

# Analysis of Scientific Literacy Research in Indonesia as A Basis for Developing Ecotourism-Based Teaching Materials: Literature Review

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**Abstract:** Science and technology have an important role in facing educational challenges in the 21st century, so that science education, which is part of education, has an important role in preparing students to have scientific literacy. The aim of this research is to determine research trends regarding scientific literacy as a basis for developing ecotourism-based teaching lessons for junior high school students on Lombok Island. The study in writing this article used literature studies or literature reviews from several previous studies published in Scopus indexed journals or proceedings from 2017-2022. The 157 articles obtained were selected into 30 articles. Literature analysis and synthesis was carried out using bibliometric analysis with the Vos Viewer application. The research results show that a lot of research on scientific literacy has been carried out in Indonesia, and one of the types of research related to scientific literacy is the development of teaching materials because the development of teaching materials has quite a big influence in increasing students' scientific literacy. However, there is still no research on the development of ecotourism-based teaching materials in increasing students' scientific literacy in Indonesia, so research on this topic is important to do.

**Keywords:** Ecotourism; Scientific literacy; Teaching Materials

## Introduction

Science and technology have an important role in facing educational challenges in the 21st century, so that science education, which is part of education, has an important role in preparing students to have scientific literacy. Everyone needs information in everyday life as a reference for scientific thinking in making decisions and solving problems, so scientific literacy is very important to teach. Students with scientific literacy skills can apply the knowledge learned to solve problems in everyday life (S. N. Pratiwi et al., 2019). The capacity to

analyze an issue and make choices about a phenomenon is a function of scientific literacy (Fortus et al., 2022; Valladares, 2021). Unfortunately, the important role of scientific literacy and scientific argumentation skills is not accompanied by a good level of proficiency (Cavagnetto, 2010; Fakhriyah & Masfuah, 2021; Ika Noviyanti et al., 2019; OECD, 2016).

Good science learning outcomes cannot be separated from the teaching materials used during the science learning process in class. The science learning process should be an active learning process where the teacher acts as a learning manager who can select and

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determine teaching materials that suit student characteristics, material characteristics, instrumental factors, and the learning environment (Nurulloh, 2019). Professional science teachers are expected to be able to direct their students to explore science and technology in this competitive era of globalization. Therefore, meaningful science learning can empower students' scientific literacy, as well as prepare professional teacher candidates in science subjects.

Many studies on scientific literacy have been carried out in Indonesia. This is because based on the assessment of the Program for International Student Assessment (PISA), one of the international studies designed and programmed by the Organization for Economic Cooperation and Development (OECD), students' scientific literacy is in the lowest category. In 2009 Indonesia was ranked 60th out of 65 countries, in 2012 it was ranked 64th out of 65 countries, and in 2015 it was ranked 63rd out of 72 countries (OECD, 2016). The results of research conducted by (I. Budiman et al., 2021) shows that Indonesian students' literacy skills are still low, namely 29% for content, 34% for process, and 32% for context. In the context of the application of science, it is clear that many students in Indonesia cannot relate the scientific knowledge they learn to phenomena found in everyday life (Anshar et al., 2023; H. Budiman, 2017; Hidayati et al., 2023).

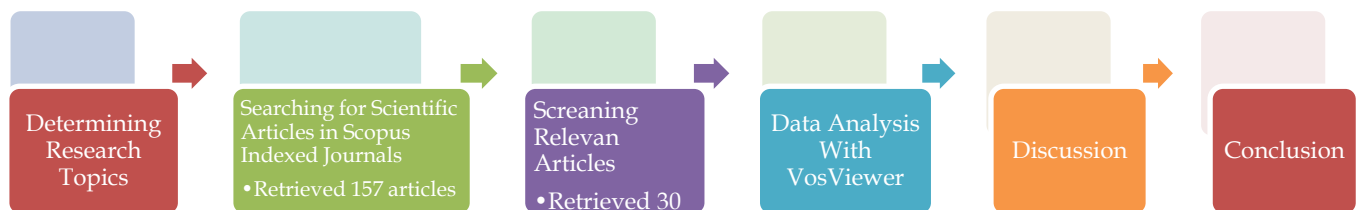
The low scientific literacy abilities of students in Indonesia are caused by several factors. The absence of good teaching materials for learning is one of the factors that influence low literacy. The scientific literacy abilities of students who use scientific literacy teaching materials can increase (Septiani et al., 2021). Low students' scientific literacy is influenced by several factors, including the curriculum and education system, the choice of teaching models and methods by teachers, learning tools and facilities, learning resources, and teaching materials that do not meet 21st century learning (Agustin et al., 2021; Irsan, 2021; Miharja, 2016; I. Pratiwi, 2019).

In this research, the teaching materials developed are ecotourism-based. Ecotourism is considered to be a suitable tourism alternative in developing the tourism sector (Agung & Alit, 2023; Harianto et al., 2020). The ecotourism concept continues to pay attention to environmental issues and involves local residents in its development (Kia, 2021; Siahaya et al., 2021; Sisriany & Furuya, 2020). Ecotourism is an activity oriented towards destinations, tourism resources, and the form of tourism activities organized (Willard et al., 2022). Thus, ecotourism-based teaching materials are teaching materials that carry the concept of ecotourism, namely paying attention to environmental issues and involving local residents in learning.

Based on the description above, it is very important to carry out an analysis of why students' scientific literacy in Indonesia is still low and what solutions should be taken to overcome this. In this way, a basic analysis was carried out by reviewing several research results that had been carried out with the aim of compiling teaching ecotourism-based materials to increase the scientific literacy of junior high school students in Lombok Island in particular and in Indonesia in general.

**Method**

The study in writing this article used literature studies or literature reviews from several previous studies published in Scopus indexed journals or proceedings from 2017-2022. The steps taken for journals to be reviewed include topic selection, searching and selecting articles according to topic, analysis and synthesis of literature using bibliometric analysis with the VosViewer application. The 157 articles obtained were selected into 30 articles (See Figure 1 for research flow). The discussion was carried out descriptively in research articles regarding the scientific literacy of students in Indonesia.



**Figure 1.** Research Flow

**Result and Discussion**

Scientific literacy research is a topic that is starting to receive a lot of attention in the academic field. This is

based on the importance of mastering scientific literacy for each person to solve a problem. One of them is related to scientific literacy in physics learning which is very important in living in the current era of science and

technology. During the period from 2017 to 2022, many scientific literacy research in Indonesia was published in reputable international journals and reputable international conferences. This number shows

researchers' interest in scientific literacy research in Indonesia. In Table 1, the analyzed research published in Journals or Proceedings indexed by Scopus is presented.

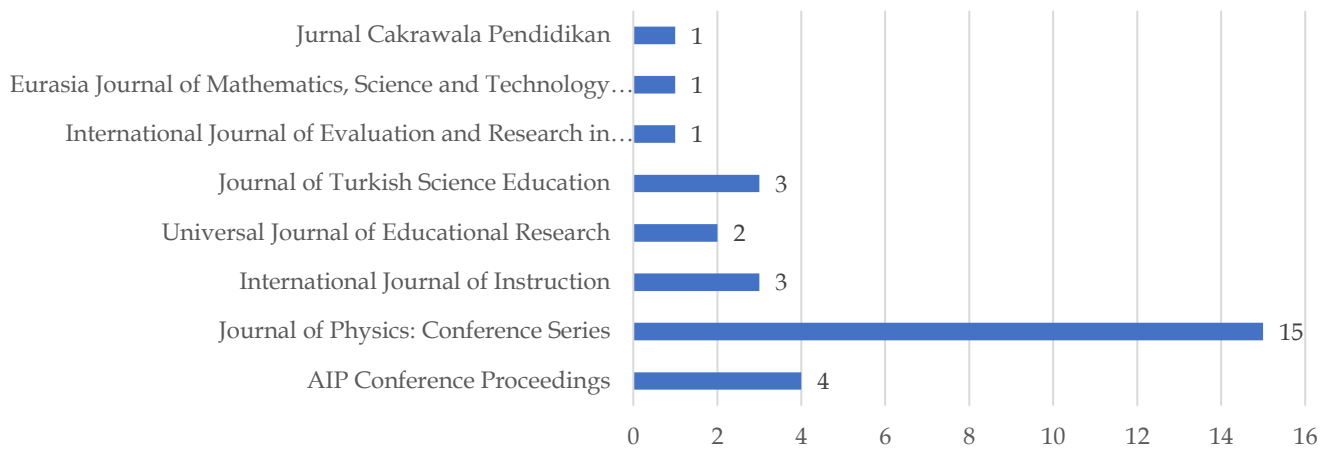
**Table 1.** Research Data on Scientific Literacy from 2017-2022 Published in Journals or Prosdings indexed by Scopus

Authors (Years)	Title	Publish in
(Marsuki et al., 2020)	Development of digital learning media based on android games with joyful inquiry model to increase science literacy skills for second year students of junior high school in subject matter of vibration	<i>AIP Conference Proceedings</i>
(Amaringga et al., 2021)	The effect of problem-based learning module containing research results to improve students' scientific literacy	<i>AIP Conference Proceedings</i>
(Mawaddah et al., 2021)	RICOSRE: An innovative learning model to promote scientific literacy	<i>AIP Conference Proceedings</i>
(Retno et al., 2018)	Properness test: Development of an inquiry-based learning module to improve science literacy in thermochemistry subject	<i>AIP Conference Proceedings</i>
(Adriyawati, 2020)	Steam-project-based learning integration to improve elementary school students' scientific literacy on alternative energy learning	<i>Journal of Physics: Conference Series</i>
(Deta et al., 2019)	The Scientific Literacy Profile of Tsunami Disaster Mitigation of Non-Science Undergraduate Students at Surabaya State University	<i>Journal of Physics: Conference Series</i>
(Hufri, 2019)	Validation analysis of physics teaching materials based on contextual through inquiry to increase student's science literacy	<i>Journal of Physics: Conference Series</i>
(Murti et al., 2018)	The Analysis of High School Students' Science Literacy Based on the Nature of Science Literacy Test (NOSLiT)	<i>Journal of Physics: Conference Series</i>
(Parno et al., 2020)	The impact of STEM-based guided inquiry learning on students' scientific literacy in the topic of fluid statics	<i>Journal of Physics: Conference Series</i>
(Puspaningtyas et al., 2020)	Analysis on readability of scientific literacy enrichment book on earth science concept.	<i>Journal of Physics: Conference Series</i>
(Rusilowati, 2019)	Investigating scientific literacy of students on the topic of water pollution through STEM based 6E learning by design	<i>Journal of Physics: Conference Series</i>
(Rusilowati, 2018)	How to improve students' scientific literacy	<i>Journal of Physics: Conference Series</i>
(Rusilowati, 2018)	The development of scientific literacy assessment to measure student's scientific literacy skills in energy theme	<i>Journal of Physics: Conference Series</i>
(Taxwim et al., 2019)	Strengthening scientific literacy on nuclear reactors and its application through Nuclear School	<i>Journal of Physics: Conference Series</i>
(Suryanti, 2018)	Process skills approach to develop primary students' scientific literacy: A case study with low achieving students on water cycle	<i>Journal of Physics: Conference Series</i>
(Wati, 2017)	Science Literacy: How do High School Students Solve PISA Test Items?	<i>Journal of Physics: Conference Series</i>
(Widiyawati, 2020)	Global warming & climate change: Integration of socio-scientific issues to enhance scientific literacy	<i>Journal of Physics: Conference Series</i>
(Yuliati et al., 2021)	Concept acquisition and scientific literacy of physics within inquiry-based learning for STEM Education	<i>Journal of Physics: Conference Series</i>
(Yuniar et al., 2020)	Triggering Students' Scientific Literacy through Static Fluid Scrapbook.	<i>Journal of Physics: Conference Series</i>
(Adnan, 2021)	Scientific literacy skills of students: Problems of biology teaching in junior high schools in South Sulawesi, Indonesia	<i>International Journal of Instruction</i>
(Cahyana et al., 2019)	The influence of web-based learning and learning independence toward students' scientific literacy in chemistry courses	<i>International Journal of Instruction</i>
(Wahyu et al., 2020)	The effectiveness of mobile augmented reality assisted STEM-based learning on scientific literacy and students' achievement	<i>International Journal of Instruction</i>
(Adriyawati, 2020)	Steam-project-based learning integration to improve elementary school students' scientific literacy on alternative energy learning	<i>Universal Journal of Educational Research</i>
(Ekantini, 2018)	The development of science student worksheet based on education for environmentally sustainable development to enhance scientific literacy	<i>Universal Journal of Educational Research</i>
(Dewi, 2021)	Effect of Contextual Collaborative Learning Based Ethnoscience to Increase Student's Scientific Literacy Ability	<i>Journal of Turkish Science Education</i>
(Safrizal et al., 2022)	Developing Students Science Literacy in Adiwiyata School: Case Study in Padang City, Indonesia	<i>Journal of Turkish Science Education</i>

Authors (Years)	Title	Publish in
(Zahara & Atun, 2018)	Effect of science-technology-society approach on senior high school students' scientific literacy and social skills	<i>Journal of Turkish Science Education</i>
(Islami, 2020)	Comparative study of scientific literacy: Indonesian and Thai pre-service science teachers report	<i>International Journal of Evaluation and Research in Education</i>
(Suwono et al., 2022)	The Development and Validation of an Instrument of Prospective Science Teachers' Perceptions of Scientific Literacy	<i>Eurasian Journal of Mathematics, Science and Technology Education</i>
(Yusop et al., 2022)	The scientific literacy performance of gifted young scientist candidates in the digital age	<i>Journal of Educational Horizons</i>

Based on Table 1, most of the research on scientific literacy in Indonesia was published in the Journal of

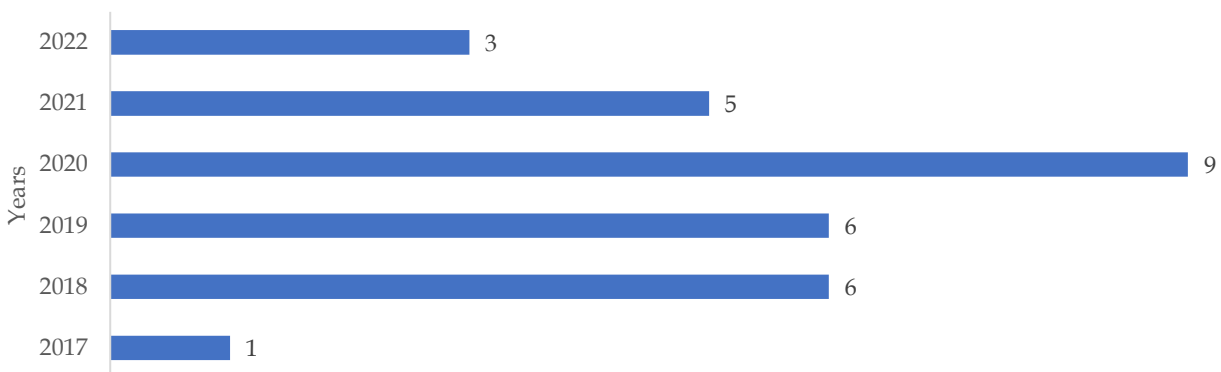
Physics: Conference Series. The distribution of data by publisher can be seen as in Figure 1.



**Figure 1.** Data on the Number of Researches on Scientific Literacy Based on Publication Location

Based on Table 1, from 2017 to 2022, the highest number of publications about scientific literacy in Indonesia occurred in 2020 (Figure 2). In 2020, there were cases of Covid-19 virus infection which spread throughout the world and became a pandemic. The Covid-19 pandemic has become a non-natural disaster in

this world so that activities have become paralyzed and have to be done from home (work from home). The large number of Covid-19 sufferers among children at that time caused a lot of research to be carried out, one of which was about students' scientific literacy.



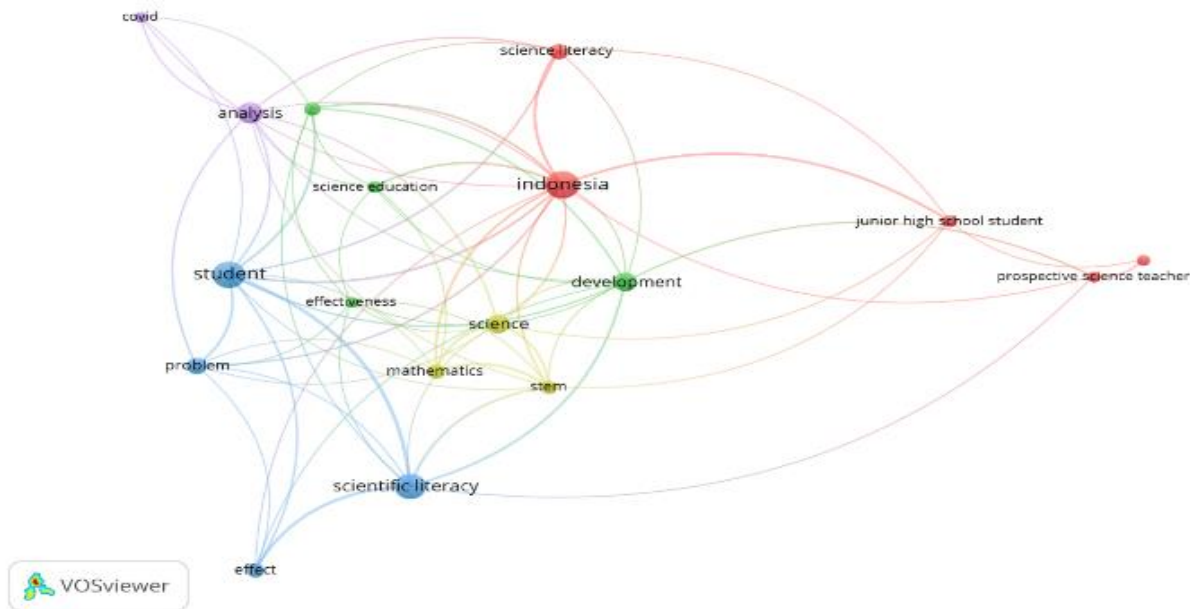
**Figure 2.** Number of Samples of Scientific Publications on Scientific Literacy in Journals indexed by Scopus in the period 2017-2022

Scientific literacy requires someone to have knowledge in explaining, explaining and predicting

natural phenomena (Eviyanti et al., 2022). Someone who has scientific literacy means being able to read articles

about science with understanding (Azaly, 2022; Fa'idah et al., 2019; Septiani et al., 2021). Understanding scientific literacy leads a person to always have the capacity to use scientific knowledge, identify questions and to draw conclusions based on evidence in order to

help and make decisions (Abidin et al., 2021). Scientific literacy will help students understand the importance of health protocols and vaccinations during the current pandemic (Zahroh & Yuliani, 2021).



**Figure 1.** Results of analysis of the relationship between scientific literacy and other indicators using Vos Viewer

Based on Figure 1, it is clear that research in Indonesia related to scientific literacy has a relationship with other indicators. Some research on scientific literacy is in the form of analytical research and was conducted in junior high schools. Apart from that, research on science iteration that has been carried out in Indonesia is in the form of development research with the object of attention being students in junior high schools. According to research results (Wahyu et al., 2020), there are differences in students' literacy results and science achievements between students taught using STEM-based learning assisted by mobile augmented reality and students taught using conventional learning. Research findings Ekantini, (2018) also shows that the science worksheet with the EESD approach is theoretically valid according to the validator with an A grade (very good category), and is effective for increasing students' scientific literacy. The integration of STEAM-PjBL into science learning encourages students to see the relevance of science knowledge to phenomena in everyday life, develops curiosity and problem solving, and increases students' courage to ask questions and explore various sources to find information (Adriyawati, 2020).

In research conducted by Suryanti, (2018), it was found that there was an increase in students' scientific literacy abilities when learning used a process skills

approach. Apart from that, students' scientific attitudes are also increasingly positive. In science learning activities, students must be challenged as often as possible so that they get more practice using their scientific knowledge and skills to solve problems presented by the teacher in class. Research result Dewi, (2021) shows that students' overall achievement of science content, processes and attitudes has increased with ethnoscience-based contextual collaborative learning.

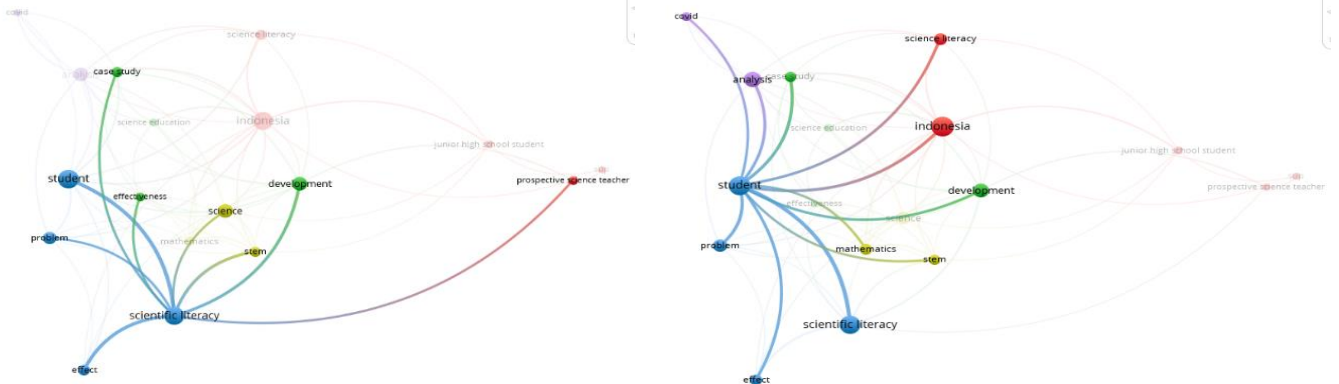
Based on the results of this research, several studies on scientific literacy are related to the development of teaching materials. This shows that the development of teaching materials has quite a big influence in increasing students' scientific literacy. However, unfortunately, from several previous research results there is nothing specific about creating environmentally based teaching materials.

Learning scientific literacy is the most important part in determining the achievement of science education in schools. Of course, it must be accompanied by a learning process that is interactive, inspiring, fun, challenging, and can motivate students to participate actively in the learning process (Eviyanti et al., 2022). Learning that focuses on scientific literacy is learning that is in accordance with the nature of science which is not only oriented towards knowledge but also towards



the process of integrating concepts and practice as well as the achievement of a scientific attitude (Sayekti, 2019). Therefore, the application of scientific literacy must be balanced with scientific inquiry learning to foster critical

thinking skills in students so they are able to solve all existing problems so that students will gain a deeper understanding of the natural surroundings.



**Figure 2.** Network of Research Relationships on Scientific Literacy with Other Indicators

Science as a form of integration of the fields of biology, physics, chemistry and biology discusses various topics of problems related to everyday life (Ali, 2018). Scientific literacy by utilizing the environment can be applied to material about living things and their life processes (Jannah et al., 2019). Students are invited to observe the characteristics of the living creatures they see, what their needs are, where their habitat is and so on. Observation results can be written down and matched with the subject matter being studied. After making observations Students can also carry out experiments to prove the concepts stated in the book. Simple observations can not only be made on living things, but can also extend to other materials such as forces, ecosystems, energy changes in form, and so on. All things related to scientific literacy can be learned through simple observation.

Learning using the environment as a learning resource is known as the environmental approach. Learning scientific literacy through an environmental approach can be done by bringing students to the environment for learning activities and bringing resources from the environment to school for learning purposes (Amin et al., 2020). Learning by utilizing the environment as a learning resource is contextual learning (Sudirgayasa et al., 2021) namely a learning concept in which the teacher brings the real world into the classroom and guides students to make connections between the knowledge they have and its application in everyday life.

### Conclusion

Based on the results of the analysis, research on scientific literacy is carried out quite often. The low scientific literacy of students requires that research must

continue to be carried out, one of which is developing teaching materials. Learning using teaching materials will make it easier for teachers to carry out their teaching duties, because with teaching materials, students can interact directly with their environment. The development of teaching materials has quite a big influence in increasing students' scientific literacy. However, unfortunately, from the results of several previous studies there was no specific research to develop Ecotourism-based teaching materials. Thus, research on developing ecotourism-based teaching materials to increase students' scientific literacy is very important to carry out.

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