

The Effect of Biology Learning on Increasing Students' Scientific Literacy: A Review

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Abstract: This study is a literature review which aims to identify the most effective learning model for improving students' scientific literacy skills in biology learning. 25 articles were obtained from search results on Google Scholar that met the relevant criteria for review. Article criteria are articles that are relevant to biology learning to increase scientific literacy and articles on other learning subjects that increase scientific literacy. Researchers limited the articles reviewed to the last five years, namely 2018 to 2023. The results of a review of 25 articles show that there are many learning models that can be used to improve scientific literacy skills. The most effective learning model in increasing scientific literacy is Contextual Teaching and Learning (CTL).

Keywords: Biology learning, scientific literacy, literature review.

Introduction

Quality education is one of the goals of sustainable development (sustainable development goals). To support the achievement of quality education requires appropriate mobilization and attention in subject areas including science education (Pujiyanti et al., 2022). One of the subjects in science education is biology. Biology learning must provide learning experiences to form science skills (Puspita, 2019).

The curriculum in science learning aims to provide learning experiences regarding concepts, scientific processes, and problem solving. This shows that the aim of science education in Indonesia is towards scientific literacy (Alfionora & Putri, 2021). The major dimensions of scientific literacy are the science process, science content, and the context of science application (Fuadi et al., 2020).

The implementation of learning in Indonesia still has problems (Doyan et al., 2023). This is proven by the results of the 2018 Program for International Student Assessment (PISA) survey, Indonesia was

ranked 71st out of 79 countries, which shows that Indonesian education is still far behind (Aswita et al., 2022). Another thing that proves the low quality of education in Indonesia is the learning outcomes of students. The low learning outcomes of students in Indonesia are still often complained about (Oktaviani et al., 2020).

Learning outcomes are changes in habits obtained through the thinking process so that they are able to solve problems (Wahyudi & Marsyidin, 2019). This shows that learning outcomes are determined from the learning process. The teacher is the main factor that determines the success of the learning process. Teacher ability is one effort to improve the quality of education. This ability is the ability to teach by applying certain learning models that are appropriate, efficient and effective (Djonmiarjo, 2020).

Learning outcomes are expected to improve students' skills and abilities, including scientific literacy. Nugraha & Octavianah (2020) has proven that there is a strong connection between learning outcomes and scientific literacy. The learning

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outcomes obtained by students can reflect scientific literacy abilities.

The essence of literacy is the ability, skills and competence that students have to use knowledge and understand scientific concepts and processes. Scientific literacy ability is the ability to use scientific knowledge to identify questions, obtain new knowledge, and explain scientific phenomena and draw conclusions based on scientific evidence (Fuadi et al., 2020).

Several studies have been conducted to improve scientific literacy skills (Febrianti, 2021). These include the use of a scientific approach in learning (Setiawan, 2020), reconstruction of STEM-based teaching materials (Rusyati et al., 2019), and the use of other learning models. The application of this model has different results in increasing scientific literacy, so the author took the initiative to review various articles that are relevant to increasing scientific literacy so that an effective model can be identified for increasing scientific literacy skills.

Method

This research is a literature study or literature review of research results that have been published in various journals. articles obtained from national and international journals on Google School related to science learning to improve scientific literacy. Article criteria are articles that are relevant to biology learning to increase scientific literacy and articles on other learning subjects that increase scientific literacy. Researchers limited the articles reviewed to the last five years, namely 2018 to 2023.

Result and Discussion

As a result of searching for articles on Google Scholar, researchers found 25 articles that met the criteria for scientific literacy. All search results for articles relevant to scientific literacy in biology learning are summarized in Table 1.

Table 1. Results of searching for learning models, approaches, methods and/or strategies in increasing scientific literacy.

Writer	Article title	Achievement of scientific literacy
Banila et al., 2021	Application of blended learning with a STEM approach to improve students' scientific literacy skills in biology learning during the Covid-19 pandemic	85.50
Saadah & Isnaeni, 2019	The role of the brain-based learning model in learning the nervous system in increasing students' scientific literacy	83.30
Kuswanto et al., 2021	The Influence of the Guided Inquiry Learning Model on the Science Literacy Abilities of Class	85.71
Saparuddin et al., 2023	Analysis of the scientific literacy abilities of biology learning students at SMAN in Bone Regency	77.40
Azaly & Fitrihidajati, 2022	Development of Microsoft Office Sway-Based Learning Media on Environmental Change Material to Train the Science Literacy Skills of Class X High School Students	84.79
Wati, 2022	Application of a scientific approach assisted by the recitation method to improve students' scientific literacy skills on human reproductive system material	79.00
Safitri, 2019	Application of the guided inquiry learning model to improve scientific literacy skills and learning outcomes in biology learning for class XI IPA 1 students at Kepanjen Islamic High School	87.50
Zuhra et al., 2022	Efforts to increase students' scientific literacy with the contextual teaching and learning (CTL) learning model assisted by animation media in class XI plant tissue material at SMAN 1 Siblah Krueng	95.00
Muniarti et al., 2023	The development of a brain based whole learning (BBWL) model of biology learning has an impact on scientific literacy, mastery of concepts and retention	81.33
Junita & Yuliani, 2022	Development of ethnoscience-based e-LKPD to train scientific literacy skills on membrane transport material	85.80
Utami & Setyaningsih, 2023	Students' scientific literacy abilities use problem based learning on excretory system material	77.72

Writer	Article title	Achievement of scientific literacy
Wati, 2022	Application of a Scientific Approach Assisted by the Recitation Method to Improve Scientific Literacy Skills in Reproductive System Material	79.00
Hajrah et al., 2021	Implementation of the Discovery Learning Learning Model to Improve the Science Literacy of Class XI Students at SMA Negeri 1 Soromadi	88.00
Ariana et al., 2020	Development of a Discovery Learning-Based Module on Plant Tissue Material to Improve the Science Literacy Abilities of Class XI Science High School Students	86.00
Utomo, 2018	Development of an Inquiry Lesson Based Module to Increase Scientific Literacy Process Dimensions and Learning Outcomes Skill Competencies in Class X Digestive System Material	87.78
Silvia & Simatupang, 2020	Development of LKPD Based on Science, Technology, Engineering, and Mathematics to Develop Science Literacy Skills of Class X MIA SMA NEGERI 14 Medan TP 2019/2020	81.70
Yusuf et al., 2019	Development of Guided Inquiry-Based Learning Tools to Improve Student Learning Outcomes and Scientific Literacy on the Concept of Cell Division	79.00
Resti, 2022	Analysis of Science Literacy and Self Awareness of Class X Students in Limited Face-to-Face Biology Learning in Public High Schools in Liwa City, West Lampung	80.00
Khasanah et al., 2022	Development of T-PACK Based Digital Teaching Materials to Empower Science Literacy in Class IV Students at SDN Pilangbango	88.20
A.A, 2019	Implementation of the YouTube-Based Environmental Exploration (Jas) Approach to Increase Students' Scientific Literacy in Public High Schools 1 Source	88.06
Hardianti et al., 2020	Development of Science, Technology, Environment, Society (Sets) Based Teaching Materials to Improve Students' Scientific Literacy	82.50
Usemahu et al., 2022	Application of Blended Learning with a STEM Approach to Improve Science Literacy and Cognitive Abilities of High School Students	86.53
Faridah et al., 2022	Development of an Interactive E-Module to Train Students' Science Literacy Skills on Membrane Transport Material	89.00
Prastiwi et al., 2020	Development of Biorivista (Biology Magazine) Based on Mind Mapping to Improve the Science Literacy Abilities of High School Students on Excretory System Material	75.00

Based on Table 1, it is known that the lowest value for increasing scientific literacy is 77.4. Meanwhile, the highest increase in scientific literacy was 95. The lowest increase value, namely 77.4, was still included in the medium category. Jihani & Muis (2023) revealed that the results of the scientific literacy ability test were 77.4 because 7.9% of students were unable to use scientific data and evidence in evaluating the quality of the material being assessed. Compared with the very high increase in scientific literacy, namely 95, it shows that to increase scientific literacy it is most effective to use the Contextual Teaching and Learning (CTL) learning model.

The contextual learning model can improve scientific literacy skills because contextual learning provides real context in students' environments, making it easier for students to understand lesson material and relate it to the knowledge they have.

Based on Figure 1, it is known that the average value of increasing scientific literacy through learning models, approaches, methods and/or strategies is 80-90. Of the 25 articles that have been reviewed, there are 6 articles whose results of increasing scientific literacy skills are in the range of 70-80. A total of 17 articles resulting from improving scientific literacy skills were in

the 80-90 range. There was only 1 article whose scientific literacy increase score was 90-100.

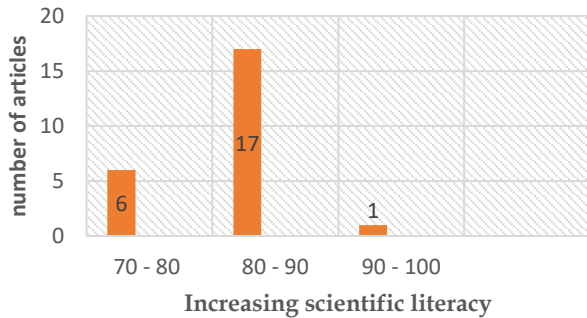


Figure 1. Increasing scientific literacy through learning models, approaches, methods and/or strategies

Articles with a value of increasing scientific literacy of 70-80 include using PBL learning models, guided inquiry, scientific approaches, and mind mapping based. articles with a value of increasing scientific literacy of 80-90 using PBL, BBL, BBWL, guided inquiry, discovery learning, STEM, SETS and ethnoscience learning models. Articles with a value of increasing scientific literacy skills of 90-100 using the CTL learning model.

The difference in values is because each learning model, approach, method and/or strategy has its own characteristics that can influence the learning process. The use of appropriate learning models, approaches, methods and/or strategies can significantly improve scientific literacy skills. The use of learning models, approaches, methods and/or strategies must also be adapted to the learning material and students' conditions.

Conclusion

Based on the results of literature studies, it was found that the learning models that can be applied by teachers in biology learning are very diverse. One of the most effective learning models in improving scientific literacy skills is Contextual Teaching and Learning (CTL).

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