing on the accumulation of knowledge, but also on the integration of concepts, practices, and the development of scientific attitudes. Therefore, the application of scientific literacy needs

to be accompanied by scientific inquiry learning to stimulate critical thinking skills in students, enable them to overcome various challenges, and ultimately, gain a deeper understanding of their surroundings.

The implementation of the science literacy implementation guide was carried out on PGSD students of class B class 2023. Science literacy learning is learning that is based on the development of scientific knowledge skills in various aspects of life, finding solutions to problems, making decisions, and improving the quality of life. The steps for planning science literacy learning were adopted and adapted from the *Chemie im Context* or *Chik* project which was adjusted to the Holbrook science literacy-based learning criteria with 6 stages, including:

1. Contact stage

The material used in the implementation of this science literacy is the solar system. Students cannot distinguish between one planet and another. In addition to knowing the planets, it is hoped that students can recognize other celestial bodies, namely satellites, comets, asteroids. This is because it is important for prospective elementary school teachers to understand the basics of the solar system in order to teach the concept to students effectively. In this implementation, there are objectives that must be achieved. The learning objectives that must be achieved are:

- a. Students are able to explain the main components of the solar system
- b. Students are able to identify the unique characteristics of each planet
- c. Students are able to design simple learning activities about the solar system for elementary school students

2. *Curiosity Phase*

At this stage, students are given student worksheets (LKM) which contain questions related to issues or problems related to the material being studied. To work on LKM, students are formed into groups. In one class, it is divided into 6 groups. Each group has 9 members.

3. *Elaboration Phase*

At this stage, students explore the concept consolidation. Exploration is carried out until the questions at the curiosity stage can be answered. The exploration of the concept consolidation is carried out using various methods, including meaningful lectures, discussions, questions and answers, and reading

scientific texts. So that through this activity, students' abilities can be further explored, both in terms of knowledge, process skills, and values and attitudes.

4. *Decision Making Phase*

At this stage, joint decision-making is carried out from the problems that arise through LKM which are worked on in groups. At this stage, students search for information and reflect on what they have discussed through LKM. Furthermore, discussions and Q&A are carried out between lecturers and students so that the resolution of the problems that arise can really be understood by students properly. In addition, students also write conclusions related to important points from the discussions that are carried out

5. *Nexus Phase*

At this stage, students apply the context of the material learned into a creative activity in the form of a poster work. This stage is carried out so that the knowledge gained is more applicable and meaningful, not only in the context of learning but also outside the context of learning.

6. *Assesment Phase*

At this stage, students apply the context of the material being studied into a creative activity in the form of a poster work. This stage is carried out so that the knowledge gained is more applicable and meaningful, not only in the context of learning but also outside the context of learning. At this assessment stage, in addition to being carried out through LKM work, students are also asked to carry out literacy on related journals or scientific texts. From this journal or scientific text literacy activity, students are asked to write a scientific essay. The following is a photo of the results of the student poster. Learning that applies scientific literacy has succeeded in creating an interactive, inspiring classroom atmosphere and motivating students to actively participate.

The content analysis of the learning materials shows that scientific concepts are presented in an integrated manner, combining theory and practical applications. In addition, the scientific inquiry learning method provides students with the opportunity to develop critical and creative thinking skills in solving scientific problems. However, there are still several challenges faced in the implementation of scientific literacy, such as limited learning time and availability of resources. Therefore, greater efforts are needed

to improve the effectiveness and efficiency of the implementation of scientific literacy in the Science Study course for PGSD students. Several recommendations were also put forward, including increasing training for teaching lecturers, increasing access to learning resources, and developing a curriculum that emphasizes the development of scientific literacy. The implementation of scientific literacy in Elementary School Teacher Education (PGSD) students does not always run smoothly. Several obstacles that may be faced in the implementation of scientific literacy in PGSD students can involve the following aspects: Limited Understanding of Science Concepts: PGSD students who have difficulty in understanding science concepts in depth. This can be an obstacle in implementing scientific literacy, because scientific literacy requires a strong understanding of scientific principles. Resource Constraints: Schools or educational institutions may experience limitations in providing the resources needed to support science literacy learning. This includes textbooks, experimental equipment, or access to technology needed to support the use of learning media. Lack of Lecturer Pedagogical Skills: Lecturers or instructors who do not have adequate pedagogical skills in integrating science literacy into learning can also be a barrier. Lack of training or adequate understanding of science literacy strategies can hinder the effectiveness of implementation.

1. Lack of Student Motivation: Primary school teachers may not be fully motivated to develop scientific literacy, especially if they do not see the direct relevance of these skills to future teacher work. Low motivation can hinder active student participation and engagement.
2. Student Initial Literacy Level: Variability in the initial literacy level of PGSD students can be a challenge. Students with different literacy levels require a customized learning approach to ensure that all students can gain maximum benefits from science literacy.
3. Language Barriers: Limited understanding or language skills in PGSD students can also be a barrier. Especially if the learning material uses terms or language that are difficult to understand, this can hinder the understanding and implementation of science literacy.
4. Lack of Curriculum Support: If the curriculum of the Science Studies course is inadequate or does not provide sufficient support for the development of science

literacy, this can be a barrier. There needs to be comprehensive curriculum support to integrate science literacy into learning.

In overcoming these obstacles, it is important to involve lecturers, students, and other relevant parties in the planning and development of more effective strategies, as well as ensuring adequate resources and support.

DISCUSSION

The implementation of scientific literacy in the Science Study course for PGSD students aims to develop students' abilities in understanding and mastering scientific concepts and processes needed to participate in society in the digital era. Understanding related to science will also increase students' capacity to hold important and productive jobs in the future. Scientific literacy skills are basic skills that must be possessed by students, especially in science learning. Students' scientific literacy skills can be developed through student-oriented learning so that students are able to apply the scientific concepts that have been learned in solving problems faced in everyday life. This study shows that the implementation of scientific literacy has had a positive impact on the understanding of scientific concepts, especially in the solar system material and students' critical thinking processes which are carried out through several activities such as: meaningful lectures, discussions, questions and answers, reading scientific texts, and making posters. Although scientific literacy learning develops following the direction of scientific development and social interaction, literacy-based science learning is not easy to do. (Syofyan & Amir, 2019) put forward several common problems in science learning related to low scientific literacy skills, especially at the basic and secondary indicator levels, namely:

1. Use of Learning Strategies: The results of the study show that the teaching staff has successfully implemented various learning strategies that support the development of scientific literacy. Scientific, contextual, and problem-based learning (PBL) approaches are an integral part of the learning process. The existence of practical activities and field research also provides students with direct experience, allowing them to experience the scientific process directly. (Fitariya, 2018) states that scientific literacy is the ultimate goal of science education, in other words, science

learning is given to students with the aim of forming students who are scientifically literate.

2. **Integration of Scientific Concepts:** Analysis of the content of learning materials shows that scientific concepts are presented in an integrated manner, combining theory and practical applications. Thus, students not only understand the concepts theoretically but are also able to apply them in practical situations. This supports the development of knowledge transfer skills.
3. **Application of Scientific Inquiry Learning:** The importance of implementing scientific literacy accompanied by scientific inquiry learning to stimulate critical thinking skills in students is emphasized. This approach provides students with the opportunity to develop critical and creative thinking skills in solving scientific problems.
4. **Active Student Participation:** The implementation of science literacy successfully created an interactive, inspiring classroom atmosphere and motivated students to actively participate. The positive response of students to this learning approach reflects a high level of satisfaction with the implementation of science literacy.
5. **Challenges Faced:** Although the results of the study showed positive developments, there are still several challenges in the implementation of science literacy. Constraints such as limited learning time, availability of resources, and variability in students' initial literacy levels need to be addressed to improve the effectiveness and efficiency of the implementation of science literacy.
4. **Recommendations for Further Development:** Based on the results of the study, several recommendations are proposed, including increasing training for teaching lecturers in science literacy strategies, increasing access to learning resources, and developing a curriculum that emphasizes the development of science literacy.

Thus, the results of the study show that the implementation of scientific literacy in the Science Study course for PGSD students has had a positive impact and can be a basis for further development in improving the quality of science learning at the Elementary School Teacher Education level.

CONCLUSION

The conclusion of this study is that the implementation of scientific literacy in the Science Study course for PGSD students is effective. The urgency of this study is driven by the urgent need to improve the scientific literacy of PGSD students. Strong science education at the elementary level can help students develop a deep understanding of scientific concepts, build a logical and critical thinking framework, and develop evidence-based skills. Therefore, the development of this scientific literacy implementation guide will help PGSD students acquire the knowledge, skills, and strategies needed to teach science effectively in elementary schools. The implications of this study can provide a basis for the development of a curriculum that is more oriented towards scientific literacy in the context of elementary school teacher education.

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