The Role of Eco-School Program (Adiwiyata) towards Environmental Literacy of High School Students

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Abstract: This study was intended to display the role of eco-school program (Adiwiyata) towards environtmental literacy (EL) of high school students by analyzing, (a) EL of students in Adiwiyata and non-Adiwiyata high schools, and (b) EL of students in Grade X and XI, Adiwiya and non-Adiwiyata high schools in Malang-East Java, Indonesia. The survey involved 275 students. The respondents were from four state high school i.e. SMAN 1, SMAN 3, SMAN 4, and SMAN 7. Data were taken via MSELS questionnaire that was modified and filled online. Aspects of EL include ecological knowledge, environmental affect, cognitive skills, and behavior. The results of multivariate analysis showed that the level of students' EL was significantly influenced by school type and grade. However, the interaction both of them had no significant effect on their EL. Univariate results on school type factor informed that significant differences occured in all aspects of EL, where the lower identified level of students in Adiwiyata schools compared to Non-Adiwiyata was only in the environmental affect. On the other hand, the significant influence of grade level only occurred in cognitive skills aspect. Broadly speaking, all data analyzes concluded that the application of the Adiwiyata program was able to bring a positive impact on the level of students' EL. There was also a tendency that the higher the student's grade, the better their EL level.

Keywords: *Adiwiyata, eco-school, environment literacy, MSELS.*

Introduction

Environmental problems in Indonesia are increasingly worrying (Case et al., 2007; Kurniawan & Managi, 2018), and even have an impact on people's lives and on other countries around it (Fadli et al., 2019). These environmental problems include deforestation (Austin et al., 2019; Islam et al, 2016; Petrenko et al., 2016; Tacconi et al., 2019), households and industrial waste (Belinawati et al., 2018; Garg et al., 2018; Luo et al., 2019), air pollution in urban areas, smoke and haze from forest and land fires (EoF team, 2019; Greenstone & Fan, 2019; Kusumaningtyas & Aldrian, 2016; Madsen, 2015; WHO, 2018), pesticides and soil pollutions as well as decreased soil fertility (Hartemink, 2005; Joko et al., 2017; Leimona et al., 2015; Luo et al., 2019; Savci, 2012).

Environmental problems are processes of deprived environmental resources due to over-use or mismanagement that change the environment quality (Asaju & Arome, 2015; Parviainen et al., 2018; Schmidt, 2007). Environmental problems mostly arise as a result of irresponsible human behavior (Sukarsono, 2018b, 2018a; Sukarsono & Utami, 2019). Environmental problems are expected to decrease with the spread of environmental education in various schools, especially with the increasing number of schools implementing pro-environment programs (Olsson, 2018; Schußler et al., 2019; Steg & Vlek, 2009; Szczytko et al.,, 2019; Carrier, & Stevenson, 2018; Ulutas & Köksalan, 2017). In Indonesia, many schools have won the title of environmentally friendly school (green school or known as "*Adiwiyata*" in Indonesia) annually (Djuwita & Benjamin, 2019; Haris & Afdaliah, 2016; Utami, 2018; Warju et al., 2017). The number of "*Adiwiyata*" schools in Malang-East Java Province is the highest in Indonesia, reaching 173 schools at the city, provincial, national and independent levels (Samsudin, 2016). The introduction and inculcation of environmental care attitudes have been carried out from grade 1 to grade 6 (in elementary schools), grades 7 to grade 9 (in junior high schools), and grades 10 to grade 12 in high schools (Samsudin, 2016).

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Environmental problems can be overcome, or at least reduced, through increasing public awareness of the importance of quality and environmental preservation. Public awareness of the quality and environmental sustainability will be manifested in environment knowledge or environmentally friendly behavior (Hendryx & Ahern, 2008; Hendryx et al., 2013). The "*Adiwiyata*" school program aims to create a society that is characterized by caring and environment-pro culture exhibition (Fadlilah & Ngabekti, 2018; Nurwaqidah et al., 2019; Utami, 2018; Wulandari, 2017). The construction of environmentally friendly schools is an effort to open up insights and basic environmental management and raise awareness to overcome a variety of wider environmental problems (Dasrita et al., 2015). Environmental education is expected to increase environmental literacy (Stevenson et al., 2013).

Environmental literacy has become a global issue. Essentially, environmental literacy is both an objective and an indicator of environmental education (Franzen, 2017; Igbokwe, 2016; Istikomayanti et al., 2016; Kaya & Elster, 2018; Spinola, 2015). The essence of environmental literacy is the ability to treat, minimize and/or resolve environmental problems (Liang et al., 2018). Individuals who show a good level of environmental literacy will be willing to act on the aim of improving the welfare of other individuals, communities, and the global environment, and can participate as part of life (Syamsussabri et al., 2019; Wicaksono et al., 2019). Measurement of environmental literacy can be used as input to start an environmental education program, and at the same time as an output of environmental education (Hollweg et al., 2012; Pitman & Daniels, 2016; Szczytko et al., 2019).

The increasing number of *Adiwiyata* schools in Malang City, East Java Province, is expected to increase environmental literacy among students. Malang City has the highest number of Adiwiyata schools in Indonesia, in 2017 there were 173 *Adiwiyata* schools (Nuzulia et al., 2017). However, based on 2014 research, the implementation of *Adiwiyata* was not maximally carried out in High School of Malang City. This is due to several factors, including some students who still do not understand the concept of environmentally friendly schools, some of them still do not care about environmental conditions, lack of community participation, and lack of enthusiasm in the application of environmental education among teachers and school staff (Landriany, 2014). To find out the achievement of this expectation, environmental literacy research is needed for high school students in Malang City, East Java. Results of research published in scientific journals or poriding showed that studies related to the topic of "environmental literacy in *Adiwiyata* school students" and "analysis or profile of environmental literacy in high school students in Indonesia" was still very limited. Research related to the topic of "environmental literacy in *Adiwiyata* school students" was only conducted by Meilinda et al (2017) with the subject of elementary school students in Surakarta-Central Java, then by Susilastri and Rustaman (2010) with the subject of junior high school students, and Riskina and Listyaningsih (2019) with the subject of high school students in Pamekasan-East Java. The topic "analysis or profile of environmental literacy in high school students" has been reviewed and published in a limited manner, for example related to the environmental literacy of students in two high schools in Kutai Kartanegara district of East Kalimantan at a moderate level (Nasution, 2016), as well as at Senior High School in Karanganyar Regency, Indonesia (Wardani et al., 2019) and six different secondary schools in the city of Bitlis in Turkey (Sahin & Uzun, 2017). Roshayanti et al. (2019) research focused on the profile of students' analytical skills in environmental issues which showed that the tested students had 0.5690 scores as adequate levels of analytical skills. Several other studies focus on environmental literacy in elementary schools (Karimzadegan & Meiboudia, 2012; Narut & Nardi, 2016; Ozsoy et al., 2012; Saltan & Divarci, 2017), implementing the supplementary book of green consumerism (Ichsan et al., 2020), HOTS from elementary school to master program in environmental learning, but without high school student (Ichsan et al., 2019), Thinking skills for environmental sustainability of biology teacher candidates (Husamah, 2015; Husamah et al., 2018), the opportunities and challenges to promoting effective environmental education in middle schools (El-Batri et al., 2019), and prospective student teachers (Farwati et al., 2017). Meanwhile, there have actually been studies that show that the Eco-School Program is not really a better environmental education strategy than other strategies adopted in ordinary schools (Spinola, 2015). However, in line with the statement from Spinola (2015), this study fails to point out the reasons for the results obtained since the design of the research is not adequate for this purpose.

Research Goal

In this regard, the measurement of environmental literacy in grade X and XI of high schools attracts attention with its efforts to assess based on future developments, namely the conditions when they were in grade XII, or to see the conditions backward (flashback), related to the condition of environmental literacy when they were in grade IX of junior high school. The environmental literacy profile of grade X and XI students is possible to be formed from previous learning environments, even possibly since elementary school. This study aims to show the role of environmental education on environmental literacy in high school students by analyzing, (a) environmental literacy in *Adiwiyata* high school students compared to non-*Adiwiyata* high schools, and (b) environmental literacy between grade X and XI students in *Adiwiyata* and non-*Adiwiyata* schools.

High school students, based on their age, are at an important developmental stage in order to continue to the next stage. High school graduates will soon be involved as professional groups (workers) or intellectuals (students) on campus who will have important roles related to their environment. Therefore, environmental education for high school students occupies a strategic position to save the environment from increasingly severe and global problems

(Luko & Kollarics, 2013). This research is important because it will contribute to efforts to investigate the effect of ecomapping learning on motivation and environmental literacy for secondary school students. The importance of research on environmental behavior in adults was stated by Palupi and Sawitri (2018), that humans are determinants of environmental quality and are also recipients of environmental impacts. Therefore, research into human attitudes and behavior towards the environment occupies a significant position to improve the quality of the environment.

Methodology

This research was a quantitative research involving survey on *Adiwiyata* and non-*Adiwiyata* high school students in Malang City, East Java Province-Indonesia. The population of this research is all Adiwiyata and Non-Adiwiyata schools in Malang. Next, the researchers chose several schools involved in the survey. The selection of schools involved in this study is based on school status. The school involved is a public school. Furthermore, from ten public schools in Malang, the researchers chose one Adiwiyata school (based on the government's decision) and a non-Adiwiyata school. Data collection was conducted from June to August 2019. Researchers selected samples, administered questionnaires the subjects in order to collect data about the variables being studied. The research participants consisted of 275 students were selected using cluster sampling techniques. The participants divided into students coming from *Adiwiyata* High School grade X and XI and students from non-*Adiwiyata* High School grade X and XI. The respondents were from four state high school i.e. SMAN 1, SMAN 3, SMAN 4, and SMAN 7 (Table 1). The four selected schools are schools that have done a Memorandum of Understanding (MoU) in the fields of education, research, and service with the University of Muhammadiyah Malang, with the approval of the Malang City Education Office, so there are no problems related to research ethics.

Table 1. Sample Characteristics

Schools	Classes	Number of Participant
Adiwiyata	X	65
	XI	59
Non Adiwiyata	X	86
	XI	65

The implemented research instruments were the 2006 version of the Middle School Environmental Literacy Survey/MSELS that has been developed and improved by experts (McBeth & Volk, 2009; McBeth et al., 2011; Mcbeth et al., 2014). This instrument includes the following: (1) Ecological Knowledge; (2) Verbal Commitment; (3) Environmental Sensitivity; (4) Environmental feelings; (5) Issue Identification; (6) Issue Analysis; (7) Action Planning; and (8) Actual commitment. Table 2 illustrates aspects of environmental literacy measured in this study and the scoring system.

Table 2. Aspects of environmental literacy and scoring

Components of Environmental Literacy	Specific Conceptual Variables and Parts of the MSELS	Item Number	N items	Range
Ecological Knowledge	Ecological Knowledge (Part II: Ecological Foundations)	5 - 21	17	0-17
Environmental Affect	Environmental Sensitivity (Part V: You and Environmental Sensitivity)	46-56	11	0-55
	General Environmental Feelings (Part VI: How You Feel About the Environment)	57, 58	2	0-10
Cognitive Skills	Isue Identification (Part VII.A: Issue Identification)	59, 60, 67	3	0-3
	Issue analysis (Part VII.B: Issue Analysis)	61-66	6	0-6
	Action Planning (Part VII.C: Action Planning)	68 - 75	8	0-20
Behavior	Actual Commitment or Pro-environmental Behavior (Part IV: What You do About the Environment)	34 - 45	12	0-60

The collected data was then analyzed using statistical calculations. There were two stages of data analysis performed. The first stage was analyzing the data using descriptive statistics which is calculating the mean score. This calculation aimed to describe the environmental literacy profile of grade X and XI high school students in both Adiwiyata and non Adiwiyata schools. The calculation results were then presented in the form of bar graphs. Next, inferential statistical analysis was performed. Two-Way Multivariate Analysis of Variance (MANOVA) was exemplified to investigate the differences between school type variables (Adiwiyata and non Adiwiyata) and grades (X and XI) towards environmental literacy. When the MANOVA results concluded there were significant differences, the analysis continued to the post hoc test. The post hoc test chosen in this study was the Least Significant Difference (LSD) test.

Results

In this study, the effect of implementing the Adiwiyata program and grade factor on the environmental literacy level of high school students was analyzed. Before analyzing the influence of these two factors, an analysis using descriptive statistics was performed on the entire research data. By involving 275 students, the mean of ecological knowledge, pro environmental behavior, environmental affect, and cognitive skills scores were 10.48, 35.37, 81.78, and 16.48, respectively. The results of Shapiro-Wilk analysis on residual data indicate that all of literacy components data have a significance value that smaller than alpha. The results of this calculation inform that the data of this study were not normally distributed. In more detail, the results of the descriptive statistical analysis are presented in Table 1.

Table 3. Descriptive statistics of research data obtained in this study

Components	N	Minimum	Maximum	Mean	Std. Deviation	Shapiro-Wilk
Ecological Knowledge	275	1.00	16.00	10.48	2.70	0.97*
Pro Environmental Behavior	275	26.00	52.00	35.37	3.15	0.96*
Environmental Affect	275	61.00	112.00	81.78	8.45	0.99*
Cognitive Skills	275	5.00	25.00	16.48	3.39	0.98*

p-value < 0.05

To find out whether there was a significant difference, the MANOVA test was carried out. Multivariate test results are presented in Table 4. Based on Table 4, three findings were obtained. First, the type of school had a significant effect on the mean of environmental literacy scores of students [$F_{(4, 268)} = 31,103$, $p < 0.001$]. Referring to the results of this analysis, the environmental literacy of students in Adiwiyata schools is significantly different from that of Non Adiwiyata school students. Second, the grade level also has a significant effect on the mean of environmental literacy scores [$F_{(4, 268)} = 5,376$, $p < 0.001$]. Based on the average difference of the two classes, the environmental literacy of grade XI students was significantly different from grade X students. Third, the interaction between school type and grade level did not significantly influence the level of environmental literation of high school students [$F_{(4, 268)} = 0.394$, $p = 0.813$]. These results indicated that the two main factors (school and grade) have mutually debilitating interactions. The reason, when standing alone, each main factor was able to provide a significant influence. However, when the two interact with each other, the significant influence disappeared.

Table 4. Summary of the multivariate tests results on the effect of school type and grade level on the environmental literacy scores of high school students

Effect	Value	F	Hypothesis df	Error df	Sig.
School	0.683	31.103	4	268	< 0.001
Grade	0.926	5.376	4	268	< 0.001
Interaction	0.994	0.394	4	268	0.813

Furthermore, to investigate which aspects of environmental literacy were affected by the type of school and grade level, a univariate test was conducted. The difference in mean scores of each aspect of environmental literacy between *Adiwiyata* and Non *Adiwiyata* school students is presented in Figure 1, while the summary of univariate test results is presented in Table 4. Based on Figure 1, it is clear that the values of each aspect of environmental literacy have no similar tendencies.
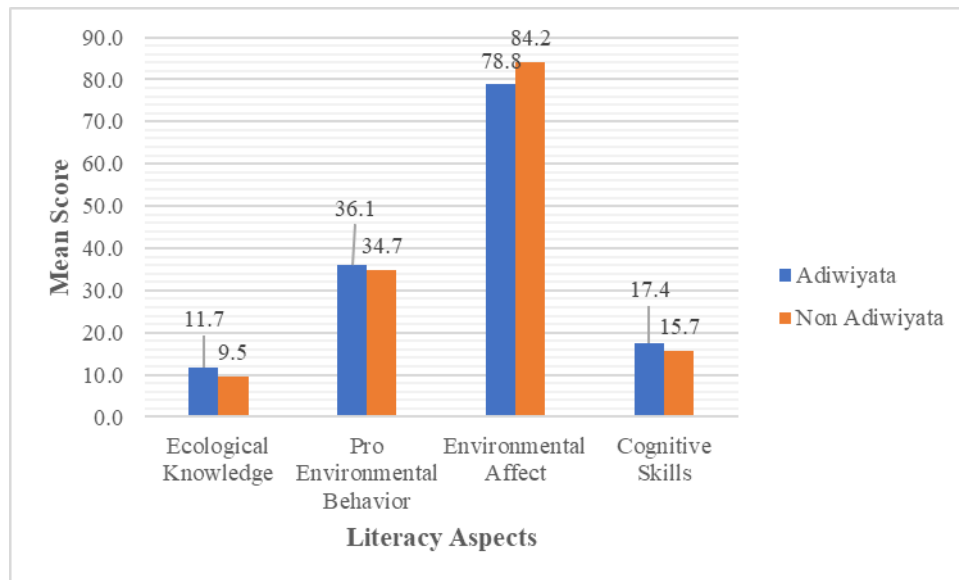
Figure 1. Comparison of each aspect of environmental literacy between students in Adiwiyata and non-Adiwiyata high schools

Based on Table 5, the type of school always had a significant influence on all four aspects of environmental literacy (p <0.001). Interestingly, when linked to Figure 1, *Adiwiyata* schools were not always superior to non-*Adiwiyata* schools. *Adiwiyata* schools had a literacy score that is significantly higher than non-*Adiwiyata* schools in the aspects of ecological knowledge, pro-environmental behavior, and cognitive skills. On the other hand, *Adiwiyata* schools had scores that were significantly lower than non-*Adiwiyata* schools on environmental affect.

Tabel 5. Summary of the univariate test results on the effect of school type on the environmental literacy scores of high school students

	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
	Ecological Knowledge	344.914	1	344.914	56.693	< 0.001
	Pro-Environmental Behavior	132.815	1	132.815	13.972	< 0.001
School	Environmental Affect	2068.677	1	2068.677	32.375	< 0.001
	Cognitive Skills	179.990	1	179.990	17.721	< 0.001

Literacy score fluctuations between one aspect and another also occurred at grade level factor. The fluctuation could be seen from the diagram in Figure 2. However, in contrast to school type factor, grade factor only gave a significant influence on aspects of cognitive skills (F = 16,092, p <0.001) (see Table 6). When linked to Figure 2, grade X students had significantly lower cognitive skills than grade XI students.
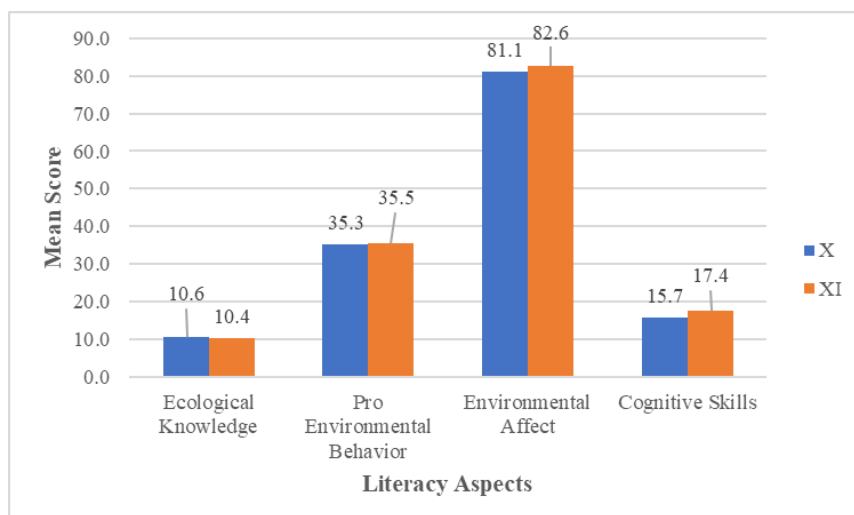

Figure 2. Comparison of each environmental literacy aspect between high school students grade X and XI.

Table 6. Summary of the univariate test results on the effect of grade level on the environmental literacy scores of high school students.

	Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
	Ecological Knowledge	7.008	1	7.008	1.152	0.284
	Pro-Environmental Behavior	0.439	1	0.439	0.046	0.830
Class	Environmental Affect	217.996	1	217.996	3.412	0.066
	Cognitive Skills	163.444	1	163.444	16.092	< 0.001

Furthermore, the results of the univariate test on interaction factors are presented in Table 7. In Table 7, the four aspects of environmental literacy were not significantly affected by the interaction between the type of school and the grade level of high school students ($p > 0.05$). This univariate result is in line with the multivariate results which also reported that school and classroom interactions did not have a significant effect on the level of student environmental literacy.

Tabel 7. Summary of the univariate test results of the interaction between school types and grade levels on various aspects of the environmental literacy

	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
	Ecological Knowledge	1.348	1	1.348	0.222	0.638
Interaction between school and class	Pro-Environmental Behavior	0.660	1	0.660	0.069	0.792
	Environmental Affect	0.042	1	0.042	0.001	0.980
	Cognitive Skills	14.471	1	14.471	1.425	0.234

Discussion

Environmental literacy is seen as one of the main competencies in dealing with depriving environmental conditions. In this study, the main finding was that the environmental literacy of students in *Adiwiyata* schools was generally better than non-*Adiwiyata* schools. This statement is in line with previous research conducted in Ponorogo by Nurwaqidah et al (2019). Although using the subject of junior high school students, Nurwaqidah et al. (2019) also inform that the implementation of the *Adiwiyata* program significantly increases students' environmental literacy. Research in several countries also confirms the positive impact on environmental literacy when schools implement programs similar to *Adiwiyata*, such as green schools in Israel (Goldman et al., 2018) and eco-schools in Turkey (Ozsoy et al., 2012). One Belgian study also reported that schools that were in the process of obtaining eco-school certificates would change students' environmental outcomes (Boeve-de Pauw & Van Petegem, 2018). These reports reinforce the role of environmentally friendly school programs in building student environmental literacy.

The existence of the *Adiwiyata* school program in Indonesia aims to instill the values of environmental awareness to students. The target leads to the importance of building environmental literacy to direct in building environmental awareness attitudes in students (Susilowati et al., 2018). In the *Adiwiyata* program, schools often implement various activities such as sorting between organic and inorganic waste, composting, hydroponic classes, and cleaning competitions (Roswita et al., 2019). In addition to these various activities, the application of the *Adiwiyata* program will become more optimal if the concept of the program is also integrated in the learning material in each class (Lasno et al., 2019). Teachers also have to be able to become role models that provide examples of environmental attitudes towards their students (Lasno et al., 2019; Murdani et al., 2018). In addition, to achieve the goals of the *Adiwiyata* program- based on data findings in this study-four components were established. The four components are environmentally sound policies, implementation of an environment-based curriculum, participatory-based environmental activities, and management of environmentally friendly supporting facilities.

It is certainty better if the environmental literacy of students in *Adiwiyata* schools is in accordance with the findings of this study due to the existence of environmental education in the school curriculum. Hence, according to Nugraha et al (2019), environmental education aims to equip students with adequate environmental literacy. The statement is also based on an explanation suggesting of Adela et al (2018) that the integration of environmental education in *Adiwiyata* program was reported to be able to foster student eco-literation. In addition, Stevenson et al (2013) was argue that the implementation of an appropriate environmental education curriculum was also reported to be able to encourage

various aspects of environmental literacy in high school students. In line with the essential role of the curriculum, Delphi's study in 2019 (as cited in Kaya & Elster, 2018) has succeeded in formulating topics that should be offered in the curriculum and textbooks oriented to environmental education. These topics include environmental perceptions, environmentally-friendly behavior, nature of environmental concepts, solutions to environmental problems, sustainability, and social perspectives.

Interestingly, research in different locations informed different findings. Research in Portugal reported that eco-school programs were not seen as a better environmental education strategy than other strategies implemented in ordinary schools. The implication is that the environmental literacy of grade IX junior high school students was not significantly higher than that of students in ordinary schools (Spinola, 2015). In fact, research involving other *Adiwiyata* schools in Indonesia dis not always have students with good environmental literacy (Meilinda et al., 2017). Less optimal implementation of all *Adiwiyata* components was the main reason why the environmental literacy of students in some *Adiwiyata* schools was less than optimal. Miscommunication was found as the main obstacle in the socialization and internalization of the four components of Adiwiyata in Pekanbaru (Rachman & Maryani, 2018). These problems had to be overcome by schools because the implementation of the four *Adiwiyata* components would help the schools' efforts to improve student environment literacy in Pekanbaru (Deswari & Supardan, 2016). The more effective the four components of Adiwiyata are implemented, the higher the level of student environmental literacy (Desfandi et al., 2017).

The lower level of students' environmental literacy in non-*Adiwiyata* schools is due to the lack of environmental education programs in regular schools. Research in Macedonia and Turkey informed that the empowerment of aspects of environmental literacy still has an unequal distribution (Srbinovski et al., 2010). In addition, the textbooks used in regular schools in several countries do not adequately present topics based on environmental literacy (Karatekin, 2012; Karimzadegan & Meiboudia, 2012). Therefore, the non-empowerment of environmental literacy in various other reports might be caused by the lack of optimal application of the curriculum or the use of books not oriented to empowering environmental literacy.

Related to the low environmental literacy issue in Non-*Adiwiyata* schools, it does not mean that Non-*Adiwiyata* schools have no chance of increasing their students' literacy. According to Wardani et al (2018), the lack of students' environmental literacy can be caused by several factors, such as their lack of understanding of environmental concepts, learning plans that are not based on empowering environmental literacy, or the limited concepts transferred to students.

In contrast, Non-*Adiwiyata* schools can still empower the environmental literacy of their students through the implementation of various forms of learning. One form of learning that is reported to be able to improve the environment literacy of student is Problem-based Learning (PBL) (Febriasari & Supriatna, 2017). The report further strengthens PBL's position as an innovative learning that provides many benefits in the learning process, as suggested by various other previous studies (Loyens et al., 2015; Marra et al., 2014; Ramdiah et al., 2018).

The use of environmental literacy based educational games, such as EnviroPoly also has promising potential in empowering students' environmental literacy (Arslan et al., 2011). The application of curriculum-based experiential learning is also recommended. The application of such learning is reported to be able to significantly increase the environmental literacy of American students (Craig & Allen, 2015). In addition, implementing various programs outside of school can also increase one's environmental literacy. In America, various programs such as summer camp and after-school programs that raise various environmental issues and involve the community, scientists from universities, and educators are carried out to improve children's environmental literacy (Laveaux et al., 2018).

If assessed per component, the results of this study indicated that the level of environmental knowledge of students at *Adiwiyata* School was significantly superior to Non-*Adiwiyata* students. Research at Yogyakarta High School by Wulandari and Sulistiyowati (2017) also informs us that the level of environmental knowledge of students in *Adiwiyata* schools is significantly higher than Non-*Adiwiyata* schools. Meanwhile, research in Slovenia by Krnel and Naglic (2009) also confirms that the level of environmental knowledge of students in eco-schools is higher than those attending regular classes.

In the aspect of environmentally friendly behavior, students in *Adiwiyata* schools have significantly higher levels than Non-*Adiwiyata*. According to Rachman and Maryani (2018), the environmentally friendly behavior of teachers and students in target schools is supported by repetitive environment-based activities. At *Adiwiyata* School, students will be repeatedly accustomed to carrying out various environment-oriented activities, such as caring for plants, disposing of trash in the space provided, treating waste, and various other environment-based activities. However, Krnel and Naglic (2009) said that there are also reports that inform otherwise. Students who participate in an eco-school program have awareness and environmentally responsive behavior that is not significantly different from those who attend a non-eco-school program. According to Nurhafni et al (2019), less optimal implementation of the eco-school program is the main cause of the differences in the findings of these studies with the current study. In addition, schools cannot instantly change a person's behavior and character towards the environment. Therefore, it is possible that in the Krnel and Naglic (2009) study, the research subjects were not too long involved in the eco-school program.

The study results also presented that *Adiwiyata* school students' cognitive skills were better than non-*Adiwiyata* school students. One's good cognitive skills is caused by a person's understanding of related knowledge. Relating to students' environmental literacy, students who understand environmental knowledge will have good crtitical thinking skills about environmental issue, since comprehension is correlated with critical thinking skills (Aloqaili, 2012). Furthermore, in the instruments used in this study, there were three indicators that served as a reference in cognitive skills, namely issue identification, issue analysis, and action planning. The ability of students to identify, analyze, and plan is inseparable from what they have learned and mastered (Kamarulzaman et al., 2017). Therefore, students' cognitive skills at *Adiwiyata* schools cannot be separated from the application of an environment-based curriculum that allows students to gain more knowledge about the environment in several subjects.

On the other hand, different from the other three aspects, environmental effect of students in *Adiwiyata* schools was proven lower than those of non-*Adiwiyata* schools. Environmental affect measured by the instrument in this study consisted of three components, such as verbal commitment, environmental sensitivity, and environmental feeling. Affect deals with someone's feeling, in this case students' feeling. This was quite different from environmental knowledge and thinking skills, where developing feeling to pay more attention to environment was seen more difficult and time consuming. Then it was suggested that the low affect level of the students was due to the short time span of the *Adiwiyata* environment program. If they were given a longer period of learning the environment, it was expected that the students would have an increase affect level. This finding was affirmed by the profile of environmental knowledge with environmental attitudes portrayed by Turkey's students, which were not in line (Saribas et al., 2014). The findings from Taiwan also confirmed that knowledge and attitudes did not have a significant correlation (Liang et al., 2018). Research in Belgium also informed that eco-school influenced students' environmental knowledge, but did not affect their attitudes towards the environment (Boeve-de Pauw & Van Petegem, 2011).

Overall, the results of this study have indicated that the *Adiwiyata* program is an essential step in empowering environmental-oriented knowledge and behavior. The lower aspect of knowledge and behavior to shape environmental literacy in Non-*Adiwiyata* schools was relevant with reports in Taiwan as a result of research (Liang et al., 2018), informing that undergraduate students in Taiwan have had low environmental knowledge and behavior. According to Biswas (2019) empowerment of environmental literacy can be a strong basis for environmental responsiveness to healthy living habits. Therefore, students need more education and information about environmental issues, something that can be achieved, by adding environmental education programs in schools.

Furthermore, the results of this study also inform that, when viewed one by one, class level does not significantly influence each literacy component. However, when viewed from multivariate results, the grade level was able to have a significant effect on environmental literacy. The results of this study differ from several other studies that have examined the effect of class level on student literacy, such as studies that examine the effect of class level on student literacy and numeracy in Australia as stated by Grasby et al (2019) and the United States by Kim and Morrison (2018). This difference in findings may be due to differences in the characteristics of the research subjects between developed and developing countries and the different aspects of literacy measured. Furthermore, related to the significant influence revealed in this present study, literacy deals with the ability of students to obtain and process information. Literacy is related to one's ability and skill to think and process information. In connection with the statement, several previous studies also informed that class level is able to have a significant influence on student ability (Fauzi & Sa'diyah, 2019; Siswati & Corebima, 2017). Both studies were also conducted in the same area as this present study, so that it shows the importance of the role of the class level on the students' abilities in this region.

The influence of class level on environmental literacy also indicates the role of schools in forming students in environmental literacy. Naturally, schools are able to improve the environmental literacy of students through several subjects, especially biology. In biology, students will learn the position of humans as a major component that influences the conditions of the environment around them (Erdogan et al., 2012; Nurtian & Aminatun, 2019). The increase in environmental literacy with increasing class levels will also be more optimal if the Adiwiyata school. The reason is, the schools are continuously implementing environmental activities based on student participation. School and curriculum policies are environmentally friendly and environment-based (Nurwaqidah et al., 2019; Roswita et al., 2019). Therefore, this condition will cumulatively have a positive effect on students as they continue to study at the school.

The study makes a significant contribution to the research field of high school students for environmental literacy. However, there are some limitations in this study. First, the number of respondents is small. Based on the total population in Malang, the number of samples that is only 275 less able to represent the population well. Second, the quality of the instruments is not yet optimal. Environmental literacy instruments based on Indonesian characteristics are still difficult to do. Research that seeks to develop such instruments is also still lacking interest. Therefore, in this study the researchers adopted the MSELS instrument. Besides that, this research data is also not normally distributed. This condition might affect the accuracy of the results of parametric analyzes that have been carried out. Hopefully, in subsequent studies, these deficiencies can be covered. Furthermore, the results of those studies can strengthen and confirm the results of this present study.

Conclusion

In this study, the impact of implementing the Adiwiyata program on high school students was investigated. The results of the analysis concluded that the students' environmental literacy was significantly influenced by the implementation of the *Adiwiyata* program. Grade also had a significant influence on environmental literacy, although the interaction of the two factors was not significant. In more detail, students in *Adiwiyata* schools have significantly higher ecological knowledge, pro-environmental behavior, and cognitive skills scores than students in non-*Adiwiyata* schools. On the other hand, significant differences in aspects of environmental literacy between students in grade X and XI were only found in aspects of cognitive skills where students in grade XI had better scores. The results of the analysis showed that the application of the *Adiwiyata* program was able to have a positive impact on students' level of environmental literacy. The higher the grade level of the students, the better the level of their literacy.

To conclude, *Adiwiyata* program is recommended to be carried out optimally. Implementation of the four components of Adiwiyata needs to be ensured to run well so that the benefits of this program can be seen to the maximum. The four components are environmentally sound policies, implementation of an environment-based curriculum, participatory-based environmental activities, and management of environmentally friendly supporting facilities. In addition, in order to improve the environmental literacy of students in public schools, various programs outside of school hours can be designed. The various programs are aimed at directing students to be closely involved in environmental management and to be able to interact with environmental observers or practitioners around them.

Declaration of Conflicting Interests

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