

# Review: Integrated Scientific Literacy on Natural Science Learning

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**Abstract:** This literature review reveals the journal publication on integrated scientific literacy in natural science learning. A systematic review was carried out through a modified and adopted items selected for the systematic review and meta-analysis (PRISMA). The articles with integrated scientific literacy have been detected in a number of journals, such as ERIC, SCIENCE DIRECT, IJSE, SE, JRST, IOP SCIENCE, DOAJ, and Springer, using the keywords of "Science Literacy teaching materials." The results suggest that the number of studies on integrating scientific literacy learning materials from 2016 to 2020 is still low, so that the opportunity for its development remains wide.

**Keywords:** learning material, scientific literacy, natural science learning

In science learning, learning material holds an essential role. It is a tool that facilitates students to learn crucial or new competencies to master proficiency comprehensively (Atika Mappiara et al. n.d.). Learning material is divided into two types, the printed and electronic material. The electronic material can be in the form of video or Powerpoint presentation, while the printed material can be in the form of textbooks, students' worksheets, or modules (Aydin and Aytakin 2018).

The purposes of the learning material implementation in natural science learning are to motivate the students (Sari, Sunarno, and Sarwanto 2018) and improves students' cognitive, psychomotor, and affective skills. Within the learning materials, the author usually includes characters or materials that enhance students' reasoning ability, as intended by the teachers. One of the skills added to the learning material is scientific literacy. PISA (2017) (Mudzanatun 2017) defines scientific literacy as the ability to use scientific knowledge in identifying problems and drawing conclusions according to the evidence, in comprehending or making decisions related to nature or its transformation through human activity.

In natural science learning, scientific literacy is eminently required in this 21<sup>st</sup> century (Susiani 2019) because it prepares students with the skills needed in this era. The students are trained to provide the evidence for their argumentation, make

decisions, and use scientific processes to understand natural phenomena.

A study on scientific literacy carried out by Masyruhan, Pratiwi, and Al Hakim (2020) describes that scientific literacy is one of the skills required in the 21st century since it affects the education quality that helps countries compete in the globalization era. Another study on improving students scientific literacy in natural science learning conducted by Dhieta Dewi Utami (2018) shows that students' scientific literacy can be expanded by implementing the proper scientific learning model and approach that accentuate the behavior, idea, and skills development process, focusing on the scientific discovery approach. Besides, the teacher should also provide scientific literacy-based evaluation instruments. Meanwhile, the students have to have high interest, motivation, learning intensity, and scientific behavior that should be continuously developed.

In addition, there is also research on the media used to improve scientific literacy. This study uses multimedia to accelerate scientific literacy with the 4D developmental model from Thiagarajan. The model consists of define, design, develop, and disseminate. The extended learning multimedia consists of animation, video, pictures, and texts visualizing the interactive biodiversity concept. Its effectiveness test shows that natural science learning

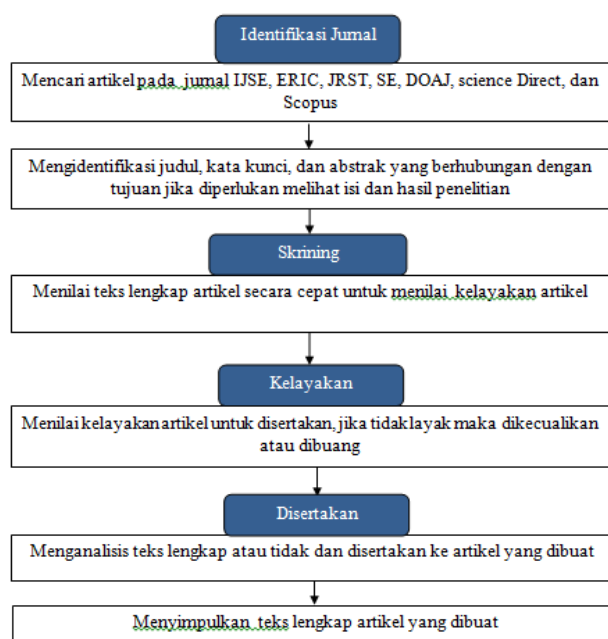
multimedia increases students' scientific literacy. Besides, this study is being supported since the developed learning media improves students' cognition (Rahaded and Widodo 2019) in scientific literacy.

The amount of research on natural science learning materials from 2016 to 2020 is relatively small. From eight scope of journals, only six journals provide articles on integrated scientific literacy. The research that involved scientific literacy focuses on improving the curriculum in helping students to increase their scientific literacy.

The keyword of "scientific literacy teaching materials" was used in the journals of ERIC, SCIENCE DIREC, IJSE, SE, JRST, IOP SCIENCE, DOAJ, and Springer. The results show that journal ERIC, Science Direct, and Springer have the highest number of articles related to scientific literacy. The highest number of scientific literacy materials articles (3,716) have been obtained from ERIC journals, while the lowest number of relevant articles and books (61) is detected in the IOP SCIENCE. The data collected in this study involve (1) the trend of research on integrated scientific literacy; (2) the trend of research on integrated scientific literacy from 2016 to 2020; (3) the countries that conduct research on integrated scientific literacy material; (4) the scientific journals that publish articles on integrated scientific literacy materials at most.

## METHOD

This study investigated the scope of research in integrated scientific literacy systematically. The systematic review was carried out using a modified procedure adopted from Item Selection for Systematic Review and Meta-Analysis Statement (PRISMA) (Wiyanto, Saptono, and Hidayah 2020). The design consisted of four primary stages of identification, screening, advisability, and inclusion. The research procedure in this study is presented in Figure 1.



Gambar 1. Prosedur penelitian

## Figure 3. Research methods

In the identification stage, the article exploration was carried out by writing keywords "scientific literacy materials" in the search box of IJSE, JRST, SE, DOAJ, ERIC, IOP Science, ScienceDirect, and Springer Link website. The survey targeted the articles published from 2016 to 2020. All of the articles were identified in the screening and advisability stage based on their title, abstract, keywords, topic relevance, and downloaded. Those article texts' topic relevance were screened and evaluated following the research purposes. The editorial, comment, and response article, as well as the book chapters and book review were excluded. Further, all of the relevant articles were reviewed and analyzed to attain their conclusion or synthesized. The analysis included publication distribution, the authors' nationality, type of research, and research sub-topic.

The distribution of research on scientific literacy teaching materials was obtained through identifying and classifying the journals' names on each article. All articles that have matched the criteria were downloaded, while the journal names were noted. The journal classification was carried out to determine the number of obtained articles from each journal. Meanwhile, the authors' nationality was analyzed and assessed quantitatively to identify the countries' publication rank, the year with the highest publication, the media used in the research, and the sub-topic discussed on scientific literacy materials topic.

**Results and Discussion**

The data were collected from ERIC, SCIENCE DIREC, IJSE, SE, JRST, IOP SCIENCE, DOAJ, and Springer. The topic selected in this study is integrated scientific literacy materials in natural science learning. The article exploration has been carried out by writing the keywords "scientific literacy teaching materials" on the journals' search box. The article exploration is focused on the latest five years to identify the current trend of the publication of the article.

The data were collected from eight publishers. The results of this article exploration are presented in Table 1.

**Table 1. Results of Journals**

Identification from Various Sources								
Search	SE	JR	ERIC	IJSE	Scienc	Doaj	IOP	springer
ing	ST			e	direct		SCIE	
							CE	
Identif	92	117	3716	234	425	81	61	856
cation								
Scree	3	1	7	3	2	5	51	2
ning								
Advis	2	0	7	0	1	5	13	2
ability								

Table 1 shows the number of the article appears from the scientific literacy teaching material keywords. The most extensive number of reports (3,716) come from ERIC, while the lowest number of articles is from IOP Science (61). After the screening and advisability stage, the highest number of relevant articles come from IOP Science. Meanwhile, two journals are observed to have no feasible articles for this study, namely JRST and IJSE.

The advisability criteria used in this study were 1) the articles should be published around 2016 to 2020; 2) it should not be in the form of a book; and 3) the article should discuss the integrated scientific literacy in natural science learning, using

module or textbook. Using those criteria, the number of articles were screened, producing lower results.

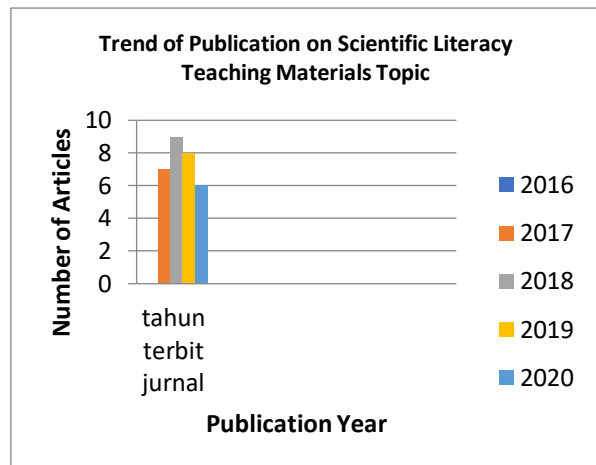
Some articles are observed to have no relevance with the topic reviewed in this research during the rescreening process. Those articles were excluded due to some factors. First, they discuss different literacy, not scientific literacy. Second, they are implemented not in a natural science learning.

The screening process results in articles that are following the criteria of the topic and the publication year. The number of reports of scientific literacy teaching materials from different years is presented in Table 2.

**Table 2. Number of Articles on Scientific Literacy Teaching Materials in the Last Five Years**

Year	Number of Articles
2016	0
2017	7
2018	9
2019	8
2020	6

Table 2 shows the trend of integrated scientific literacy teaching material. In the last five years, the highest number of publications (nine articles) on scientific literacy teaching material occurs in 2018. The trend of research on integrated scientific literacy teaching materials is illustrated in Figure 2.



**Figure 4. The Trend of Research on Integrated Scientific Literacy Teaching Materials**

According to Figure 2, in 2016, there is no research on the integrated scientific literacy teaching material, while seven articles on the same topic are published in 2017. 2018 becomes the peak of research on integrated scientific literacy teaching material. However, in 2019, the research publication trend on that topic is reduced to only eight articles. The decrease is continuous to six papers in 2020.

After the publication trend on the integrated scientific literacy teaching materials in natural science learning had been obtained, the country with the highest publication on this topic was investigated. The results of that analysis are presented in table 3.

**Table 3. Countries with Research on Integrated Scientific Literacy Teaching Material**

Country	Number of Articles
Indonesia	21
United States of America	2
Canada	2
Turky	1
Saudi Arabia	1
Taiwan	1
Germany	1

Table 3 shows the researchers' trend in studying integrated scientific literacy teaching material. Most of the researchers who investigated this topic are from Indonesia, followed by researchers from the United States of America and Canada, who have published two articles.

In addition, this study also examines the learning media reviewed in teaching integrated scientific literacy. The identified media are shown in table 4.

**Table 4. The Media Used in Integrated Scientific Literacy Teaching**

Media	Total Number
Video	1
Book/Module	24
Social Media	2
Virtual Laboratory	3

Based on the data in Table four, the media of video, book, virtual lab, and social media have been used in teaching integrated scientific literacy (Wulandari et al., 2019). The most used media is textbooks or modules of integrated scientific literacy. It may be caused by limited infrastructure

provided by the schools or the restriction for the students not to bring electronic devices. Meanwhile, the most rarely used media in this learning is video. The use of video as learning media requires a projector and a relatively long development period. Besides, students need to have a greater concentration if they want to replay the footage (Walsh et al., 2020). Meanwhile, by using textbooks or modules, students can re-read the materials that they have not understood individually (Misbah et al., 2018).

The sub-topics of the articles' on integrated scientific literacy teaching materials are presented in Table 5.

**Table 5. Articles' Sub-Topics with Integrated Scientific Literacy**

Sub-Topics	Number of Journal
Instructional	1
Scientific Literacy Skills	2
Popular Scientific Texts	1
QR Code	1
Socio-Scientific Issues	1
Representations	1
Environment	1
Inquiry	3
Literacy Skills	3
Local potential	3
Thematic	2
STM ( science, technology, and society)	1
STES	2
Critical thinking skills and information	1
STEM	1

Table 5 shows the sub-topics discussed on the integrated scientific literacy teaching materials research. The data suggest that most of the research on integrated scientific literacy teaching materials discuss inquiry (Hufri et al. 2019), (Wu, Lee, and Chan 2018), (Yusmanila, Hasra, and Razi 2017), literacy skills (Yurnetti, Asrizal, and Murtiani 2020), (Fairuz, Kaniawati, and Sinaga 2019), (Hartini et al. 2018), and local potential based (Hernawati et al. 2019), (Setiawan 2019), (Melyasari, Suyatno, and Widodo 2018).

From the keywords of "scientific literacy teaching materials," many scientific articles have been obtained. However, some of those articles do not discuss the teaching material. From those articles, many of them discuss the curriculum expected to increase various students' literacy. Other than the curriculum on literacy, those articles also discuss the electronic media and social media used to improve students' literacy. However, the number of publications on the integrated scientific literacy teaching material is low. Therefore, future

research can investigate integrated scientific literacy teaching materials further and more profound.

## CONCLUSION AND SUGGESTIONS

From ten journals, 30 articles published in 2016 to 2020 have topic relevance with the topic set in this study. From those years, the highest number of articles on integrated scientific literacy in natural science learning is observed published in 2018 (nine articles). Meanwhile, the journal with the highest number of articles for 'scientific literacy teaching materials' keywords is ERIC (3,716 articles). Besides, IOP Science has the highest number of reports (13 articles) with the most relevant topic. Most of the researchers investigating integrated scientific literacy teaching materials are from Indonesia, generating 21 articles. The most used media for this material is textbooks or modules. The results of this study signify that the integrated scientific literacy teaching materials still have a vast space to be explored.

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