The Enrichment of Science Teaching Materials Sourced from Marine Aquaculture Ecology to Increase Scientific Literacy of Students' Junior High School

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Abstract—The environment is an interactive learning resource to improve students' scientific literacy, such as the study location's marine cultivation area environment. This study aimed to integrate the marine culture environment's ecological parameters for the enrichment of teaching materials in improving students' scientific literacy. The research method used observation and experiment—the non-equivalent pretest-posttest control group design—sampling technique using a total sampling technique. The research data collection used multiple-choice tests, and the data were analyzed using the independent sample t-test with the help of SPSS 17.00. The results showed that students at the initial stage had limited knowledge about the marine culture environment relevant to the teaching material. However, relatively all students understand correctly the location of cultivation and cultivation techniques developed by the community. Furthermore, the results of the analysis of the independent sample t-test showed that the significant value of students' scientific literacy skills was less than 0.05 ($p < 0.05$). The conclusion is that the enrichment of science teaching materials sourced from marine cultivation ecology can significantly increase students' science literacy. Therefore, scientific learning that only standardization material from school books with fabric sourced from the environment.

Keywords—teaching materials, ecological of marine culture, scientific literacy, and junior high school students

I. INTRODUCTION

Marine cultivation in the coastal waters of East Lombok has significant value as an instrument in the economic development of small fishers and the sustainability of fish and ecosystem resources [1]. The development of marine culture is also supported by the large potential for cultivated seeds from the environment around the cultivation. Such as crucial economic fish seeds (rabbit fishes, mullets, snappers, grants sweetlips, and goatfishes) and lobster seeds [1,2]. Besides, it is suspected that climate change has put pressure on fishing yields [3]. And changes in temperature as an indicator impact the community structure of fish caught [4]. The two factors, namely over-fishing and climate change, are a problem for the fishing business's sustainability, such as in the study location.

The cultivation environment, such as marine cultivation in the study location, can be developed as a learning object to improve students' scientific literacy towards the environment. However, an educational design that will contribute effectively to a sustainable future requires a consistent learning framework as part of an integrated environment [5,6]. In this regard, environmental materials can be developed or integrated into the form of teaching materials. Teaching materials can provide students with positive achievements compared to those who do not use teaching materials [7] and make teaching materials easier for students to understand about nature-based learning objects [8,9].

The development of marine cultivation-based teaching materials in junior high schools in the study location has been carried out by observing all schools using science teaching materials from textbooks. Therefore, research is needed related to teaching materials sourced from the surrounding environment, namely marine cultivation. The objectives of this study are (1) participants can apply knowledge, skills, and attitudes in developing an understanding of science literacy, (2) strengthen and stimulate curiosity and imagination of students about the potential of the local environment; and (3) foster understanding, care and a sense of responsibility. the responsibility of students for environmental sustainability and the sustainable use of local ecological resources. This research can also be a rational and effective solution to overcome the shortage of teaching materials. Students are concerned about the sustainability of cultivation as a source of sustainable livelihoods and environmental protection from anthropogenic threats.

II. METHODS

This research was conducted in the odd semester of the 2020/2021 school year, at the Pesisir Village Junior High Schools in East Lombok Regency. The research method uses the method of observation and quasi-experimental (Quasi Experiment). The study population was all students at the sample school, and in this study, all populations were the research sample. The research was conducted using the nonequivalent pretest-posttest control group design. The pre-test in the research design was used for statistical control so that it could be seen the impact or effect of the enrichment of science teaching materials from the environmental ecology of marine culture on students' scientific literacy skills. The data collection of scientific literacy skills was carried out using a test instrument, namely a multiple-choice type test. Analysis of the research data raw scores obtained from the pre-test and post-test were presented in tabular form for interpretation purposes; the mean, standard deviation, and mean difference were calculated for each group at each school. The significance of the difference between the mean scores of the two experimental and control groups on the pre-test score variable, the post-test score was tested at the significance level of 0.05, through the independent sample T-test using SPSS 17.00 assistance.

III. RESULTS AND DISCUSSION

Teaching materials that are sourced from teacher textbooks are enriched with material relevant to the marine culture environment's ecology. Before teaching materials are used, students are first given pre-test questions, with a multiple-choice model of 20 items. The pre-test results refer to changes in students' literacy abilities after being given enrichment teaching material. The learning process typically runs like learning activities commonly carried out by teachers. The process carried out is that students and teachers participate in orientation and field visits, which include group discussions and making topics led by teacher representatives about the value of ecology in biology and physics from the environmental aspect of marine culture. Students work in small group activities to develop and understand material according to predetermined competencies. They were given a Post-test with the same model in the post-test after using the teaching materials (Table 1).

The mean (pre-test) of science literacy skills of Mts NW Nurul Ikhsan Tanjung Luar, in the experimental group, shows an average value of 40.52, with a minimum value of 20 and a maximum value of 65. Meanwhile, the average value (Pre-test) of scientific literacy skills in the control group showed an average score of 41.03, with a minimum value of 30 and a maximum value of 55—the pre-test score of scientific literacy skills in SMP 1 Keruak. The experimental group showed that the 57.34, with a minimum value of 45 and a maximum value of 75. Simultaneously, the mean (pre-test) score of scientific literacy skills in the control group showed an average value of 59.69, with a minimum score of 50 and a maximum value of 70. -The mean (pre-test) of the science literacy ability of SMP

1 Jerowaru in the experimental group showed that the mean score was 59.65, with a minimum score of 45 and a maximum value of 75, while the mean score (pre-test) of scientific literacy skills in the group control shows the value of r an average of 58.79, with a minimum value of 35 and a maximum value of 80.

TABLE I.   THE RESULT OF PRE-TEST AND POST-TEST OF SCIENCE LITERACY ABILITY

School Name	Group	N	Min	Max	Mean	SD
Mts NW Nurul Ikhsan Tanjung Luar	pre-test of experimental group	29	20	65	40.52	11.52
	post-test of experimental group	29	40	85	66.03	9.85
	pre-test of control group	29	30	55	41.03	7.60
	post-test of control group	29	30	70	52.24	7.51
SMP 1 Keruak	pre-test of experimental group	32	45	75	57.34	8.89
	post-test of experimental group	32	50	85	68.28	9.21
	pre-test of control group	32	50	70	59.69	6.21
	post-test of control group	32	45	80	66.41	8.63
SMP 1 Jerowaru	pre-test of experimental group	29	45	75	59.65	8.96
	post-test of experimental group	29	65	95	78.62	7.10
	pre-test of control group	29	35	80	58.79	8.73
	post-test of control group	29	55	85	73.79	8.20

The average score (Post-test) of Mts NW Nurul Ikhsan Tanjung Luar scientific literacy in the experimental group shows that the average value is 66.03, with a minimum value of 40 and a maximum value of 85. In contrast, the average value (Post-test) The scientific literacy ability in the control group showed an average score of 52.24, with a minimum score of 30 and a maximum value of 70. The post-test score for the science literacy skills of SMP 1 Keruak in the experimental group showed that the average score was 68, 28, with a minimum score of 50 and a maximum score of 85. In contrast, the average score (post-test) of scientific literacy skills in the control group showed an average value of 66.41, with a minimum score of 45 and a maximum value of 80. The pre-test) of the scientific literacy skills of SMP 1 Jerowaru in the experimental group showed that the average score was 78.62, with a minimum value of 65 and a maximum value of 95. In contrast, the average score (post-test) of scientific literacy skills in the control group showed a value average of 73.79, with a minimum of 55 and a maximum value of 85. All data (Table 1), in pre-test and post-test of science literacy students of Mts

NW Nurul Ikhsan Tanjung Luar, SMP 1 Keruak, and SMP1 Jerowaru.

The analysis of scientific literacy skills in this study used the Independent Sample T-test with the SPSS 17.0 program's help at the 5% significance level (Table 2). The research of the Independent Sample T-test (Table 2) shows the significance value (2-tailed) on the scientific literacy skills of students of MTs NW Nurul Ikhsan Tanjung Luar, SMP 1 Keruak, and SMP 1 Jerowaru is 0,000. Still, the significance of the control class in SMP 1 Keruak is 0.001, which means less than 0.05 ($p < 0.05$). And this result illustrates the effect of enrichment of science teaching materials sourced from the ecology of the marine culture environment to improve students' scientific literacy in the coastal village junior high schools in East Lombok.

This teaching material is a science teaching material that comes from aquaculture ecology in students or called Socio-Scientific Issues, which is different from the teaching materials that students usually use. The teaching materials used by researchers are sourced from aquaculture ecology material. The same thing has been developed in teaching materials based on Socio-Scientific Issues on technology materials in learning [10]. Furthermore, similar researches have also been done [11-14]. Indonesian students' literacy skills could be improved by presenting science teaching materials in schools with a balanced dimension of scientific literacy and are associated with socio-social issues and community technology. The enrichment of science teaching materials can provide students with positive achievements compared to those who do not use teaching materials [7] and make teaching materials easier for students to understand about nature-based learning objects [9]. It is in line with the scientific literacy abilities of students who receive project learning assisted by modules with scientific literacy that are better than students who receive lecture learning accompanied by experiments and use teaching materials commonly used in schools [15].

Learning is a teaching activity in terms of student activities in the form of student learning experiences. Science learning has been less relevant and less popular among junior high school students. It is because the curriculum used in schools tends to put subject matter first then has little application. Even though scientific principles must be balanced so that it can be used to solve problems or make decisions regarding everyday problems [6]. Scientific literacy skills are closely related to students' research abilities. Students' research abilities will influence efforts to produce discoveries that come from the world of education. Based on research data conducted at three junior high schools in Keruak District, there were post-test results that increased based on the average value (Table 1) and had a significance value of less than 0.05 ($p < 0.05$) (Table 2). shows that the enrichment of science teaching materials sourced from the East Lombok waters' ecology affects students' scientific literacy. The results of this study are the same as a research [13] that teaching materials based on Socio-Scientific Issues in subject matter affect students' scientific literacy skills.

Literacy is the ability to read, analyze, assess the accuracy of data and written information, and utilize and communicate well in different contexts [16]. Literate students will find it easy to understand and answer the surrounding natural phenomena known as scientific literacy [17]. It is related to researchers' teaching materials and sourced from aquatic ecology or the environment around students or related to SSI because in the PISA document (2013). One of the literacy skills is the ability to link knowledge with social problems related to science or Socio-Scientific Issues [18-20]. About the strategic value of this research, the urgency is: (1) as a rational and effective solution to overcome the problem of shortage of teaching materials from the surrounding environment and (2) students have a concern for the sustainability of cultivation as a source of sustainable livelihoods and environmental protection from anthropogenic threat.

TABLE II.   RESULTS OF THE INDEPENDENT SAMPLE TEST ANALYSIS

School Name	Group	Post-Test	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mts NW Nurul Ikhsan Tanjung Luar	pre-test of experimental group	-9.064	56	0.000	-25.517	2.815
	post-test of experimental group	-9.064	54.684	0.000	-25.517	2.815
	pre-test of control group	-5.647	56	0.000	-11.207	1.985
	post-test of control group	-5.647	55.991	0.000	-11.207	1.985
SMP 1 Keruak	pre-test of experimental group	-4.833	62	0.000	-10.938	2.263
	post-test of experimental group	-4.833	53.314	0.000	-10.938	2.263
	pre-test of control group	-3.573	56	0.001	-6.719	1.881
	post-test of control group	-3.573	55.991	0.001	-6.719	1.881
SMP 1 Jerowaru	pre-test of experimental group	-8.956	56	0.000	-18.966	2.118
	post-test of experimental group	-8.956	53.095	0.000	-18.966	2.118
	pre-test of control group	-6.745	56	0.000	-15.000	2.224
	post-test of control group	-6.745	55.9784	0.000	-15.000	2.224

IV. CONCLUSION

The enrichment of science teaching materials sourced from the ecology of the marine culture environment can improve students' scientific literacy skills at junior high schools in the coastal village of East Lombok. A significant value indicates this. Therefore, scientific learning that integrates ecological values, such as marine aquaculture ecology, can be a source of enrichment for rational and practical teaching materials in improving students' scientific literacy.

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