

# Ecoliteracy: Knowledge, Attitudes, and Ecological Behavior of Elementary School Students Using the Multiliteracy Learning Model

Desiana Natalina Muliarsari<sup>1</sup> Ani Hendriani<sup>2</sup> Dadan Setiawan<sup>3</sup>  
Yusuf Tri Herlambang<sup>2</sup> Budi Hendrawan<sup>4</sup> Nunuy Nurjanah<sup>2</sup>

## Affiliation:

<sup>1</sup> Primary Education, Flinders University, Adelaide, South Australia

<sup>2</sup> Elementary School Teacher Education Study Program, Indonesian University of Education, Bandung, Indonesia

<sup>3</sup> Madrasah Ibtidaiyah Teacher Education Study Program, IAIN Syekh Nurjati University Cirebon, Cirebon, Indonesia

<sup>4</sup> Program Studi Pendidikan Guru Sekolah Dasar Universitas Muhammadiyah Tasikmalaya

## Correspondence:

Desiana Natalina Muliarsari, Primary Education, Flinders University, Adelaide, South Australia, Sturt Rd, Bedford Park SA 5042, Australia. Email: [desiani@upi.edu](mailto:desiani@upi.edu)

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## Abstract

Density area by buildings than land green moment This resulted problem health and literacy ecological experienced the individual who inhabits it . Focus on research This is literacy ecological covering \_ aspect knowledge cognitive , attitude , and behavior ecological student school base through learning models multiliteracy . Study This is study experiment with the matching pretest posttest control group design , and involved 79 students grade 5 school base in the environment \_ factory area Bandung regency . Data collected use test choice double For measure knowledge and attitude ecological students , and use scale likert For see behavior ecological student . Research results show that knowledge , attitude , and behavior ecological student experience enhancement after get learning using learning models multiliteracy . Response results attitude and behavior ecological student show positive thing

**Keywords:** Ecological Literacy, Multiliteracy Model, Elementary Classroom

## 1. Introduction

Density area by buildings than land green moment This resulted problem health and literacy ecological experienced the individual who inhabits it . Focus on research This is literacy ecological covering \_ aspect knowledge cognitive , attitude , and behavior ecological student school base through learning models multiliteracy . Study This is study experiment with the matching pretest posttest control group design , and involved 79 students grade 5 school base in the environment \_ factory area Bandung regency . Data collected use test choice double For measure knowledge and attitude ecological students , and use scale likert For see behavior ecological student . Research results show that knowledge , attitude , and behavior ecological student experience enhancement after get learning using learning models multiliteracy . Response results attitude

and behavior ecological student show positive thing. Ecological literacy is the ability to understand natural systems, understand the role of humans in them, and engage in evidence-based discussions about human impact on these systems (Jordan et al., 2009; McBride et al., 2013; Irianto, et al, 2020). To give birth to a generation that is ecologically literate, it must start in elementary schools (National Research Council, 2007). In line with this, recent research shows that environmental education can be carried out in elementary school children by introducing nature and its relationship with humans (Elliot & Davis, 2009; Torquati, Culter, Gilkerson, & Sarver, 2013). In an effort to support students to be ecologically literate, this can be done by introducing students to environmentally friendly practices in their own schools, places where students spend a lot of their time and in the environment around

students. As schools increasingly adopt eco-friendly practices, they offer a potential way to show how society uses scientific ideas to protect natural systems, and conversely how human systems impact the surrounding ecosystems (Hiskes, 2011).

Ecological literacy should be one of the main focuses in education. This is due to the increasing complexity of environmental problems. Air pollution, garbage, water contamination, diminishing water supplies, and global climate change are becoming daily problems in the factory area. This shows that ecological literacy is very important to provide ecological understanding to students in order to overcome problems encountered in everyday life. In line with this explanation, ecological education has a very important role because it can hone ecological sensibility and raise human awareness about the existence of the environment as part of an ecosystem that influences human life.

To support ecological education so that it can give birth to a generation that is ecologically literate, in practice students must be given the opportunity to make environmental observations, analysis, investigations, and problem solving (Irianto, et al, 2020; Irianto, et al, 2021). Learning that allows students to learn directly in the field by carrying out scientific thinking activities can encourage students to be ecologically literate (Knackmuhs, Farmer, & Reynolds, 2017; Hix, 2015; Boyle et al., 2007; Elkins and Elkins, 2007; Fuller et al., 2006).

From the explanation above, ecological education must be carried out with appropriate and systematic learning stages in order to produce ecologically literate students. However, the observation results show that the facts in the field of ecological education are still carried out in a traditional way. Much learning is done in the classroom and does not allow students to learn to make direct observations. The learning process is still teacher-centered so that students are not given the opportunity to make direct observations, conduct analysis, investigate, and solve problems about what is being studied.

To eliminate the gap in ecological education in Indonesia, this research was conducted with the aim of providing students

with experience and knowledge about ecological learning that is meaningful and enjoyable for students. In this study, researchers used a multiliteracy learning model to be applied in ecological learning for elementary school students on energy. Multiliteracy learning model is a learning model that can empower students to acquire new knowledge, understanding, and skills based on the learning activities carried out (Allison & Allison, 2018; Harrop-allin, 2017; Silvers, Shorey, & Crafton, 2010; Irianto, et al, 2021) .

## **2. Base Theory Study**

### **a. Literacy Ecology**

Since the term ecological literacy first appeared in the literature by the previous president of the Ecological Society of America, Risser (1986), and then built on that by Orr (1992), ecologists, science educators, and environmental educators have struggled to define what it means to be physically literate. ecological literacy, and how to distinguish this term from other forms of scientific literacy, such as ecoliteracy and environmental literacy (for a comprehensive review, see McBride et al., 2013).

While various frameworks for ecological literacy have been proposed, they all share a common theme that includes knowledge of ecological principles, considering human agency, and understanding how and why human and natural systems are linked through a variety of cause and effect relationships that occur across both spatial and social dimensions. temporal (Morrone, Mancl, and Carr, 2001; Jordan et al., 2009; McBride et al., 2013). The ecological framework proposed by Jordan et al. (2009) place ecological literacy within this commonality. They articulate the student must hold ecological literacy on three elements: (1) understand ecological connectivity and key concepts; (2) appreciation of the relationship between human action and the environment; and (3) promotion of the ability to reason about science and ecological issues (Jordan et al. 2009, p. 497). The three elements proposed by Jordan et al. (2009) is necessary for students and adults to become ecologically literate.

In essence, ecological literacy does not only talk about aspects of knowledge, but includes aspects of attitude, ecological

behavior, social, emotional, and spiritual intelligence. The existence of these aspects is important to increase the success of ecological literacy. With this intelligence, problems regarding the environment can be resolved because everyone is able to live in harmony with nature (Charles, 1990; Muliana, Maryani, & Somantri, 2018).

knowledge aspect is the first thing that someone has in ecological literacy. (Karatekin, 2013). Although the knowledge aspect is the first thing in building ecological literacy, it is not the main aspect. There are other aspects that are building elements of ecological literacy including aspects of attitude, ecological behavior, and skills. Aspects of ecological attitudes and behavior can be formed through critical and in-depth thinking, and through daily interactions with the surrounding environment (Mcbeth, Volk, & Mcbeth, 2010).

Ecological literacy is expected to form students who have a broad understanding of how everyone can relate to natural systems and then continue to do so in a sustainable manner. Therefore, an understanding of ecology, attitudes, and ecological behavior must become a pattern of living together that can be integrated through environmental education, but what is more important is the development of an environmental culture (Keraf, 2014). Education is expected to build an understanding of sustainable life regarding knowledge, attitudes and ecological behavior so that humans can live in harmony and harmony with nature.

### **b. Ecological Literacy in Elementary Schools**

From an early-age-children have started to collect the basics of ecological relationships (Inagaki & Hatano, 2013; Irianto, et al, 2020). Children make causal links between ecosystem components, understanding that one needs the other for food, such as what-organisms frogs eat to stay alive (Leach et al., 1996). Other causal relationships such as the presence of the sun are needed by plants and animals for warmth and survival (Kalvaitis and Monhardt 2012). Things like this encourage children to make connections between ecosystem components when children observe, analyze, and classify. This builds their perception of how the natural world works (Inagaki and Hatano 2013). It is

important for children to serve as a foundation for children's thinking to build ecological literacy in schools (Zangori & Forbes, 2016).

Elementary school students need not only conceptual understanding about how the relationship between plant and animal ecosystems but students also need an understanding of the causes that underlie how and why this relationship occurs (Grotzer & Bell Basca, 2003). It is important for students to gain a comprehensive understanding of ecology.

In this study, researchers not only presented learning about how students understand ecology in knowledge but also presented how learning can build ecological attitudes and behavior of elementary school students so that they can give birth to generations who are able to live in harmony with the environment and nature.

### **3. Methodology**

The purpose of this study was to explain the knowledge, attitudes, and ecological behavior of elementary school students using a multiliteracy learning model. This research is an-experimental research using the matching pretest posttest control group design. Experimental research is research that aims to determine the effect of the treatment given (Creswell, 2017).

In this study, the multiliteracy learning model was applied to the experimental group while the traditional model was applied to the control group. The two groups were selected by purposive sampling technique. This means that they are not chosen randomly but are selected based on similar characteristics and certain considerations. Things that are taken into consideration in determining the group include: (1) the location of the area; student achievement; (2) school accreditation; and (3) teacher qualifications.

The sample for this study was grade 5 elementary school located in a densely populated factory area in Bandung Regency. The number of samples in this study were 79 students consisting of 36 male students and 43 female students. The number of samples in this experimental group were 40 students while the number of samples in the control group were 39 students.

#### **a. Instruments**

The research instrument used a multiple-choice test and a non-test in the form of a questionnaire with a Likert scale. Ecological literacy indicators used in this study are: (1) knowledge; (2) attitude; and (3) ecological behavior. This research instrument has been validated and has received judgment by three assessment experts so that this instrument is feasible to use. For more details, we explain the research instrument in detail as follows.

- (1) Knowledge: to measure the knowledge aspect of ecological literacy, researchers used 15 multiple-choice questions focused on the theme of the relationship between ecosystem components and food webs in the surrounding environment.
- (2) Attitude: to measure aspects of attitude, the researcher used a 5-point Likert scale: "1 = strongly disagree (STS), 2 = disagree (TS), 3 = partially agree (ST), 4 = agree (S), 5 = strongly agree (SS)" consisting of 10 statements focused on students' attitudes in protecting ecosystems and food webs in the surrounding environment.
- (3) Ecological behavior: using a 5-point Likert scale: "1 = never (TP), 2 = rarely (J), 3 = sometimes (K), 4 = often (S), 5 = very often (SS)" 12 statements focused on student behavior in protecting ecosystems and food webs in the surrounding environment.

According to the procedure, this study was conducted for eight weeks. In practice, this research was conducted in eight meetings. One

meeting was used for pretest, then six meetings were used for treatment, and one meeting was used for posttest activities. In the experimental group students studied using the multiliteracy learning model while students in the control group studied using the traditional learning model.

**b. Data Collection and Data Analysis**

The research data were collected through tests and non-tests with a questionnaire using a Likert scale to measure students' ecological literacy abilities. After the data is collected, the analysis of test research data uses the normality test, homogeneity test, and t test if the data is normal and homogeneous. Conversely, if the data is not all normally distributed, then the next analysis is used non-parametric test. For non-test data analysis using descriptive statistical analysis. The results of this non-test are described in detail so that the information described can be easily understood.

**4. Results**

In this section the researcher describes in detail each aspect of students' ecological literacy skills before and after being given treatment using a predetermined learning model.

**a. Ecological Knowledge**

The results of the statistical analysis of students' ecological literacy abilities in the knowledge aspect are explained as follows.

**Comparison results pretest**  
Table 1. *Summary of the findings*

N	Groups	Means	Mean Differences	std. Deviation	Normality Test (p-value)	Homogeneity Test (p-value)	Independent Sample Test (p-value)
40	Experiment	55	0.8	9026	0.086	0.93	0.8
39	Control Group	54.2		7,627	0.079		

Table 1 shows that the two data are normally distributed and homogeneous. This

can be seen from the significance value ( $p > .05$ ). From the results of data analysis, there was no

significant difference in the ecological literacy of students in the knowledge aspect before being given treatment. This can be seen from the mean values of the two sample groups which are not much different. The average difference between the two groups was only

0.8. independent sample test results show that ( $p > .05$ ). To see how the effect of the treatment given to students is on students' ecological knowledge, it can be seen in table 2 below, which is as follows.

**Comparison results Posttest**  
**Table 2. Summary of the findings**

N	Groups	Means	Mean Differences	std. Deviation	Normality Test (p-value)	Homogeneity Test (p-value)	Mann-whitney (p-value)
40	Experiment	88.5	15.34	6036	0.017	-	0.00
39	Control Group	73.16		8,717	0.038		

Table 2 shows that the students' ecological literacy abilities between the experimental and control groups after being given treatment were significantly different. This can be seen from the mean value of the two groups which differ greatly. The difference in the mean value of the two groups is 15.34.

Based on the results of the normality test, the data was not normally distributed because ( $p < .05$ ) so a nonparametric test was performed using the Mann-Whitney test. The results of the Mann-Whitney test for students' ecological literacy skills in the knowledge aspect were 0.00 ( $p < .05$ ).

**Comparison results Posttest**  
**Table 3. Summary of the findings**

N	Groups	Means	Mean Differences	std. Deviation	Normality Test (p-value)	Homogeneity Test (p-value)	Mann-whitney (p-value)
40	Pretest	55	33.5	9026	0.086	-	0.00
40	Posttest	88.5		6036	0.017		

Table 3 above shows that the ecological knowledge of students in the experimental group has increased significantly after being given learning using the multiliteracy model. This can be seen from the difference in the average of the two data of 33.5. Based on the

results of the normality test, the data was not normally distributed because ( $p < .05$ ) so a nonparametric test was performed using the Mann-Whitney test. The results of the Mann-Whitney test show that the U value is 110,500, then the significance value is 0.00 ( $p < .05$ ).

**b. Ecological Attitude**

**Table 4. Student responses in the experimental class to the environmental care attitude variable**

Items	N	Meanscore	
		Pretest	Posttest

we have to save energy	40	3.63	4.58
we should not throw garbage carelessly	40	3.50	4.32
we have to save water	40	3.62	4.32
we should plant more trees	40	3.55	4.48
we have to take care of the environment	40	3.60	4.75
Reduce driving using fuel	40	3.65	4.80
Use your own food container when buying food	40	2.83	4.23
not much use of plastic	40	2.93	4.75
don't waste paper	40	3.35	4.73
protect animals	40	3.22	4.70

Table 4 describes the attitude of caring for the environment between students before and after being given treatment using the multiliteracy learning model. Overall the ecological attitude of students has increased. If seen from the data in table 4, most students show a positive attitude to care about protecting ecosystem components and protecting the environment

so as not to damage the environment which results in damage to the ecosystem in the surrounding environment. From the statements given to students, the majority of students want to live in harmony with nature. This is because students' awareness begins to awaken that all the activities we do have an impact on other creatures.

**c. Ecological Behavior**

**Table 5** Student responses in the experimental class to ecological behavior variables

Items	Meanscore	
	Pretest	Posttest
I take care of plants	3.60	4.58
i save water	2.90	4.40
I don't cut trees carelessly	3.50	4.40
I ride a bicycle, walk or take public transportation to go to school	3.28	4.63
I walk or ride a bicycle when going a short distance	3.35	4.73
I don't hurt animals	3.40	4.80
I collect and recycle used waste that can be used	2.70	4.32
I don't overuse plastic	2.78	4.60
I bring my own cutlery when I go to school or go out of the house	3.13	4.73
I don't throw garbage into rivers or seas	3.07	4.70
I don't litter	3.25	4.83
I grow plants	3.22	4.63

Based on table 5 we can describe the ecological behavior of students between before and after being given learning with the multiliteracy model. If you look at the data in table 5, it is known that student behavior shows positive behavior. This means that students have good ecological behavior. This can be seen from some of the responses given, most of the student responses lead to efforts to protect the environment and do not want to damage it so that the ecosystem components are

maintained so that the food chain continues to run as it should. Evidence that students have positive behavior can be seen in table 5. Student responses are that students often do not litter, plant plants, take care of plants, do not use plastic excessively, do not cut trees carelessly, save water, recycle waste, use bicycles or the road. feet when traveling a short distance.

Overall, the ecological behavior of students has increased between before and

after being given learning with the multiliteracy model. This can be seen from the average score of the pretest and posttest conducted. This shows that the multiliteracy model has an influence on improving the ecological behavior of elementary school students.

## 5. Discussion

The findings show that the ability of ecological literacy in the aspects of knowledge, attitudes, and ecological behavior of students has increased after being given learning with a multiliteracy learning model. This is an interesting finding that the multiliteracy learning model has a major impact on students' ecological literacy abilities. In the aspect of knowledge, students experienced a significant increase. This is because in the learning process with the multiliteracy model students are given the opportunity to carry out scientific activities such as making observations both directly and indirectly using media in the form of video. Learning activities that facilitate students to gain experience through direct observation activities to find out environmental problems and needs, and encourage students to make tools to solve environmental problems can develop students' ecological literacy skills and ecological awareness (Goulgouti, Plakitsi, & Stylos, 2019; Herlambang 2018) . In addition, the multiliteracy learning model provides opportunities for students to carry out analysis, investigation, problem solving, and create creative work to solve problems so as to strengthen students' cognitive aspects. Learning that uses the stages of scientific thinking can increase knowledge, understanding and strengthen students' cognitive aspects (Alexander, DePalma, & Ringer, 2016; Allison & Allison, 2018; Trigos-carrillo & Rogers, 2017; Irianto, 2020) .

learning model emphasizes learning that can develop higher-order thinking skills, build experiences by actively involving students in learning, and develop students' abilities in problem solving so that in the learning process students are assigned to determine what problems they want to solve (Abidin, & Herlambang, 2020; Abidin, 2015). After determining the problem, students gather information through reading from various sources. Sources of information can be sought

by students either from the internet, books, or expert interviews. After the information is collected, students analyze the information obtained and ensure that the information obtained is valid information. After the information is analyzed students carry out investigations to solve predetermined problems. After finding a problem-solving solution, students can create creative works or tools to solve problems. This activity provides a meaningful experience for students and can encourage students to think at a higher level. This is in line with previous research that learning using the multiliteracy model learning stages can improve critical thinking skills, creative, problem solving, and can strengthen cognitive aspects (Zachariou, Voulgari, Tsami, & Bersimis, 2020; Nuryani, Abidin, Herlambang, 2019; Adams, 2019; Allison & Allison, 2018; Miller, 2015; Navehebrahim, 2011; Silvers et al., 2010; Zhang, Nagle, Mckishnie, Lin, & Li, 2018; Setiawan, Hartati, & Sopandi, 2020; Irianto et al., 2020; Hendriyani et al., 2019) .

The next finding is that environmental care attitudes and ecological behavior also increase along with the increase in students' ecological knowledge. ecological attitudes and behavior of students towards a positive direction. This can be seen from the results of students' responses that most students show a caring attitude towards natural preservation so that the ecosystem components in nature are balanced so that food webs are always available. In addition, the results show that most students behave very well by not destroying the ecosystem and always protecting nature and other living things. In line with this, there is a correlation between students' knowledge and understanding of ecology and students' ecological attitudes and behavior. The better the knowledge and understanding of ecology, the better the attitude and behavior of the ecology (Liu et al., 2015; Pe'er, Goldman, & Yavetz, 2006; TuncerTexoz et al., 2014; Tuncer et al., 2009; Zachariou, Voulgari, Tsami, & Bersimis, 2020; Hunter & Jordan, 2019) . Ecological knowledge has an important role in developing students' environmental attitudes and behavior. Therefore, to develop students' attitudes and behavior that are responsible for the environment, it is necessary to increase

students' knowledge about ecology (Nurhafni, Syahza, Auzar, & Nofrizal, 2019) .

Based on the description above, it can be concluded that the multiliteracy learning model can improve the knowledge, attitudes, and ecological behavior of elementary school students. In addition, the multiliteracy model can also encourage students to gain high understanding, develop critical thinking skills, creative, problem solving, and build students' reading culture. The multiliteracy learning model can be used as an alternative learning model in environmental education in elementary schools, especially in Indonesia, which still has not focused on educational goals that are oriented towards increasing students' ecological awareness.

## 6. Conclusion

Based on the results of the study, it was shown that students' ecological literacy in the aspects of knowledge, attitudes, and ecological behavior can be improved through the implementation of a multiliteracy learning model. Overall, students' ecological literacy shows a very good thing. Attitudes and ecological behavior of students shows a positive thing. The student's ecological awareness has increased as shown by attitudes and behavior that always do not damage the environment which can result in the ecosystem being damaged. The learning stages of the multiliteracy model have a major impact on changes in awareness and ecological knowledge of elementary school students. The multiliteracy learning model has implications for the learning process, namely it can increase student learning activities, encourage students to think scientifically, increase environmental care attitudes, develop environmentally responsible behavior, and train students' thinking skills.

This research has provided an understanding of innovative and creative teaching and learning processes. The thing that needs to be underlined in this research is that all students can learn and can show their best abilities when participating in learning using the steps of the multiliteracy learning model. This research provides additional knowledge about learning models that are able to provide learning independence for students, encourage

students to be actively involved in the learning process so that students can bring out their best abilities and develop all their potential through the learning activities carried out.

This multiliteracy learning model can be used as an alternative in implementing environmental education in elementary schools, especially in Indonesia which has a diversity of cultures and languages so it requires a learning model that can accommodate the existing diversity.

In an effort to build students who are literate about the environment, have responsible ecological attitudes and behavior, it is necessary to have learning innovations and to improve the quality of service to students. Therefore the researchers suggest a number of things including: (1) In implementing multiliteracy learning, adequate learning facilities and resources must be prepared; (2) must be able to manage learning effectively; (3) must be able to manage time as well as possible; (3) school principals must have a commitment and be able to involve all school members to actively participate in environmental management activities and preserve the environment in schools; (4) all stake holders must work together to always take good care of the environment and must be able to live in harmony with nature.

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