



Research Articles

Utilization of laboratories through scientific literacy activities to improve scientific attitudes and creative thinking

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ABSTRACT

One way to empower students' potential is by providing and utilizing laboratories, but this is what happens in public high school 8, 10 and 12 southTanimbar, only a small number of teachers utilize the laboratory as a means of learning biology for practicums in the teaching and learning process, even only delivering material without practicum activities by the majority of teachers. The purpose of this study was to determine the effect of laboratory utilization through science literacy activities on the scientific attitudes and creative thinking of high school students throughout the Tanimbar Islands Regency. The type of research used is quasi-experimental research. The population in this study were all grade X students at public high school 8, 10 and 12 Tanimbar Islands, totaling 75 students. Data analysis using Anova and continued with Duncan's test with the help of SPSS Version 27. The results of the study showed that the use of laboratories through science literacy activities influenced the scientific attitudes of high school students in Tanimbar Islands Regency with a sig value of 0.018 <0.05 and the use of laboratories through science literacy activities influenced the creative thinking of high school students in Tanimbar Islands Regency with a sig value of 0.030 <0.05.

Keywords: *Laboratory Utilization, Scientific Attitude, Creative Thinking*

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INTRODUCTION

Education has components that support its implementation such as students, teachers, infrastructure, curriculum, funds and environment. Educational facilities include all equipment and supplies that directly support the educational process, while educational infrastructure includes all facilities such as buildings, land and so on that indirectly support the educational process. Therefore, educational facilities and infrastructure are factors that must be present because they are very important to support learning activities (Ahdila et al. 2022). One way to empower the potential of students is by providing and utilizing laboratories. The use of laboratories as one of the facilities and infrastructure in the learning process aims to enable students to test and carry out real activities based on what has been obtained in theory (Hikmah and Nurzila, 2022). As a science that develops experimentally, science contains a lot of declarative knowledge that can be learned by students as well as procedural theoretical knowledge that is learned through practicums. Procedural knowledge includes how knowledge is obtained and how knowledge is implemented by students who have the knowledge to understand scientific facts and the relationship between science, technology, and society, and are able to apply their knowledge to solve problems in real life, which is called scientific literacy.

Scientific literacy is a scientific activity to be able to identify questions, explain scientific phenomena, and draw conclusions based on scientific methods. Students who have scientific literacy will be able to collect scientific information to produce scientific products through scientific attitudes and logical, critical, creative thinking, mastering technology and following the development of science. Therefore, measuring scientific literacy is very important to determine the level of scientific literacy of students so that the quality of education in Indonesia can increase and compete with other countries (Erniwati et al. 2020). The importance of these thinking skills is used to help students in the problem-solving process with the affective aspect, namely scientific attitudes.

Scientific attitude is an attitude in the form of actions to solve a problem with the habit of thinking through scientific steps. Scientific attitude in biology learning is often associated with attitudes towards science. Assessment of scientific attitudes in science learning is important because learning is related to ability, so it becomes a benchmark for whether students are capable or not in the learning process. Attitude contains three dimensions, namely cognitive beliefs, affective or evaluative feelings and a person's behavior towards the object of the attitude because scientific attitude is an attitude that must exist in a person when facing scientific problems because this scientific attitude needs to be accustomed and started from learning in class until when carrying out practicums (Yuliatin et al. 2021). Thus, scientific attitude is a person's view of the way of thinking that is in accordance with the scientific method, so that there is a tendency to accept or reject the way of thinking that is in accordance with the field of science. This way of thinking is called creative thinking skills. Creative thinking according to Yuliatin et al. (2021) is an individual's skill in using their thinking process to produce new, constructive ideas based on rational concepts and principles as well as a person's perceptions and intuitions. Creative thinking skills are built by concepts that already exist in a person which are then applied in the learning process in solving problems. Considering the importance of creative thinking skills, the Indonesian government has integrated creative thinking skills into the education curriculum.

Several previous studies on the use of laboratories by Isti et al. (2020), regarding the analysis of high school students' scientific literacy skills in biology learning using noslit, showed that students' scientific literacy was very low due to learning methods that did not empower students in carrying out the science process, then research by Yuliatin et al. (2021) regarding the relationship between scientific attitudes and creative thinking skills in chemistry education students at the University of Mataram and Yasiro et al. (2021) regarding the analysis of students' creative thinking skills in solving problems on global warming material based on student learning achievement that students' scientific attitudes and creative thinking were still moderate due to practicum activities that were rarely carried out by teachers so that the process of training students to develop an attitude of curiosity, critical and creative thinking, an attitude of wanting to get something new, being diligent, an attitude of being sensitive to the surrounding environment and an attitude of free thinking which are part of the science attitude were not carried out properly. The provision made by teachers to students is important because starting from concepts, ideas and processes must include the level of implementation so that the learning that takes place is not boring.

Based on the results of researcher observations in several schools in Ambon City and also interviews conducted by telephone with biology teachers at public high school 8, 10 and 12 SouthTanimbar, it is known that only a small number of biology subject teachers use the laboratory as a means of learning biology for practical work in the teaching and learning process, while the majority only deliver learning materials without any practical activities in the laboratory. This situation can occur due to several factors, such as: (1) the lack of facilities and infrastructure for biology laboratories in schools; (2) practical activities are difficult and dangerous; (3) the lack of complete tools and materials; (4) a lot of time is wasted and (5) it is feared that it can damage the materials available in the laboratory. Changing the way teachers teach needs to be a central solution in improving the quality of students' scientific literacy. The improvement in the quality of teaching must of course be realized by each teacher who sees that students' scientific literacy is still lagging behind nationally. The implementation of providing scientific literacy through science learning can pay attention to the elements of Core Competencies (KI) and Basic Competencies (KD) contained in the curriculum package for use in the biology learning process.

METHODS

The type of research used is quasi-experimental. The population in this study were all students of public high school 8, 10 and 12 of the Tanimbar Islands. The sample in this study was 75 students. Data collection techniques used observation, documentation and written tests (post-test and past test). Before conducting inferential analysis, a normality test was first carried out using the Shapiro - Wilk test. While inferential statistics use Anova analysis which is used to analyze the use of laboratories through science literacy activities on scientific attitudes and creative thinking of high school students in the Tanimbar Islands Regency. This Anova test uses the SPSS 27 calculation application and then a further Duncan test will be carried out.

RESULTS AND DISCUSSION

The students' pre-test and post-test results data can be seen in the following table:

Table 1. Pre-test and post-test values of students of SMA 8 Kepulauan Tanimbar

<i>Pre-exam</i>			<i>Post-test</i>		
Interval	F	%	Interval	F	%
30-35	2	8%	70-75	14	56%
40-45	7	28%	80-85	8	32%
50-55	8	32%	years		
60-65	8	32%	90-95	3	12%
			years		
Total	25	100%	Total	25	100%

Table 2. Pre-test and post-test values of students of SMA 10 Kepulauan Tanimbar

<i>Pre-exam</i>			<i>Post-test</i>		
Interval	F	%	Interval	F	%
30-35	7	28%	70-75	7	28%
40-45	10	40%	80-85	16	64%
50-55	5	20%	years		
56-60	3	12%	90-95	2	8%
			years		
Total	25	100%	Total	25	100%

Table 3. Pre-test and post-test values of students of SMA 12 Kepulauan Tanimbar

<i>Pre-exam</i>			<i>Post-test</i>		
Interval	F	%	Interval	F	%
20-25	2	8%	70-75	7	28%
26-30	4	16%	80-85	12	48%
31-35	5	20%	years		
40-45	4	16%	90-95	6	24%
50-55	5	20%	years		
60-65	5	20%			
Total	25	100%	Total	25	100%

Based on the table above, it is known that the scores on the initial test indicate that students have a low level of concept mastery. Meanwhile, if we look at the final test, it shows that 100% of students experienced an increase in scores. This means that there is a difference in the increase in scores between before and after students utilized the laboratory through science literacy activities.

Table 4. Students' scientific attitude values

Tanimar Islands High School 8			High School 10 Tanimbar Islands			Tanimbar Islands 12 High School		
Interval	F	%	Interval	F	%	Interval	F	%
80-85	2	8%	80-85	8	32%	80-85	5	20%
years			years			years		
86-90	14	56%	86-90	5	20%	86-90	14	56%
91-95	9	36%	91-95	12	48%	91-95	6	24%
years			years			years		
Total	25	100%	Total	25	100%	Total	25	100%

Based on the table above, it is known that the number of scores for the scientific attitudes of students at public high school 8, 10 and 12 Tanimbar island is in the range of 80-95. From the table above, it can be seen that students with the highest scientific attitude scores are at SMA 10 Tanimbar island with a percentage of 90-95 as many as 12 students (48%).

Table 5. Students' creative thinking scores

Tanimar Islands High School 8			High School 10 Tanimbar Islands			Tanimbar Islands 12 High School		
Interval	F	%	Interval	F	%	Interval	F	%
70-75	11	44%	70-75	6	24%	70-75	9	36%
80-85	11	44%	80-85	15	60%	80-85	13	52%
years			years			years		
90-95	3	12%	90-95	4	16%	90-95	3	12%
years			years			years		
Total	25	100%	Total	25	100%	Total	25	100%

Based on the table above, it can be seen that the creative thinking scores of students at public high school 8, 10 and 12 Tanimbar island, have scores in the range of 70-95. From the table above, it can be seen that students with the highest creative thinking scores are at public high school 10 Tanimbar island with a percentage of 90-95 as many as 4 students (16%).

Table 6. Normality test results

NO	School	Variables	Signature	Information
1	Tanimbar Islands 8th High School	Laboratory Utilization	0.309	Normally distributed
		Scientific Attitude	0.300	Normally distributed
		Creative Thinking	0.354	Normally distributed
2	High School 10 Tanimbar Islands	Laboratory Utilization	0.421	Normally distributed
		Scientific Attitude	0.200	Normally distributed
		Creative Thinking	0.302	Normally distributed
3	Tanimbar Islands 12 High School	Laboratory Utilization	0.458	Normally distributed
		Scientific Attitude	0.400	Normally distributed
		Creative Thinking	0.324	Normally distributed

Based on the table above, it is known that Public high school 8, 10 and 12 Tanimbar island for each variable of laboratory utilization, scientific attitude and creative thinking obtained a sig value > 0.05 , so the value can be said to be valid, which means that all data is normally distributed.

Table 7. ANOVA test results

Variables	Signature
Scientific Attitude	0.018
Creative Thinking	0.030

Independent Variable: Laboratory Utilization

The sig value is $0.018 < 0.05$, so it can be concluded that H1 is accepted, which means that the use of laboratories through science literacy activities has an effect on the scientific attitudes of high school students in Tanimbar Islands Regency. The sig value is $0.030 < 0.05$, so it can be concluded that H2 is accepted, which means that the use of laboratories through science literacy activities has an effect on the creative thinking of high school students in Tanimbar Islands Regency.

Table 9. Duncan's advanced test results

Variables	School	N	1	2	3
Laboratory Utilization	Senior High School 8 K. Tanimbar	25	78.80		
	Senior High School 10 K. Tanimbar	25		79.60	
	SMA 12 K. Tanimbar	25			80.20
Sikap Ilmiah	SMA 8 K.Tanimbar	25	90.20		
	SMA 10 K.Tanimbar	25		91.80	

Creative	SMA 12 K. Tanimbar	25		92.40
	SMA 8 K.Tanimbar	25	78.20	
	SMA 10 K. Tanimbar	25		80.00
	SMA 12 K. Tanimbar	25		81.60

The results of the Duncan test showed that the utilization of the laboratory of high school 8 Kepulauan Tanimbar had a significant difference with students of high school 10 Tanimbar island and significantly different from students of high school 12 Tanimbar island with a sig value <0.05 and the highest value of high school 12 Tanimbar island was 80.20 and high school 10 Tanimbar island was 79.60 and high school 8 Tanimbar island was 78.80. The scientific attitude of students of SMA 8 Kepulauan Tanimbar was significantly different from students of high school 10 Tanimbar island and significantly different from students of high school 12 Tanimbar island with a sig value <0.05 and the highest value of high school 12 Tanimbar island was 92.40 and high school 10 Tanimbar island was 91.80 and high school 8 Tanimbar island was 90.20. Creative thinking of students of high school 8 Tanimbar Islands is significantly different from students of high school 10 Tanimbar Islands and significantly different from students of high school 12 Tanimbar Islands with a sig value <0.05 and the highest value in high school 12 Tanimbar Islands is 81.60 and high school 10 Tanimbar Islands is 80.00 and high school 8 Tanimbar Islands is 78.20.

Discussion

The scientific attitudes of students at high school 8, 10 and 12 Tanimbar island are in the range of 80-95. From the table above, it can be seen that students with the highest scientific attitude scores are at high school 10 Tanimbar island with a percentage of 90-95 scores of 12 students (48%). (Table 4). Meanwhile, the results of the Anova test showed that the use of laboratories through science literacy activities had an effect on the scientific attitudes of high school students in Tanimbar island Regency with a sig value of $0.018 <0.05$. So it can be concluded that H1 is accepted.

In line with the research of [S, hulkhah \(2020\)](#) the use of laboratories can improve students' scientific attitudes. The average scientific attitude of students in cycle I was 10.256 (low), in cycle II 14.923 (high) and in cycle III increased to 18.128 (very high). Thus it can be concluded that there is an increase in students' process skills through the use of laboratories. Then the research of [Ahdila et al. \(2022\)](#) explained that the results of the study on the effectiveness of the use of laboratory functions were in the effective category (83.81%), including the aspect of instilling students' scientific attitudes in the effective category (80.8%). [Sulistiyowati et al. \(2016\)](#) The scientific attitude of the control class without using the inquiry method increased but the increase was not too high, this can be seen from the results of the N-gain test which is included in the low category. The scientific attitude in the experimental class using the inquiry method increased, the increase was quite large, this can be seen from the results of the N-gain test which is included in the moderate category.

Biology learning using laboratories (practicums) provides direct experience in the form of observation, preparation, exploration and understanding of subject matter, and directs students to active learning. One of the most important characteristics of the learning process is student activity. Biology learning is part of science that emphasizes process skills so that in learning, students are required to be actively involved. This shows that the practical activities carried out help students understand the subject matter so that their learning outcomes can improve. Practical work can arouse science learning motivation and support subject matter. [Emda \(2017\)](#) also stated that practical work is one of the laboratory activities that plays a very important role in supporting the success of the science teaching and learning process.

One way to improve laboratory utilization is to look at students' scientific attitudes. Developing a scientific attitude from creativity and experience in learning will certainly be embedded in students' memories longer, so that students can easily identify problems, make hypotheses and design experiments and collect data and analyze them through learning activities. In addition to improving scientific literacy, students can also improve communication and concern for friends and the surrounding environment ([Yuliantin et al., 2021](#)). As research conducted by [Ani Hastuti, \(2013\)](#) stated that the practicum method can influence scientific attitudes and in line with previous research it was also found that the practicum method of using materials in everyday life can improve students' understanding. Students who have a strong understanding will have better learning outcomes, while students who have a weak understanding of a theoretical concept will have less than optimal learning outcomes.

In this study, the increase in students' scientific attitudes can be said to be quite optimal. This can be seen from the increase in students' attitudes in the medium to high categories from all schools. The main factor that causes this condition to occur is that the time used for the learning process is very limited. Therefore, in the future, it is hoped that the biology learning process can make it easier for students to improve their scientific attitudes both in terms of time and the learning process.

Utilization of Laboratories Through Science Literacy Activities for Creative Thinking of High School Students in Tanimbar Islands Regency

Creative thinking of students at High school 8, 10 and 12 Tanimbar Islands is in the range of 70-95, from the table above it can be seen that students with the highest creative thinking scores are at high school 10 Tanimbar Islands with a percentage of 90-95 scores of 4 students (Table 5). Meanwhile, the results of the ANOVA test showed that the use of laboratories through science literacy activities had an effect on the creative thinking of high school students in Tanimbar Islands Regency with a sig value of $0.030 < 0.05$. So it can be concluded that H2 is accepted.

In line with previous research on the use of laboratories by Lubis (2024) IPA that the use of laboratories is very good because the frequency of laboratory use, completeness of tools and materials, the suitability of materials is right and can improve students' creative thinking skills. Yuliatin et al. (2021) regarding creative thinking skills in chemistry education students at the University of Mataram can be improved by utilizing existing laboratories. Rosa (2017) explained that there is an influence of laboratory contributions to students' creative thinking skills using the PjBL learning method.

The success of the biology learning process is influenced by creativity (Mukaromah et al., 2013). Creative students tend to be active in learning, are more courageous in expressing their ideas, are able to formulate questions by referring to the material and find solutions to every problem that may occur during learning. Creative students are more interested in facing challenges, have a great curiosity and are enthusiastic in presenting the results of their work. These habits make it easier for students to solve problems in physics subjects so that they can improve students' physics learning outcomes and support the achievement of learning objectives.

Through the use of laboratories through science literacy activities, students can construct their own creative thinking skills through direct observation, students can be stimulated to formulate problems, can have varied answers, provide interpretations of an object, and are able to detail the details of an object of observation. Students are able to work together to find solutions to problems and can discuss with their group mates to find solutions from the results of observations. In addition, they can train to make observations systematically starting from preparing tools and materials, making observations and collecting and recording data from the results of the investigation. Students can also interpret the concepts given so that they can be applied in everyday life. day, so it can be concluded that the practical activities carried out can develop students' creative thinking skills.

Based on the results of the researcher's observations, the use of this laboratory increases students' enthusiasm in participating in learning activities. This happens because the practicum process is an interesting learning medium, not boring, and becomes a new learning medium for students, so that students are enthusiastic and curious. Practical activities that can be repeated automatically in a short time mean that students can repeat practical activities if they are still curious or experience failure. This is in line with the opinion of Wijaya (2017) who reported that the use of laboratories as a teacher support tool can create a strong learning process and increase student learning motivation, provide opportunities for students to learn independently and manage their time depending on their learning speed.

In this study, the increase in students' creative thinking can be said to be quite optimal. This can be seen from the increase in students' creative thinking in the medium to high categories from all schools. The main factor that causes this condition to occur is that the time used for the learning process is very limited. Therefore, in the future, it is hoped that the biology learning process can facilitate students in improving students' creative thinking both in terms of time and the learning process.

CONCLUSION

Based on the research results that have been described, it can be concluded that the use of laboratories through science literacy activities has an effect on the scientific attitudes of high school students in the Tanimbar Islands Regency with a sig value of $0.018 < 0.05$ and the use of laboratories through science literacy activities also has an effect on the creative thinking of high school students in the Tanimbar Islands Regency with a sig value of $0.030 < 0.05$.

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