JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Needs Analysis to Develop Learning Media Based on Scientific Literacy

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Received: May 20, 2024
Revised: September 18, 2024
Accepted: November 25, 2024
Published: November 30, 2024

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DOI: 10.29303/jppipa.v10i11.9190

Abstract: Encouraging students to become more proficient in scientific literacy is crucial. Biology is the study of living things and the phenomena of life in their surroundings. A person who literates science is prepared to engage in meaningful discussions about science and technology, which require competence to explain phenomena scientifically, to evaluate and design scientific research, and to interpret data and evidence scientifically. This research uses quantitative approaches with correlational type. The samples in this research were about 105 junior high school students in Bogor, Indonesia. The purpose of this study to analyzing the needs in developing science literacy-based learning media. The result show that scientific literacy score is 51 categorized in medium category. The results suggest a need for science literacy-based educational media to enhance students' science literacy. Hence, the development of instructional media grounded in scientific literacy is essential to enhance students' ability to engage with and comprehend complex scientific concepts.

Keywords: Junior high school; Learning media; Literacy; Scientific literacy; Student.

Introduction

Encouraging students to become more proficient in scientific literacy is crucial. Students who possess scientific literacy abilities will be capable of using the knowledge they have learnt to address difficulties in their daily lives. PISA defines science literacy as the ability to engage with scientific issues, and with scientific ideas, as a reflective citizen (OECD, 2023). A person who literates science is prepared to engage in meaningful discussions about science and technology, which require competence to explain phenomena scientifically, to evaluate and design scientific research, and to interpret data and evidence scientifically. This aspect of competence is known as the domain of science literacy. Moreover, The World Economic Forum has established science literacy as one of the sixteen life skills that students must possess. Literacy of science recognizes that it is essential to think and act, which requires control over thought and the use of scientific thought to find and solve social problems. Students need science literacy to understand things like environment, health, economics, and technology.

The PISA 2022 results showed that Indonesia had a decline of 13 points, was 383. From level 1b to level 6, 41.10% of Indonesian students were at level 1a, on the other hand, not one of Indonesia's students was able to reach level 5, let alone level 6 (OECD, 2023). It shows that Indonesian students still have low science literacy. Research indicates that the mean science literacy scores among Indonesian students are subpar, with a considerable number of students exhibiting performance at the minimal levels of proficiency (Novaristiana et al., 2019; Sutrisna & Anhar, 2020). The lack of scientific literacy in Indonesia reflects that students in Indonesia are largely unable to analyze and apply the concept to solve a problem. The deficient scientific literacy competencies of students are

How to Cite:
Fadlah, U., Pursitasari, I. D., & Rubini, B. (2024). Needs Analysis to Develop Learning Media Based on Scientific Literacy. *Jurnal Penelitian Pendidikan IPA*, *10*(11), 9846–9852. https://doi.org/10.29303/jppipa.v10i11.9190

significantly affected by the predominance of a teacher-centric pedagogical approach, the insufficient capacity of students to articulate scientific phenomena, and the scarcity of educational resources available to learners (Anggreni et al., 2020).

Learning that tends to memorize concepts, theories and laws alone causes students difficulty in applying knowledge gained in everyday life (Fitriani et al., 2014). Furthermore, the selection of learning models and methods that are not sufficient to develop students' science literacy skills (Cahyana et al., 2019; Razak et al., 2021; Seprianto & Hasby, 2023; Suhaimi et al., 2022; Taha & Cobanoglu, 2021). It shows that educating the public to literate science must be considered and must be the primary objective of any science education reform. Investigating the interconnections between scientific literacy within educational institutions and the contextual factors associated with these institutions, as evaluated through a variety of elements concerning students, educators, and administrative personnel, can elucidate the manner in which these variables are interconnected and function collectively to enhance the overall effectiveness of schools (Ding, 2022).

Biology is the study of living things and the phenomena of life in their surroundings. It is a branch of science education. Material in biology calls for a high level of intellectual comprehension. Contrary to popular belief, biology is not a topic that requires memorization. The biology study materials also contain laws, forecasts, and practical substitutes. Therefore, in order to change students' perception of biology from one that is based on memorization and would be forgotten after the exam, biology professors must be able to accurately communicate the subject matter. Cells represent the fundamental units of biological existence and are composed of billions of unique molecular entities (Beck et al., 2024).

Cells are one of the biological topics that high school pupils study. One topic that students still find challenging is cells. This is so that students can grasp the multitude of concepts that are included in the topic of cells. Pupils frequently have trouble comprehending not just the principles and functions of the individual sections of the cell, but also the parts themselves. In this case, the presence of technology plays an important role in its growth.

In the 21st century, which is also the digital age, is affecting the learning process of science. Science instruction remains one-way, from teacher to student, and has not yet been connected to real-world events in the surrounding environment (Mashudi et al., 2024). Teachers are expected to be creative and innovative in designing learning using appropriate technologies, such as computers, projections, simulations, web 2.0 tools, 3D printers, virtual laboratories, digital holograms, augmented reality (AR), and virtual reality. (VR). The significance of scientific literacy has increased in recent years as a result of swift progress in societal structures and technological innovations (Doshi et al., 2024).

Research aimed at improving the literacy of students in science can be done in a variety of ways, such as using Mobile Augmented Reality assisted STEM-Based Learning (Wahyu et al., 2020), using discovery learning (Pursitasari et al., 2019), developing E-LITE'S (Electronic Literacy of Science) (Fikri & Pursitasari, 2020), develops learning materials loaded with marine contexts (Pursitasari et al., 2019), fun science teaching materials (Pursitasari & Putikah, 2019), development of learning materials based on Socio-Scientific Issues (SSI) (Kartika et al., 2019), and the use of interactive multimedia (Natsir, 2023). All the research that has been done has been shown to improve the literacy of students in science.

The investigation underscores the insufficient levels of scientific literacy exhibited by Indonesian students, as demonstrated by the PISA 2022 findings, which indicated a marked deterioration. The study delineates particular deficiencies in instructional methodologies, resource availability, and student interaction with scientific principles. The manuscript advances the academic discourse by endorsing the creation of educational media that is explicitly rooted in scientific literacy, thereby enhancing students' understanding of intricate scientific principles. This methodology is deemed essential for rectifying the deficiencies in resources and the predominance of teacher-centric instructional strategies that constrain students' interaction with scientific inquiry.

The originality is situated in its contextual examination of scientific literacy within the Indonesian framework, the promotion of technologically sophisticated educational resources, and its significant contribution to empirical investigations concerning literacy-oriented educational strategies. Based on the above description, a needs analysis is required to develop instructional media that incorporates scientific literacy, as research in this area remains limited. Thus, this research is entitled "Needs Analysis to Develop Learning Media Based on Scientific Literacy".

Method

This research uses quantitative approaches with correlational type. Correlational research represents a category of nonexperimental investigation that facilitates the prediction and clarification of the relationships among diverse variables (Seeram, 2019). This research investigated the profile of scientific

literacy students and learning media. The respondents in this research were about 105 junior high school students in Bogor, Indonesia (Table 1).

Table 1. Number of research samples

School	Respondents
SMPN 1 Gegerbitung	43
SMPN 1 Klapanunggal	23
SMPN 2 Gunungputri	15
SMPN 3 Cileungsi	14

To find out the profile of literacy students are conducted analysis of library studies, interviews and tests. The study of the library is conducted by conducting a research study of relevant research variables, namely learning media and science literacy. Interviews were conducted with 32 science teachers to know the state of the students in the field as well as the obstacles in learning in an effort to improve literation of science students. Finally, a double-choice test was conducted to measure student literacy. The flow of the research is illustrated in the following figure 1.

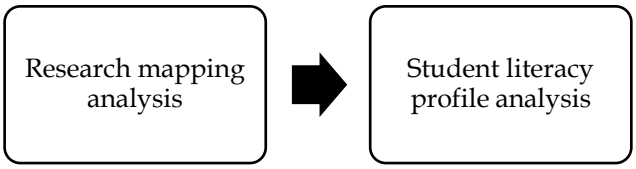

Figure 1. Research flow

The research mapping analysis was conducted using the Publish or Perish and VOS Viewer software. Publish or Perish was applied to 200 articles with the following keywords: literacy science, virtual microscope, cell, and technology, using the Google Scholar database. The flow of the research is illustrated in the following figure 1.

Result and Discussion

The data of scientific literacy is obtained through a test that is given to students of Junior High School. Scientific literacy plays a critical role in helping children comprehend what they study in school and has a significant impact on their cognitive capacities (Utami et al., 2022). The research conducted by Li & Guo (2021) highlights that over the past 20 years, the development of scientific literacy instruments in the context of both formal and informal education has been seldom specifically examined by academics, educators, and policymakers. Learning science will eventually lead to scientific literacy. Students receive test results on science in addition to tests on scientific literacy. Table 2 provides a detailed view of the average science results for the 51 with medium classifications. Table 3 displays the frequency distribution and percentage of learning outcomes.

Table 2. The results of student scientific literacy

N	Mean	Max	Min	Median	Standard of Deviation
105	51	100	15	56.25	1385

Table 3. Frequency distribution and percentage of scientific literacy

Score Interval	Frequency	Percentage (%)	Category
81-100	17	16	Very High
61-80	15	14	High
41-60	33	31	Medium
21-40	31	30	Low
0-20	9	9	Very Low
Total	105	100	

In Table 3, 31% of respondents demonstrate achievement in science within the medium category, corresponding to a score range of 41-60. The second highest was low category with percentage is 30% and the frequency is 31 students. The lowest percentage, 9%, falls within the very low category. According to Table 2, the mean scientific literacy score of students is 51, placing it in the medium category, indicating a need for further enhancement of scientific literacy.

Of the 105 students surveyed, 17 students (16%) were classified in the very high category of science literacy, while 15 students (14%) were classified in the high category of science literacy. It means, high category was the second lowest and very high category the third lowest of scientific literacy for junior high school students in this research. Based on the research conducted by Yuliana et al. (2021), the improvement in scientific literacy could be attributed to the fact that students in the experimental group engaged in hands-on activities, linked everyday problems to scientific concepts, and applied their schemata to solve new challenges.

To address the evident gaps in scientific literacy, it is essential to explore various instructional strategies that could enhance student engagement and understanding. For instance, integrating contextual learning approaches can significantly improve students' ability to relate scientific concepts to real-world applications, as evidenced by research indicating that students who engage with science in practical contexts show better outcomes in literacy assessments (Utami et al., 2022). A thorough comprehension of scientific literacy, which incorporates its multifaceted nature and various dimensions, necessitates at minimum the interdisciplinary integration of multiple domains of academic inquiry (Valladares, 2021).

According to the study conducted by Nuryanti et al. (2023), the low level of students' scientific literacy can be attributed to their difficulty in addressing questions that require the understanding and analysis of scientific concepts. This deficiency arises from students' lack of familiarity with higher-order thinking questions, as the assessments provided by educators in formative and summative evaluations predominantly focus on rote memorization rather than promoting analytical and comprehension skills. Individuals with scientific literacy skills possess the ability to explain phenomena scientifically, assess and design scientific investigations, and interpret data and evidence in a scientific context (Fauziyah et al., 2021).

Moreover, classroom instruction has yet to fully foster the development of scientific literacy. This is consistent with the study conducted by Ayuningtyas et al. (2023) which found that 67% of science teachers and junior high school students in Metro City perceive that active learning in the classroom has not yet contributed to the development of scientific literacy. This is due to the fact that the active learning process remains limited to theoretical focus and assigning tasks to students using existing learning resources without incorporating evolving technology.

One of the causes of the low level of scientific literacy is the students' lack of understanding of the questions given. This is in line with research conducted by Amala et al. (2023) which indicates that insufficient initial understanding among students in explaining scientific phenomena will impede their ability to analyze, evaluate, and draw conclusions on questions related to scientific literacy. Low scientific literacy suggests poor cognitive learning outcomes, as there is a positive correlation between the two (Kulsum et al., 2020). Scientific literacy emphasizes the meaningful application of scientific concepts to enhance students' understanding and knowledge (Khery et al., 2020). There is a necessity for educational media to improve students' science literacy. There is a critical need for educational media that is grounded in scientific literacy.

The results of interviews with 32 science teachers about subject matter and the use of learning media are shown in Table 4.

Table 4. The results of interview with 32 science teachers

Question	Respond	Quantity (%)
Is cell material easy to teach to students?	No	53
What kind of obstacles do you usually encounter in cell material?	Learning media	75
Have you used a learning media when teaching cell material?	Yes	87.50
If yes, what kind of media have you used?	Power point	59
Does the learning media help to improve science literacy?	Yes	50

As showed in Table 4 that the most difficult thing to encounter in learning process to improve science literacy is learning media. Based on the Table 4, the most used learning media is Power point with 59%. The media through which learning occurs has a significant impact on educational efficacy, as evidenced by research indicating a 72% beneficial effect on academic results when suitable media are employed (Lestari, 2022). According to research, PowerPoint instructional media can assist teachers in delivering material and support students in discovering and understanding lesson concepts, as it includes images, practicum videos, submicroscopic animations, and guiding questions on each displayed slide (Husna et al., 2022).

Additionally, 50% of the science teachers interviewed stated that learning media contributes to enhancing students' science literacy. This is evidenced by several studies conducted on learning media. The effectiveness of web-based learning media (Glideapps) in enhancing digital literacy was evaluated through large-scale group tests, yielding an average score of 0.78, or 77.57%, which is categorized as highly effective (Aprilia et al., 2023). Another study demonstrates that modern physics learning media, incorporating project-based learning and integrated with smartphones, is highly effective for enhancing students' creativity and scientific literacy (Susilawati et al., 2023). The utilization of Android-based educational media has the potential to enhance student engagement with natural science disciplines while simultaneously alleviating the common misconceptions regarding the challenges associated with the study of natural sciences that are intertwined with scientific literacy (Rosidah et al., 2021).

Conducting a thorough needs analysis not only identifies the specific requirements for developing effective learning media but also highlights the broader implications for educational practices in science subjects. In addition to enhancing scientific literacy, the integration of interactive learning media can significantly foster student engagement and collaboration.

Conclusion

Based on the result of the scientific literacy research it can be concluded that the average score of students' scientific literacy is still medium, which is 51. Hence, the development of instructional media grounded in scientific literacy is essential to enhance students' ability to engage with and comprehend complex scientific concepts. The results suggest a need for science literacy-based educational media to enhance students' science literacy.

Acknowledgments
The researcher expresses gratitude to principal, teacher, and students from SMPN 1 Gegerbitung, SMPN 1 Klapanunggal, SMPN 2 Gunungputri and SMPN 3 Cileungsi has contributed to the completion of this scientific article.

Author Contributions
There were several people who played a role in completing this research. Concept, main ideas and necessary materials, U. F.; designing and organizing the research methods, I. D. P. and B. R.; data collection, data tabulation and analysis, review process, and article writing, U. F, I. D. P, B. R.

Funding
This research was funded by Directorate of Community Service Technology Research, Ministry of Education, Culture, Research, and Technology based on SK No. 0459/E5/PG.02.00/2024; Contract No. 106/E5/PG.02.00.PL/2024; 004/SP2H/RT-MONO/LL4/2024; and 06/LPPM-UP/PTM/VI/2024 for the financial support given through Master Thesis Research funding scheme in 2024.

Conflicts of Interest
The authors declare no conflict of interest.

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