

Application of Popular Scientific Books to Improve Student's Scientific Literacy

Ridlo Firmansyah^{1*}, Ismul Mauludin Al Habib², Dwi Rani Prihandini³

^{1,3}University of Muhammadiyah Jember; nirwandeer@gmail.com

²Argopuro PGRI University; ismul.habib1982@gmail.com

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*Correspondence: Ridlo Firmansyah
Email: nirwandeer@gmail.com

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Abstract: Students' low interest in scientific literacy is mainly due to the result-oriented practice of science learning, placing the learning material as a subject without bridging the relationship between the material and the context of everyday life. In addition, learning resources that can be used by students to facilitate their understanding of complex science topics are still limited. This research conducted to describe the effectiveness of using popular scientific books to promote students in increasing their interest and scientific literacy. Scientific literacy is the capability to conclude scientific conclusions and solve issues related to science through a scientific-based idea and thinking reflectively. The criteria of evaluation for scientific literacy skills consist of inter-correlated dimension; context, knowledge, competency, and attitude. Data collection techniques are observation, tests, and questionnaire. The research indicated that (1) implementation of popular scientific books as reading sources obtained a positive response from students, and (2) students' scientific literacy skills increased, indicated by N-gain criteria in the medium to high categories. These findings concluded that the application of popular scientific books is effective in increasing students' interest and their scientific literacy skills.

Keywords: differentiation; contextual; learning media; interest; education

INTRODUCTION

Scientific literacy are urgently needed by our student as both of the life skill and the life style. Those urgency arises as the consequence of the digital era, with soaring flows of data and information, make it possible for our student to be contaminated by the hoax, distortion of information, and toxic social media trends. Program for International Student Assessment (PISA) reported that students' scientific literacy in Indonesia is relatively low when compared globally, ranked 71 out of 77 countries on the latest survey. (OECD, 2019).

OECD (Organization for Economic Co-operation and Development) defined scientific literacy as the capability to conclude scientific conclusions and solve problems related to the interaction of scientific concepts with daily lives. Furthermore, Archer (2014) refers the scientific literacy as the individual capacity to recognize, explain, conclude any occurrence related to scientific topics, understanding the science-related phenomena can be identified by research-based science. Not only as a capability to understanding, scientific literacy also giving us a proper guidance to interact coherently with the various aspects and values that underlie sciences. (Van et al., 2017). The results of Holbrook's research (2016) seem to be conformed by PISA's latest findings, where science learning is still not much in demand by students, especially because of the dimensions of complexity and the lack of contextualization of science learning material in students' daily lives. Contextualization of a learning material is important because it is able to raise students' apprehension about the importance of those understanding on many of their living aspects (Lederman et al., 2013). Contextualization of material can focus learning related to science topics on phenomena that motivate students to develop their curiosity, the learning objectives advanced from only understanding certain topic to examine basic question such as how or why certain phenomena happens, until they can come into the best possible solutions to solve a problems. Focusing the delivery of science learning on interesting phenomena and having

relevance to the social life of society can help students stay motivated and interested in digging deeper into related scientific literacy (Hafni et al, 2020). Science education is meaningful when students learn and dive into scientific concepts by first-hand experience, they can sense it, feel it, then directly possible to make contextual connections between concepts and problems (Jampel, 2018).

Several factors have been put forward regarding things that can help students developing their scientific literacy skill, including the application of science-based learning media, learning models, supplemental resources, student's worksheet, and scientific-based evaluation tools and assessment (Rusilowati, 2016). Textbooks are learning resources that are directly connected to students. In relation to the presentation of scientific information, McComas (2017) stated that science textbooks that can further helping student in order to increasing their scientific literacy, have some basic characteristic, such as having science as a building blocks of knowledge, which presents information to be studied such as facts and concepts that make students easily elaborating their understanding (2) science as a natural investigation, reflects an active aspect of science learning, involving students in scientific methodology (3) science as a mindset, giving students a clear perspective and guidance about how a scientific activity is carried out, and (4) the multi-aspect interaction between science, ever changing society and technology, encompasses how the application of science can further influencing human's life.

Popular scientific writing is a type of article that is used to facilitate the dissemination of scientific knowledge so that it can be enjoyed by the general public. This kind of popularization provides greater accessibility of science topics to public, specifically to students in the case of science-based learning (Faisal *et al*, 2019). The idea behind the emergence of the popular scholarly writing genre was to delivering complex science study and findings into a more friendly and related form for general public. The popular scientific writing considered as an effective process to form a better connections between researchers and the public. The popularization of scientific writings allows researchers as well as organizations and bodies engaged in scientific research to be followed or known by a wider society (Giannoni, 2008). Popular scientific writing make it easier for researchers in order to disseminating their findings so that the novelty brought by scientific knowledge can still be enjoyed by non-expert readers such as students.

Hyland (2010) emphasized that the urgency of making scientific writing popular for a wider audience is not related to the need for professionals to acquire scientific knowledge, but most of them just want to participate in enjoying all forms of knowledge renewal in the research disciplines they are interested in without having qualifications. high enough to understand it. This makes popular scientific writing a bridge between the scientific community which is quite closed, allowing non expert people to gain a better and more comprehensive knowledge about certain scientific research and it's benefits for their daily life.

The clear benefits of popular science writing lie in the field of education, related to facilitating students in self-development, thus increasing their learning outcomes. A case study by Wu et al (2018) revealed that students who get used to using popular science literature are better able to develop better communication skills, because various popular scientific writings use language proximity to their target readers. In addition, students also reported experiencing an increase in academic terms related to subjects that were in accordance with the fields of popular scientific writing they read. Roesch and Frenzel (2016) added related to the dimensions of knowledge that develop in students through the use of popular scientific writings on neuroscience. Their studies show that students experience broadening perspectives on neuroscience subjects through popular scientific writing. Many of the students explained that this broader perspective further helped them find new connections, create a more holistic picture of the subject, and gain a better understanding of the subject.

METHOD

The research's subjects consist of 40 students at grade 11 of Bumi Shalawat Boarding School Sidoarjo for the 2021/2022 academic year. This research was conducted for 3 weeks from April to May 2021 by integrating the use of a popular scientific book entitled "Srikaya Fruit, the *Aedes aegypti* L Larvae Exterminant:

Biolarvicidal Potential of Srikaya Fruit Extract" as a supplement learning resource. Student's impression to the implementation of popular scientific books were obtained using a students questionnaire response. The students scientific literacy skill result in the form of context, competency, and knowledge aspects obtained through a short test, while the attitude aspect was obtained through a reflection questionnaire. The obtained data were descriptively analyzed. The increase in students scores on scientific literacy skills performed using N-gain, with low, medium, to high criteria.

RESULTS AND DISCUSSION

Student response to the use of popular scientific books

Students' responses to the use of popular scientific books are known from the answers to the questionnaire filled out by students after three cycles of learning using popular scientific books as a supplement book. The results of the student response questionnaire are presented in Table 2. Based on the data in Table 2, it can be seen that the implementation of popular scientific books in the implementation of learning obtained positive responses from students ($\geq 87\%$ with very good and good responses), in all aspects including aspects of display and component, content and information, as well as learning style accommodation. This means that most students are very interested in using popular scientific books as their supplementary learning material.

Table 2. Student Responses to the Use of Popular Scientific Books

Questions	Student's Response (%)			
	Very Good	Good	Average	Poor
Aspects of display and component				
How was your first impression with the popular scientific books?	70	20	7	3
Were the instructions in popular science books easy to follow?	78	10	10	2
Was the language used in popular scientific books easy to be understood?	80	5	5	5
Aspects of Content and information				
Was the material presented in popular scientific books interesting?	65	15	15	5
How does this popular scientific book relate to your daily life?	70	20	10	-
Were the concepts integrated in popular scientific books easy to be understood?	80	15	5	-
Was this popular scientific book better than your usual textbooks?	80	5	10	5
Aspects of accommodating learning styles				
Do you like the mini experiment activities in this popular science book?	65	20	10	5
Do you like the expression column in this popular scientific book?	70	15	10	5
Do you feel comfortable reading this popular scientific book for a time?	75	20	5	-
Do you like the YouTube or TikTok links in this popular scientific book?	80	10	5	5

Based on the results of the analytical questionnaire responses in class XI Science 2 and 3, students had a good impression with the popular scientific books, where the presentation of interesting material, the use of simple-easy to understood language, made it easier for them to understand the concept of extraction and

toxicity as an applied science topics that are rarely known by students because it's not a common material studied in class. The choice of light language adapted to the reader is one of the fundamental aspects of effective scientific communication. Mapstone (2015) explains that the ability to coherently communicate questions, ideas, procedures, theories, and scientific understanding in different contexts is one of the four scientific communication skills which include identifying and understanding suitable targets and using appropriate language. target audience. In essence, these two things are types of generic skills that can be developed by scientific practitioners in order to broaden the scope of acceptability of their research results within the community.

Interactive components in popular scientific books (such as video links, expression columns, crosswords, mini experiments) are able to facilitate various learning modes (learning style preferences) owned by students. Even though book media is generally aimed at students with a visual learning style, the existence of content differentiation in the form of interactive components is proven to be able to make students with an auditory learning style learn well through the provided video links, and students with a kinesthetic learning style can learn through columns. expressions, crosswords, to mini experiments, so that even though students are not visual learning style learners, they can still make good use of this popular scientific book.

The aspect of popular scientific books that pays attention to these learning style preferences is one of the efforts made to create a more effective learning experience. Alavi and Toozandejani (2017) concluded that having an awareness of students' different learning style preferences in applied science learning can increase student learning participation, and at the same time can help students strengthen self-actualization. Teevan, Michael and Schlesselman (2011) also emphasized that knowledge of learning styles can help facilitate teachers to use appropriate teaching strategies and methods to improve students' academic performance. It also provides teachers and students with positive feedback on their strengths and weaknesses in each teaching and learning scenario. Dalmolin, Mackeivicz, Pochapski, Pilatti and Santos (2018) suggest that facilitating student learning styles will ultimately improve their learning experiences. Barman, Aziz and Yusoff (2014) also study that awareness of student learning styles will determine how teachers and students utilize the strengths/potentials of students in order to improve their academic performance.

Increasing Student Science Literacy

The increase in students' scientific literacy abilities in the application of popular scientific books was analyzed using N-gain, which indicated that there were differences in students' scientific literacy abilities before and after the application of popular scientific books to circulation system material. The results of the N-gain calculation are presented in Table 3. Based on Table 3, the application of popular scientific books is effective in increasing students' scientific literacy skills because the N-gain scores of all students show the medium to high category. In general, the high N-gain score is due to the application of popular scientific books that can give students a new perspective in learning applied concepts and scientific phenomena that they rarely get in class.

Table 3. Aspects of Student's Science Literacy

Science Literacy Aspect	N-Gain	Description
Aspects of Context and Knowledge	0,65	Medium
The importance of knowing the applied concept of science in a daily life	0,73	High
Interest in science-based learning	0,68	Medium

Science Literacy Aspect	N-Gain	Description
Desire to increase literacy related to scientific concepts/phenomena.	0,71	High

In general, there is an increase in scores on all attitude indicators because students understand that the application of popular scientific books is able to introduce them to the dimensions of the relationship between an applied scientific concept/knowledge in their real life, so that students begin to develop an active attitude in exploring, using critical, logical thinking, and creatively responding to the problems and phenomena related to the concepts of extraction and toxicity in everyday life. This result is in line with research conducted by Genc (2015) which proved that there was an increase in students' scientific literacy skills through habituation in recognizing and exploring a scientific writing. Using a popular scientific writing can attract students' attention, so education policymakers should focus on a curriculum that places a scientific process that is no longer traditional, whereas science learning is more centered on teachers and the methods used were limited to a conventionally lecture method (Dwisetiarezi & Fitria, 2021).

The science approach must be sufficiently meaningful and relevant to their everyday experiences. The quality of education can be improved through a good science literacy, either basic or applied science. Science literacy will be higher if students can implement those habit from an early age. Students will be able to understand the causes and effects of natural phenomena by reading a variety of literature. Teachers have a critical role in teaching science-themed learning integrated with the environment, technology, and society (Gathong, 2019). However, students are unable to integrate their findings and are still fragmented within the problem (Jurecky & Matthew, 2012). One of the factors is intelligence and interest. Students who are interested in science can answer well, but students who are interested in subjects other than science have difficulty. Difficulties experienced are problem identification, data processing, and decision-making. Better communication and problem-solving ability can be achieved through reading, writing, and reviewing journals to improve scientific literacy (O'toole *et al*, 2020). Several factors affecting an individual's science literacy are intellectual capacity, attitudes, social characteristics, levels of reasoning, and integration of different disciplines (Fadila *et al*, 2020).

CONCLUSION

The use of a popular scientific book entitled " Srikaya Fruit, the Aedes aegypti L Larvae Exterminant: Biolarvicidal Potential of Srikaya Fruit Extract " as a supplement book on circulation system material gets very positive responses ($\geq 87\%$ with very good and good responses), and is able to increase student's science literacy skills in the aspects of context, competency, knowledge, and attitude, indicated with moderate and high N-gain scores.

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