



THE EFFECTIVITY OF ENVIRONMENTAL EDUCATION IN SCAFFOLDING STUDENTS' ECOLOGICAL LITERACY

F. A. Ikhsan^{*1}, F. A. Kurnianto², B. Apriyanto³, E. A. Nurdin⁴,
R. W. Bachtiar⁵

^{1,2,3,4}Faculty of Teacher Training and Education, University of Jember, Indonesia

⁵Utrecht University, Netherlands

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ABSTRACT

This study aimed to determine the effectiveness of environmental education as an effort to scaffold students' ecological literacy to bring about a sustainable society. The survey method was applied in this research. This research was conducted at the Faculty of Teacher Training and Education of Jember University, which involved the heads of the study program, lecturers, staffs, and students. Data analysis was done descriptively for both dependent and independent variables by using a non-parametric statistic test. The results showed that there was a significant favorable influence of faculty policy, curriculum implementation, instructional method, and campus culture toward the students' ecological literacy through environmental education, as marked by significance level of $0.00 < 0.05$. The research findings evinced that the four components could escalate the students' ecological literacy on an on-going basis, concerning internalization of theory, real-life application, and scientific thinking through Environmental Education (EE).

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Keywords: ecological literacy, environmental education, students

INTRODUCTION

Humans carry out activities by interacting with the environment and nature as space. Rapid population growth triggers an increase in living standards, which seems to be the cause of a significant increase in the needs for natural resources (Tönük & Kayihan, 2012). The forms of sensitivity and awareness of nature through environmental education have a positive impact on ecological knowledge, attitudes, caring, trust, and intentions in preserving the environment globally (Kukkonen et al., 2018). Therefore, Environmental Education needs to be based on ecological knowledge and understanding as a system of earth function

in supporting human life (Pitman et al., 2016). Williams (2017) explained that ecological literacy from environmental education must be taught and implemented in all curricula to fit the elements of education level in the state-supported by training programs.

Higher education has a responsibility in practicing environmental education for a sustainable manner to deal with social, ecological, and economic changes as development goals (Blanco-Portela et al., 2018). The ideal ecological literacy needs to be harmonized between K-12 and higher education in creating synergies between formal and informal education concerning the environment (McBride, 2011). Understanding of ecological literacy is essential for society as it serves as an element in sustainable development in the 21st century (Capra & Stone, 2010;

Deans & Deans, 2018; Potter, 2009). It is widely acknowledged that the understanding of ecological literacy in environmental education not only leads to an understanding of ecological concepts but also results in understanding the ecosystems (Balgopal & Wallace, 2009). Introduction and understanding of ecological literacy applications are applied in universities to advance new values by prioritizing the environment and social sustainability in environmental education (Boehnert, 2015). Ecological literacy provides knowledge and competence in every student integrally as an attempt to realize sustainable development, instead of destroying the ecosystem (Albracht, 2019; Lebo et al., 2013). Environmental education is linked to cultural learning theories that are useful in transforming individual knowledge, attitudes, and behaviors to harmonize with the ecosystem in inculcating socio-ecological attitudes (Tidball & Krasny, 2011). According to Keraf (2014), to accelerate and actualize environmental education with ecological literacy, two attempts need to be made. First, ecological literacy must be well understood and implemented as a lifestyle in all communities. Second, government policy is required in encouraging the application of sustainable ecological literacy communities with concrete policies and programs run consistently. In general, ecological literacy in environmental education has not been applied thoroughly by universities in Indonesia. The results of the agreement between the Ministry of Research, Technology and Higher Education and the Ministry of Environment on July 22, 2016, indicated that the need for the development of environmental education at universities for students is unquestionable. The goal was to build ecological literacy in conjunction with the Medium Term Development Plan 2015-2019 Government of the Republic of Indonesia, particularly aiming at improving the quality of the environment, mitigating natural disasters, and addressing climate change. The research conducted by Ertekin & Yüksel (2014) indicated that the ecological project practice influences students' environmental literacy on scientific competence in identifying environmental problems and looking for solutions. The research results by Ozgurler & Cansaran (2014), environmental knowledge of graduate students is not at a high level, but their approach to literacy ecology problem is at a high level. Liang et al. (2018) explained that attitudes, knowledge, and behavior of women have better environmental concerns than men in higher education. However, Hammarsten et al. (2018) and Jannah et al. (2013) showed that the development of environmental literacy for

students could have practical impacts including competence, caring learning, and understanding of ecological knowledge. According to Kayihan & Tönük (2013), the advantages and disadvantages of ecological literacy represent normal phenomena since different geographical locations influence them. The purpose of this study was to determine the entire participation and practice of academic community from students, staff, and lectures in building ecological literacy through environmental education based on the vision and mission from faculty and Jember university. The present study aimed at delving into the following research questions:

1. How effective is the policy in Faculty of Teacher Training and Education at the University of Jember concerning the implementation of curriculum, method of lecturing, and campus culture through Environmental Education in building students' ecological literacy?
2. How effective is the policy implemented in the Faculty of Teacher Training and Education at the University of Jember through Environmental Education as the endeavor to build the students' ecological literacy?
3. How effective is the curriculum implementation in the Faculty of Teacher Training and Education at the University of Jember through Environmental Education as the endeavor to build students' ecological literacy?
4. How effective is the lecturing method applied in the Faculty of Teacher Training and Education at the University of Jember through Environmental Education as the endeavor to build students' ecological literacy?
5. How effective is the campus culture accrued in the Faculty of Teacher Training and Education at the University of Jember through Environmental Education as the endeavor to build the students' ecological literacy?

METHODS

This research applied the quantitative approach in the form of a survey (Singarimbun & Effendi, 1995). The research took place at the Faculty of Teacher Training and Education, University of Jember. The data were obtained from the head of study programs, lecturers, educational staffs, and students. The data were collected through questionnaires and observations. The variables observed in this study were faculty policy (X1), curriculum implementation (X2), instructional method (X3), campus culture (X4), and ecological literacy (Y), and relationships among variables (see: Figure 1). A non-parametric statistical test was performed to analyze the data. The first hypothesis test operated Kendall's Concor-

*Correspondence Address
E-mail: ahwan.fkip@unej.ac.id

dance Test, while hypothesis test between two variables (2-5) applied Kendall's Tau Correlation test. The research result was determined by comparing the significance levels with a probability of 0.05. The result of decision analysis was determined based on the following premise; if the

value of the significant level is < 0.05, then H0 is rejected, while if the calculation of significance value is > 0.05, then (Ha) is accepted. The research hypothesis was examined using SPSS 21 software.

Table 1. The Number of Respondents by Their Status and Study Program

The Study Program at The Faculty	Status				Total	(%)
	Head of Study Program	The Number of Lecturers on Environmental Education	Education- al Staffs	Stu- dents		
Physics Education	1	2	1	90	94	9,24
Biology Education	1	3	1	112	117	11,49
Science Education	1	2	1	45	49	4,81
Mathematics Education	1	1	1	120	123	12,08
Elementary School Educa- tion	1	3	1	150	155	15,22
Non-Formal Education	1	0	1	45	47	4,62
English Education	1	0	1	85	87	8,55
History Education	1	1	1	90	93	9,14
Economy Education	1	0	1	90	92	9,04
Geography Education	1	4	1	39	45	4,42
Indonesian Language Edu- cation	1	0	1	114	116	11,39
Total	11	16	11	950	1018	100,0

Source: Primary Data

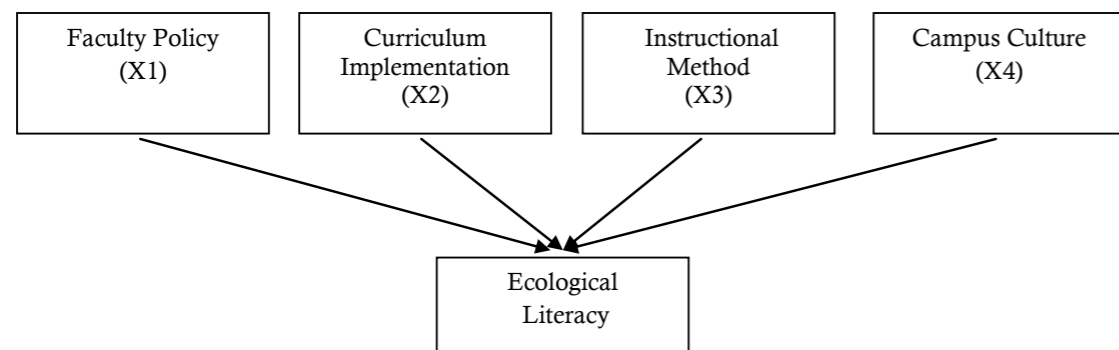


Figure 1. The Correlation among Research Variables

RESULTS AND DISCUSSION

The highest sum score in ecological literacy (Y) was 4670.17, and the highest average score was 467.01, while the total score of the lowest score was 1617.78 with the lowest score at 161.77 correspondings to the instructional method (X3). The highest deviation in the standard score of the

ecological literacy variable (Y) was 7.76, while the lowest value corresponded to campus culture (X4) was 1.67 (Table 2).

The first hypothesis testing showed that significantly positive influences were evident among faculty policy, curriculum implementation, instructional method, and campus culture toward students' ecological literacy through en-

vironmental education. The first hypothesis was examined using Kendall concordance. Based on hypothesis test concerned with faculty policy, curriculum implementation, instructional method, and campus culture toward ecological literacy, Kendall concordance coefficient was 1.00 (Table 3).

The results indicated that all research variables posed perfect concordance; thus, the influence of faculty policy, curriculum implementation, instructional method, and campus culture as a whole accounted for 100% of student's ecological literacy through environmental education. This was supported by the significance level of calculation result, resulting in $0.000 < 0,05$ (H0 was rejected, and Ha was accepted). Based on the analysis results, the first hypothesis proposed in this study was approved for the implementation of curriculum, method of learning, and campus culture through environmental education. The second hypothesis testing indicated that the sig-

nificant positive influence was evident among faculty policy on students' ecological literacy through environmental education. The result of the variable test using Kendall's Tau correlation evinced the correlation coefficient level of 0.880 and significance level value of 0,020. The faculty policy accounted for 53,5% of student ecological literacy, with a significance level of 0.880. This confirmed that 53.5% of the students' ecological literacy was influenced by the faculty policy, while extraneous factors influenced the remaining 46.5%. Environmental education has affected students in increasing environmental awareness in waste management and establishment for a waste bank. Based on operative indicator criteria to calculate the level of significance, the analysis generated a significance value of 0.020 (H0 was rejected, and Ha was accepted). Based on the results of the analysis, the second hypothesis proposed in this study was accepted.

Table 2. The Descriptive Statistic Results of the Research Variables

Variable	N	Min.	Max.	Sum.	Mean	SD	Var.
Faculty Policy	11	184,00	208,00	1936,00	196,80	2,35	5,07
Curriculum Implementa- tion	11	218,40	248,75	2368,92	236,89	4,38	18,48
Instructional Method	11	148,72	184,60	1617,78	161,77	6,32	38,98
Campus Culture	11	200,00	207,00	2072,00	207,20	1,67	2,58
Ecological literacy	11	424,67	470,75	4670,17	467,01	7,76	68,90
Valid N (listwise)	11						

Source: Primary Data

Table 3. The Results of Kendall's Concordance

	Total N
Kendall's W	11
Test Statistic	2.000
Asymptotic Sig. (2-sided test)	80.000
	0.000

Source: Primary Data

The third hypothesis testing indicated that another significant positive impact of curriculum implementation on students' ecological literacy through environmental education was evident. The test results using Kendall's Tau Correlation evinced that the correlation coefficient level reached 0,729, and the value of significance level was equal to 0,014. The curriculum implementation accounted for 43.5% of the students' ecological literacy, marked by the significance level of 0,729. This means that 43.5% of the students' ecological literacy was influenced by the imple-

mentation of the curriculum, while extraneous factors influenced the remaining 56.5%. The implementation of the curriculum changed the capability of analyzing literacy ecology to real problems and issues environmental with a spatial perspective. Based on the criteria determining the level of significance, the analysis result generated a significance value of 0.014 (H0 was rejected, and Ha was approved). Based on the analysis results, the third hypothesis proposed in this study was accepted.

The fourth hypothesis testing corroborated that between instructional methods and the students' ecological literacy through environmental education, there was a remarkable positive correlation. The result of the variable testing using Kendall's Tau Correlation showed a correlation coefficient level of 0.832, and the significance level reached 0,002. This implied that the instructional method accounted for 68.5% of the students' ecological literacy was also marked by the significance level of 0.832. This means that 68.5% of the students' ecological literacy was influenced by the instructional methods, while extraneous factors influenced the remaining 31.5%. Based on the analysis results, the correlation was marked by the significance value of 0.002 (H0 was rejected, and Ha was accepted). In other words, the fourth hypothesis proposed in this study was approved.

The fifth hypothesis testing also found a considerable positive correlation between campus culture and the students' ecological literacy through environmental education. The analysis result generated by the test using Kendall's Tau Correlation showed the correlation coefficient level of 0.855, and the significance level was 0,003. The result indicated that campus culture accounted for 72,5% of the students' ecological

literacy. The significance level of 0.855 also confirmed this. That is to say that 72.5% of the students' ecological literacy was influenced by campus culture, while extraneous factors influenced the remaining 27.5%. The level of significance was found at 0.003 (H0 was rejected, and Ha was accepted). Based on the results of the analysis, the fifth hypothesis proposed in this study was accepted.

The faculty policy, curriculum implementation, instructional method, and campus culture were proven to pose an impact in building the students' ecological literacy at the Faculty of Teacher Training and Education of Jember University. The four components were linked to the internalization of concepts, principles, and ecological applications in real life. Environmental education becomes more effective in fostering the understanding and sense of responsibility towards environmental damage (Potter, 2009). Lectures are responsible for giving on environmental education to students according to their knowledge, values, attitudes, and skills in protecting and maintaining a moderate environment (Ertekin & Yüksel, 2014; Halkos et al., 2018). The students' ecological literacy is illustrated in the following pyramid showing sustainable ecological literacy education.

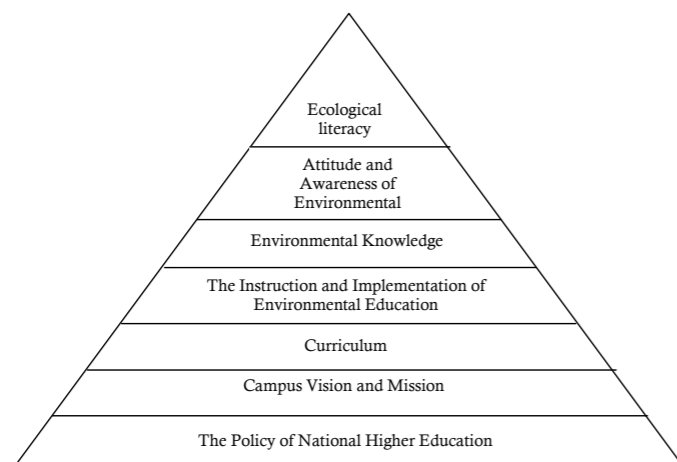


Figure 2. The Pyramid of Sustainable Ecological Literacy Education

The foundations of students' ecological literacy are influenced by knowledge, values, behavior, and environmental understanding. Students' competence influences the success of ecological literacy in environmental education for real, sustainable application. The results of this study support the findings of Davidson's (2010) work, which revealed that, based on the survey results at the University of Iceland, there was a positive value of integrating ecological literacy education to achieve university goals within the frame-

work of sustainability education. Furthermore, McBride et al.'s (2013) frameworks contrasted environmental literacy, ecological literacy, and eco-literacy with dimensions affecting knowledge (ecological, sociopolitical, and environmental), skill, and behavior. The literacy of ecology requires a fundamental understanding of reciprocity which means give-and-take relationships and interdependence. It means that, ultimately, individuals exist as parts of interconnected, dependent, and interrelated systems (Capra & Luisi, 2014).

The effect of ecological literacy for students, including knowledge, skills, and application of geography in spatial environmental problem-solving.

The University of Jember has become one of the universities in Indonesia, which pioneered the culture of ecological literacy. Green (2013), Nagra (2010), and Liefländer, et al. (2013) describes that the ecological literacy should be instilled as early as possible in the community, starting from the younger generation. This can be commenced in education. The culture of ecological literacy will be grown and developed for all academic communities at Jember University. This is in line with the vision of Jember University, "*Menjadi Universitas unggul dalam pengembangan sains, teknologi dan seni, berwawasan lingkungan, bisnis, dan pertanian industrial.*" Every student must internalize the culture of ecological literacy through learning and real application on campus and society. The results of this study are supported by several research findings (Kayihan & Tönük, 2013; Mandrikas et al., 2013; Shamuganatha & Karpudewan, 2017; Teksoz et al., 2012). These studies aver that environmental awareness is one of the attitudes every university student should develop in order to maintain a sustainable environment.

The culture of ecological literacy which lies in the vision of the University of Jember, has been applied in the Faculty of Teacher Training and Education through environmental education. The concept of ecological literacy is implemented to achieve the faculty vision, namely "*Menjadi Lembaga Pendidikan (LPTK) unggul dalam pengembangan SAINTEKS, penghasil tenaga kependidikan yang berkompeten, berdaya saing global dan berwawasan lingkungan.*" This vision is developed from the vision of the University of Jember, which takes into account environmental insight. The ecological literacy culture of environmental insight is embedded in all disciplines in the study programs affiliated to the Faculty of Teacher Training and Education. The Faculty is a pioneer at the University of Jember which instills a culture of ecological literacy to all students across multidisciplinary sciences (Indonesian language, Mathematics, Science, Social Studies, and Non-formal Education). This is in line with the findings of Reid et al. (2010), which proved that ecological literacy could be applied through a multidisciplinary approach of science requiring the creation of an educational framework to guide young people to develop their competence and capacities. The entire academic community, ranging from study-program level, faculty level, to university level, has accrued the culture of ecological literacy at

the University of Jember.

Environmental education becomes a compulsory subject in every study program at the Faculty of Teacher Training and Education of the University of Jember. The goal behind this regulation is that every student comprehends the knowledge, ecological concept, environmental awareness as well as attitude of the phenomena in everyday life. Balgopal & Wallace (2009) place the concepts of interrelatedness at the heart of ecological literacy, where it is joined by ecological knowledge, an attitude of care, and over the tendency to take actions for the environmental education. The research findings by Fragkoulis & Koutsoukos (2018) and Hadjichambis et al. (2015) showed that education has an essential influence in acquiring knowledge, skills, attitudes, and values necessary to protect the environment. The design of the curriculum, the implementation of the pioneering program, the evaluation of program progresses, and the impact of conservation programs could enhance knowledge on the ecosystem, improve positive attitudes in land management, and assist in expanding students' ecological information (Goodall, 2018). Environmental-based education is education throughout life, a condition for the formation of ecological culture and responsibility for all academics (Ernst, 2009; Öllerer, 2015; Omogun & Omogun, 2013).

The system for inculcating students' ecological literacy is done through learning theory and application. The actual applications include putting in garbage bins, land conservation, planting trees and flowers, recycling waste, disaster mitigation, and green campus. Environmental education becomes effective in building students' literacy by conducting an outdoor study and Research-Based Learning (RBL). Students become more flexible in studying phenomena and real environmental problems both on campus and in settlements. Geography and regional literacy forms also possess spatial impacts in addition to ecological literacy in assessing environmental issues at local and regional and even global level in general. These findings are in line with Lewinsohn's (2014) research which put forward that ecological literacy could contribute to social understanding and student awareness in tackling environmental problems at local, regional, and global scales. The effort has resulted in the enhancement of ecological literacy and environmental awareness, especially in the campus, as a place to learn. Environmental education has its challenges for university lecturers in the instructional process to apply the application of ecological literacy. Innovation in

the instructional process is badly needed in accruing robust ecological literacy, in addition to geography literacy in environmental studies. Esa (2010) explained that the challenge of sustainable environmental education is the innovation of traditional learning processes for children and young adults in formal education, which also requires lifelong training and learning. Therefore, Goodwin (2016), curriculum changes are needed in improving the identity of ecological literacy for all future generations with the content of developing systemic and ecological thinking skills by exploring social and political issues. The students' ecological literacy concerning the environment in Indonesia is strongly influenced by political policies of government and innovation of the use of geographic information technology in the field.

The results showed that environmental and ecosystem attitudes could build students' scientific character and attitude. The culture of ecological literacy developed through environmental education on campus is done by disposing the trash in place and planting trees as well as flowers conducted by all classes in the Faculty. Changes in environmental behavior and attitudes are the main objectives in building a culture of ecological literacy for students, in addition to growing students' scientific thinking in writing reports and scientific articles on environmental issues. The results of this study support the findings of McBride et al. (2013), explaining that ecological literacy has a scientific role in improving knowledge and logical thinking in identifying the driving factors of social system relationships for decision-making. Furthermore, Lowman (2014) and Erdoğan et al.'s (2009) findings corroborated that environmental literacy includes six significant components of the study, comprising ecological knowledge, socio-political knowledge, environmental issues, affective knowledge, cognitive skills, and environmentally responsible behavior.

CONCLUSION

Environmental education has a positive impact on ecological literacy by integrating aspects of faculty policy, curriculum, learning methods, and campus culture for all academic activities. The implementation of ecological literacy through environmental education could have an impact on knowledge, attitudes, and ethical behavior in theory and application scientifically for all students. Therefore, the development of ecological literacy through environmental education could be carried out thanks to the collaboration of lecturers, staffs, and students in realizing the

achievement of the faculty and university vision-mission.

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