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**Evaluation of the integration of environmental education in biology subjects to strengthen the environmental literacy of learners in secondary schools**

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**ABSTRACT**

*Since 1989, environmental education has been integrated into all subjects at all levels of primary and secondary education, one of which is Biology. However, until now, the learning outcomes of environmental education have not been widely felt, especially in changes in knowledge, attitudes, and behavior (environmental literacy). This study aims to determine whether environmental education materials integrated with biology subjects strengthen students' environmental literacy. Based on this, a study was conducted to analyze students' knowledge, attitudes, and behavior (environmental literacy) that have obtained environmental materials integrated with biology subjects. The research was conducted by identifying the syllabus and lesson plans for biology subjects and evaluating environmental education materials; then, students were given a questionnaire divided into three groups of questions according to environmental literacy standards: knowledge, attitudes, and behavior towards the environment. The research sample was 84 students from grades X and XII. The analysis results show that integrating environmental education materials in biology subjects does not strengthen the students' environmental literacy. These results can be interpreted that integrated environmental education materials need to be deepened, curriculum design, teaching method innovation, and learning media.*

**Keywords:** *integration of environmental knowledge, biology subject, environment education, environmental literacy.*

**1. INTRODUCTION**

Environmental literacy is knowledge about aspects of building the environment, understanding individuals about values and principles that occur in the environment, and being able to play a role in maintaining environmental quality through their behavior (Hollweg et al., 2011; Maknun et al., 2017; McBride et al., 2013; Roth, 1992).

Environmental education and education itself play an essential role towards environmental sustainability and significantly impact in the preparation of the future generations who care about the environment (Boca & Saraçlı, 2019; Liao & Li, 2019). Environmental literacy is also the goal of environmental education, and the results depend on the quality of school resources and school management, which are the determinants of

students' environmental literacy (Edsand & Broich, 2020; Hollweg et al., 2011; Negev et al., 2008).

The quality of school resources includes the quality of the teachers. The teachers introduce the environment not only in the classroom but also by carrying out experiments and activities outside the classroom, which positively impact students' environmental knowledge (Jose et al., 2017; Suryawati et al., 2020; Wilujeng et al., 2019).

The teachers must show behavior and caring attitude towards the environment. They should also have good knowledge of the environment to ensure the effective delivery of materials. The longer students receive effective environmental materials from their teachers, and it is hoped that the stronger the students' environmental literacy will be (Zsóka et al., 2013).

However, by integrating environmental education materials into several subjects in high school, the perceived impact of environmental education has not been effective yet. According to Maknun (2017), high school student's knowledge and understanding of the environment of West Java Province is still low.

It shows that environmental education in schools has several shortcomings. The results of Parker's research (2018) show that environmental education in secondary schools identified a lack of knowledge, concern, and familiarity with the environment. These are the main obstacles to overcoming environmental problems. Furthermore, Edsand & Broich (2020), in their research on the relationship between environmental education in schools and environmental literacy, show that environmental education can promote environmental literacy in students, but the result is weak.

In previous research, regarding environmental literacy described earlier, it is not explained the relationship between knowledge, attitudes, and behavior of students from the results of learning subjects in class. Meanwhile in Indonesia, environmental education materials are integrated with several subjects, including biology. So it is very important to do research, whether the learning by integrating environmental education materials strengthens the environment literacy of students.

## 2. METHODS

The survey method carried out in this study used an experimental design with a linear regression quantitative analysis method. The survey

was conducted on 84 students in class X at the State High School 1 Anjatan, Indramayu Regency. Sampling was based on the environmental material syllabus, only for biology subjects in class X and XII, while in class XI there was no environmental material.

**Table 1. Integrated Environmental Materials in Biology Subjects.**

Learning Materials	Grade
Biodiversity	X
Ecology	
Environmental Change	
Waste and Recycling	
Evolution	XII
Evolution mechanism	

Furthermore, the material that has been given is made up of multiple choice questions. Each question is grouped according to environmental literacy indicator standards, namely knowledge, attitudes and behavior skills (McBride et al., 2013; Negev et al., 2008; Roth, 1992). Before conducting the analysis, the researcher used a hypothesis test first, the stages are as follows:

The results of the normality test with the Asymp value. Sig. (2-tailed) of  $0.947 > 0.05$ . This proves that the data is normally distributed because the probability value (sig) is greater than 0.05.

**Table 2. Normality Test Results**

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		84
Normal Parameters <sup>a,b</sup>	Mean	.0000000
	Std. Deviation	3.50267926
	Absolute	.057
Most Extreme Differences	Positive	.050
	Negative	-.057
Kolmogorov-Smirnov Z		.523
Asymp. Sig. (2-tailed)		.947
a. Test distribution is Normal.		
b. Calculated from data.		

1. Furthermore, the linearity test (Table Anova test), the results show that the sig deviation from linearity data value is  $0.849 > 0.05$ . This shows that there is a significant linear relationship between the X variable and the Y variable.

**Table 3**  
**Linierity Test**  
**ANOVA Table**

			Sum of Squares	df	Mean Square	F	Sig.
Students Understanding * Integrated Education	(Combined)		125.676	16	7.855	.588	.882
	Between Groups	Linearity	1.645	1	1.645	.123	.727
		Deviation from Linearity	124.031	15	8.269	.620	.849
	Within Groups		894.276	67	13.347		
	Total		1019.95	83			
				2			

2. Finally, the heteroscedasticity test, the result is known that the significance value of the X variable is 0.508, which means it is greater than 0.05. So it can be concluded that the data does

not experience symptoms of heteroscedasticity or there is no deviation / inequality of variance in the residuals of the regression model.

**Table 4**  
**Heteroscedasticity Test**  
**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.509	2.536		1.778	.079
	Integrasi Pendidikan	-.042	.064	-.073	-.664	.508

a. Dependent Variable: RES\_ABS

The results of the hypothesis test show that there is no deviation in the hypothesis test, so the research could be continued using simple linear regression analysis, using the IBM SPSS Statistics 21 for Windows application. The hypothesis taken in this study, namely:

H0= The integration of environmental education materials in biology subjects does not strengthen the students' environmental literacy.

H1 = The integration of environmental education materials in biology subjects strengthens the environment literacy of students.

### 3. RESULTS AND DISCUSSION

Environmental literacy is an individual's capacity to know, understand, interpret environmental systems and changes to maintain, restore and be able to act on the changes that occur in the environment (Maknun et al., 2017; Roth, 1992; Saribas, 2015). Strengthening environmental literacy is the main goal to foster students to be more responsible for nature and the environment. Also, improving habits that are regularly sustainable (continuous) must be part of the core program of every school (Maknun et al., 2017; Negev et al., 2008).

Environmental materials in formal schools, do not stand alone but are integrated with several subjects, including biology subjects, which are closely related to environmental materials (Miranto, 2017; Sukmarani et al., 2017). The integration of environmental materials in subjects has been integrated into the school curriculum since 1975, starting from elementary school, continuing to high school (Istiadi, 2018). During the development period, the curriculum continues to change. The environmental knowledge materials, in some schools are integrated into subjects or become a local content only. The results of the survey and analysis (2020), explain that 51.7% of senior high schools (SMA) in Indramayu Regency do not have environmental education (PLH) subject and 48.3% have PLH subject that are integrated with other relevant subjects, it can be seen in Figure 1. Since the change in the National Curriculum from the 2006 KTSP to the 2013 Curriculum, PLH subjects have been abolished and become elective subjects whose authority is delegated to each school. However, according to the policy of the Education Office of Indramayu Regency, the required local content is the regional language. So that environmental materials are

integrated in several subjects according to the established learning syllabus.

After conducting tests on 84 upper-middle-level students in grades X and XII, the results of the analysis show:

1. Linear regression equation

Showing the regression coefficient of 0.040 is positive (+), thus it can be said that the

Integration of Environmental Knowledge (X) has a positive effect on Student Understanding (Y), although the effect is very small.

**Table 4**  
**Linear Regression Equation**

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	28.440	4.368		6.511	.000		
Integrated Education	.040	.110	.040	.364	.717	1.000	1.000

a. Dependent Variable: Students' Understanding

2. Test the hypothesis in simple linear regression.

The hypothesis test in simple linear regression is divided into 2, namely the hypothesis test comparing the Sig value with 0.05 and the hypothesis test comparing the t-count value with the t-table. The hypothesis test compares the Sig value with 0.05. Based on table 5, it is known that the significance (Sig.) of 0.717 is greater

than > 0.05 probability, so it can be concluded that H0 is accepted and H1 is rejected, which means that "Integration of environmental education materials in biology subjects (X) does not strengthen students' Environment Literacy (Y)".

**Table 5**  
**Summary Model**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.040 <sup>a</sup>	.002	-.011	3.524	.002	.132	1	82	.717

a. Predictors: (Constant), Integrated Education

3. Hypothesis test comparing the value of t-count with t-table

Based on table 6, the value of t-count is 0.364. Then looking for the t-table, while the formula for finding the t-table is with a confidence level = 95% or ( $\alpha$ ) = 0.05. Degrees of freedom (df) =  $n-k-1 = 84 - 1 - 1 = 82$ , obtained t-table = 1,989.

Because the t-count value of 0.364 is smaller than <1.989, it can be concluded that H0 is accepted and H1 is rejected, which means "Integration of environmental education materials in biology subjects (X) does not strengthen students' Environment Literacy (Y)".

**Table 6**  
**T-test Results**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	28.440	4.368		6.511	.000
1 Integrated Education	.040	.110	.040	.364	.717

## a. Dependent Variable: Students' Understanding

## 4. Regression Determination Coefficiency Test

Based on table 7, the value of R Square is 0.002. This value implies that the integration of environmental education materials in biology subjects (X) does not strengthen students' environmental literacy (Y). Meanwhile, according to Zsóka et al (2013), the more often a person gets environmental education, the

knowledge of his environment will also increase. There should be a correlation between the intensity of the environmental education of students' knowledge. The results of another study, conducted by Maknun et al. (2017) show that the knowledge of understanding of upper secondary students in West Java Province about the environment is not good.

**Table 7**  
**Regression Determination Coefficiency Test Results**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.040 <sup>a</sup>	.002	-.011	3.524	.002	.132	1	82	.717

**Table 8**  
**T-test Results**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	28.440	4.368		6.511	.000
1 Integrated Education	.040	.110	.040	.364	.717

Furthermore, the t-test analysis, in table 8 shows the results of the study, that the value of the variable integration of environmental education through biology subjects (X) does not significantly strengthen the environment literacy of students (Y), 0.364 is smaller than <1.989. Thus, the result of this study, H<sub>0</sub> is accepted and H<sub>1</sub> is rejected.

Research on environmental literacy has been carried out since 1992, at The Ohio State University of Columbus. It examined environmental literacy "Its Root, Evolution Direction in the 1990s". The research evaluated the extent to which students understand environmental literacy. The results indicate the need to improve the environmental literacy component in the future, with improvements directed at the general level of development in formal and non-formal education (Roth, 1992).

Furthermore, in the year Negev et al (2008) also conducted research on "Evaluation of the Environmental Literacy of Israel Elementary High School Students". The research was carried out on the environmental literacy components of students, from knowledge, behavior in the age range of 6-12 years. The results were surprising that in a decade after the environmental education curriculum in formal schools was not encouraging, further research on experimental pedagogical techniques in the field and new curriculum development initiatives were needed.

The results of the research from year to year have continuously concluded that the environment literacy of students is still not good. This situation is a shared task

to be more intense and focused on finding solutions, so that the environmental literacy of students can continue to be strengthened, do not let environmental education only become complementary material, the programs are made to only get prizes. It has to be sustainable to achieve the goal of strengthening understanding, attitude and good behavior towards environmental sustainability.

#### 4. CONCLUSION

Based on the results of the t-test, it can be concluded that the variable integration of environmental education through biology subjects (X) does not significantly strengthen the environmental literacy of students (Y) at a significance level of 5%. So in this study, H<sub>0</sub> is accepted and H<sub>1</sub> is rejected. This condition shows that the learning methods that have been applied by the teachers have not been maximized so that they have not been able to increase students' understanding of the environment. The findings of this study are useful for the teachers of biology subjects to evaluate the materials and teaching methods that have been applied so far. In addition, the teachers must also deepen their abilities in the field of environmental education, especially those that are integrated in biology subjects. In addition, the research findings are also useful as input for principals and curriculum developers. Stakeholders can work together to create an integrated environmental education curriculum design, so that

the environment literacy of students is stronger. In addition, stakeholders must make guidelines for teaching and learning environmental education. So that the teaching staff who are in charge of integrated subjects on environmental materials can provide more in-depth teaching, so that the objectives of environmental literacy as the goal of environmental education can be achieved and have a significant impact on environmental sustainability.

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