



## Research Article

# Differences in students' scientific literacy abilities in solving story questions on environmental change material in class X of SMA in Ambon City

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## ABSTRACT

Scientific literacy began to emerge since the implementation of the Program for International Student Assessment (PISA) in Indonesia. Since Indonesia's participation in the Program for International Student Assessment (PISA) in 2000, Indonesia has always been at the bottom of the rankings. This research aims to analyze students' scientific literacy abilities in solving story questions on environmental change material in class X SMA in Ambon City and to know differences in students' scientific literacy abilities in solving story questions on environmental change material in class X SMA in Ambon City. This type of research is *mix method*. The research population, SMA Negeri 3 Ambon, SMA Negeri 5 Ambon and SMA Negeri 11 Ambon with a total sample of 103 students. The research instruments used were tests and interview instruments. Data analysis techniques using *Independent Sample T Test* with SPSS Version 27 software. The research results show that scientific literacy ability of students is in the medium category at SMAN 11 Ambon. The research results show that Students' scientific literacy abilities are quite good at SMAN 11 Ambon, and there is a difference in students' scientific literacy abilities in solving story problems on environmental change material in class X in the SMAN 3 and SMAN 5 groups is  $0.000 < 0.05$ , the SMAN 3 and SMAN 11 groups is  $0.000 < 0.05$  and the SMAN 5 and SMAN 11 groups is  $0.003 < 0.05$ .

**Keywords:** differences, scientific literacy ability, High School Students

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## INTRODUCTION

Biology is a branch of science that studies living things, nature and the environment and the changes that occur in them. The aim of learning biology is to form students' reasoning abilities which are reflected through the ability to think critically, logically, systematically, and have an objective, honest, disciplined nature in solving problems, especially in the field of biology (Andi et al. 2019). Based on the understanding above, it can be said that science education, especially biology, plays a role in developing students' scientific literacy.

Scientific literacy began to emerge since the implementation of the Program for International Student Assessment (PISA) in Indonesia. PISA organized by the Organization for Economic Cooperation and Development (OECD) is an international program that aims to monitor the results of the education system related to the learning achievements of students aged 15 years (OECD, 2019). Since Indonesia's participation in the Program for

International Student Assessment (PISA) in 2000, Indonesia has always been at the bottom of the rankings. In 2021 Indonesia is ranked fifth from the bottom, where Indonesia's ranking is 73 out of a total of 78 countries that took the PISA test and Indonesia obtained a score of 379 from an average score of 489 (Nana, 2021). The scores obtained are below the established international standards, this shows that students' scientific literacy abilities are in the low category (Ahmad et al. 2018).

Students' scientific literacy abilities can be improved with various efforts such as the use of test questions that are based on scientific literacy, the application of appropriate learning models and learning approaches, as well as tools to increase students' scientific literacy and assessment instruments that help educators evaluate scientific literacy abilities. learners. However, not many schools have implemented evaluation questions that relate to everyday phenomena and are still in the knowledge and conceptual dimensions, so they cannot be used to measure students' scientific literacy (Ardianto and Rubbini, 2016). Scientific literacy skills in this research use scientific literacy indicators based on PISA 2018, namely explaining phenomena scientifically, evaluating and designing scientific investigations and interpreting scientific data and evidence. Scientific literacy indicators were developed to analyze and measure students' scientific literacy abilities regarding the nature of science to achieve scientific literacy success and are used at the high school (SMA) student level (Amiruddin et al. 2023).

Based on an interview with one of the biology teachers at SMA Negeri 3 Ambon, SMA Negeri 5 Ambon and SMA Negeri 11, it was stated that students had never been given questions related to scientific literacy. This is because the learning process has not involved the scientific process, especially the material on environmental change. Educators also find it difficult to teach students independently and actively because students are accustomed to material that is directly given to them, this also causes students to be less active in exploring their own knowledge, students are less able to relate material to environmental changes in everyday life to answer questions that require analytical skills.

Apart from that, the three schools have undertaken activities that can support students' scientific literacy skills, such as reading books before learning activities begin. However, most students are less interested in reading the book. This is related to students' lack of interest in scientific literacy. Hartati (2016) stated that emotional factors which include students' low interest and comfort in learning influence students' scientific literacy. Rida (2021) explains that the low level of students' scientific literacy skills is related to students' minimal ability to read as well as the availability of evaluation tools and teacher qualifications that do not yet focus on scientific literacy.

The reason for choosing environmental change material is because this material is a biological material that is closely related to everyday life and is very good material for students to raise curiosity about what they find in the surrounding environment. Through environmental change material - waste utilization, students will be in direct contact with their environment and summarize the problems found by students in everyday life. The presentation of lesson material is chosen according to what students need to solve their problems. In this case, educators can guide or stimulate students to search for and find as much information (material) as material for solving the problem.

## METHODS

This type of research is a mix method, which combines two types of research, namely qualitative and quantitative research. The population of this study was SMA Negeri 3 Ambon, SMA Negeri 5 Ambon and SMA Negeri 11 Ambon with a sample size of 103 students. The research instruments used were tests and interview instruments. The test of the research instrument for test questions used a validity test using product moment correlation, a reliability test using alpha cronbach and a test of the level of difficulty of the questions. The data analysis technique for hypothesis testing used the Independent Sample T Test with the help of SPSS Version 27 software.

## RESULTS AND DISCUSSION

Student's scientific literacy ability is performed in Table 1. On the this Table , it is known that at SMAN 3 Ambon, 3 (9.09%) students got scores in the high and medium categories, and 27 (81.82%) students got scores in the low category. Then at SMAN 5 Ambon, 3 (9.68%) students got scores in the low category, 16 (51.61%) students got scores in the medium category and 12 (38.71%) students got scores in the low category. Furthermore, for SMAN 11 Ambon, 3 (7.69%) students got scores in the high category, 26 (66.67%) students got scores in the medium category and 10 (25.64%) students got scores in the low category. From these results, it can be concluded that the scientific literacy skills of students at SMAN 11 Ambon are quite good. Based on these results, it can be concluded that students' scientific literacy skills are quite good at SMAN 11 Ambon.

**Table 1.** Results of students' scientific literacy ability test scores

No	School	Mark	Category	Frequency	Percentage (%)
1	SMA N 3 Ambon	67 – 100	High	3	9.09
		34 – 66	Medium	3	9.09
		<33	Low	27	81.82
		<b>Total</b>		<b>33</b>	<b>100</b>
2	SMAN 5 Ambon	67 – 100	High	3	9.68
		34 – 66	Medium	16	51.61
		<33	Low	12	38.71
		<b>Total</b>		<b>31</b>	<b>100</b>
3	SMAN 11 Ambon	67 – 100	High	3	7.69
		34 – 66	Medium	26	66.67
		<33	Low	10	25.64
		<b>Total</b>		<b>39</b>	<b>100</b>

Furthermore the result of validity, reliability and difficulty level of the question test is shown in Table 2, Table 3 and Table 4. The results of the construct validity test using the product moment coefficient as shown in the Table 2. can be seen that all questions (items) are in tttese valid category. This means that the scientific literacy question item instrument is suitable to be used to assess students' scientific literacy abilities regarding environmental change. Based on the Table 3, it can be seen that the test item instrument used in this study was  $0.916 > 0.07$ , so it can be concluded that all test items are reliable.

**Table 2.** Construct validity test results

Question Items	R Count	R Table	Criteria
Question 1	0.774	0.193	Valid
Question 2	0.818	0.193	Valid
Question 3	0.866	0.193	Valid
Question 4	0.761	0.193	Valid
Question 5	0.839	0.193	Valid
Question 6	0.834	0.193	Valid
Question 7	0.776	0.193	Valid
Question 8	0.798	0.193	Valid
Question 9	0.780	0.193	Valid
Question 10	0.727	0.193	Valid

**Table 3.** Reliability test results

Cronbach Alpha	Criteria	Information
0.916	0.07	Reliable

**Table 4.** Test results for the level of difficulty of the questions

Value range difficulty index (P)	Category	Question number	Amount	Percentage (%)
0.71-1.0	Easy	7, 8	2	20%
0.31-0.70	Currently	1,2,3,4,5,6,9,10	8	80%
0.00-0.30	difficult	-	-	-

Based on the data in the Table 4. it can be seen that as many as 80% of the questions tested in learning environmental change material for X SMAN students in Ambon City were in the currently, while 20% were in the easy category and there were no questions in the difficult category. Next, the hypothesis test for to analyze the different between third school like as Table 5.

**Table 5.** Hypothesis test results

School	Sig < 0.05	Information
SMAN 3 with SMAN 5	0,000	There are differences
SMAN 3 with SMAN 11	0,000	There are differences
SMAN 5 with SMAN 11	0.003	There are differences

Based on the Tabel 5, it is known that the students' scientific literacy abilities for the SMAN 3 and SMAN 5 groups are  $0.000 < 0.05$ , the SMAN 3 and SMAN 11 groups are  $0.000 < 0.05$  and the SMAN 5 and SMAN 11 groups are  $0.003 < 0.05$  so it can be concluded that  $H_a$  is accepted. This means that there are differences in students' scientific literacy abilities in solving story questions on environmental change material in class X SMA in Ambon City.

Scientific literacy skills are quite good at SMAN 11 Ambon because the Biology Teacher has accustomed students to answering questions that are equivalent to scientific literacy assessment questions, which are usually included in the mid-semester assessment (PTS) or final semester assessment (PAS). Apart from that, students at SMAN 11 Ambon are accustomed to doing literacy by reading in textbooks before starting learning for around 5-10 minutes and students are required to write down problems from their reading results into a summary which is collected at the end of the semester as a requirement for taking exams, or a summary of the results of reading the textbook will be of additional value to students.

Facilities and infrastructure are also factors that improve students' scientific literacy skills, such as at SMAN 11 Ambon for biology textbooks specifically on environmental change material consisting of 2 types, where during learning each student will get one textbook each, so that the student literacy process is also optimal, and can be seen from the student library, SMAN 11 Ambon has a comfortable library and adequate learning books so that many students always do their schoolwork in the library and it is also seen that many students read books in the library.

Meanwhile, based on the results of interviews with teachers from SMAN 3 and SMAN 5 Ambon, they stated that they had not yet accustomed students to answering questions that were equivalent to science literacy assessment questions, because teachers felt that in answering questions related to what had been learned, students still had difficulties in the learning process. Students also rarely carried out the literacy process or read books before learning began because when the book packages were distributed, 2 students only got 1 book. This made students feel uncomfortable or there were students who were lazy to wait for their friends to finish reading books. In addition, library facilities and infrastructure and textbooks were also adequate, but students seemed less enthusiastic about the library. This was stated in research conducted by [Pratiwi et al. \(2019\)](#) that students who are not used to scientific literacy questions [Rusilowati et al. \(2016\)](#) which generally use discourse will find these questions more difficult than the exam questions they usually get. also explained that the scientific literacy-based textbooks developed were effective in improving students' scientific literacy skills.

According to [Zulanwari \(2023\)](#) There are several factors that cause low scientific literacy skills, namely (1) The topic has never been studied so that students find it difficult to answer questions about the scientific literacy questions given. (2) Students are not used to working on questions that use arguments. (3) Educators are less accustomed to supporting students' learning processes in helping develop scientific literacy skills. Other factors that cause low scientific literacy skills are education programs and systems, less efficient choice of learning methods and models, inadequate learning facilities and media as well as teaching materials and resources.

From the explanation above, it can be concluded that the ability of science literacy in biology learning for grade X students of Senior High Schools in Ambon City is still relatively low. Therefore, educators need to apply the principles of constructivism learning as required in the school curriculum in order to create more effective learning. In addition, monitoring and evaluation of the implementation of the curriculum in schools need to be carried out. Then, students' low science literacy can be improved by using effective learning such as implementing creative learning approaches or models and learning media.

In line with [Yuliati \(2017\)](#) research, it is explained that students' scientific literacy abilities can be improved by implementing a science learning model that prioritizes the development of attitudes, ideas and process skills that emphasize the scientific discovery approach so as to increase students' enthusiasm, interest, motivation and curiosity about science. In research, [Asyhari and Clara \(2017\)](#) explained that LOI (Level of Inquiry) learning can improve students' scientific literacy skills compared to conventional learning.

Research by [Sari et al. \(2017\)](#) explains that the scientific literacy abilities of students who receive project learning based on scientific literacy content modules are better compared to the learning and teaching materials used in normal schools. [Safitri et al. \(2016\)](#) also explained that a scientific approach can improve students' scientific literacy abilities. [Hasnah et al. \(2017\)](#) also explained that the writing to learn approach in science learning is

effective for improving students' scientific literacy skills. Apart from the effectiveness of using various learning approaches and models in terms of appropriate evaluation instruments, it can also have an impact on efforts to increase students' scientific literacy, as research by [Hasana et al. \(2017\)](#) explains that assessment instruments using the ADDIE model can improve students' scientific literacy abilities.

Based on the results of hypothesis testing, it is known that the students' scientific literacy skills for the SMAN 3 and SMAN 5 groups are  $0.000 < 0.05$ , the SMAN 3 and SMAN 11 groups are  $0.000 < 0.05$  and the SMAN 5 and SMAN 11 groups are  $0.003 < 0.05$  so it can be concluded that  $H_a$  is accepted. This means that there are differences in students' scientific literacy abilities in solving story questions on environmental change material in class X SMA in Ambon City.

There are differences and low scientific literacy abilities caused by students not being used to working on scientific literacy-based questions. The questions are in the form of articles/discourses related to problems and conclusions, apart from that, students also have difficulty interpreting questions in the form of graphs or tables ([Qodriah et al. 2021](#)).

But the majority of educators do not have this ability. As educators have limitations in using concepts, processes and contexts of science and scientific knowledge, science learning schools pay less attention to local culture that develops in society. An educator is required to master skills and abilities, adapt to the current era of new technology, use media, choose learning models that are appropriate for the 21st century and develop instruments that will be used during the learning process. The focus of science educators must be to increase students' ability to think critically, rationally and creatively, which can only be possible when educators are ready to actively involve students in constructive scientific discussions ([Dwi, 2021](#)).

## CONCLUSION

Based on these results, it can be concluded from the three schools that the scientific literacy ability of students is in the medium category at SMAN 11 Ambon. There is a difference in students' scientific literacy skills in solving story problems on environmental change material in class X of SMA in Ambon City for the SMAN 3 group with SMAN 5 is  $0.000 < 0.05$ , the SMAN 3 group with SMAN 11 is  $0.000 < 0.05$  and the SMAN 5 group with SMAN 11 is  $0.003 < 0.05$ .

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