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Ecological Literacy, Environmental Awareness, Academic Ability and Environmental Problem-Solving Skill at Adiwiyata School

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ABSTRACT

This study aimed to analyze ecological literacy, environmental awareness, academic ability, and environmental problem-solving skill at the Adiwiyata schools in Tangerang City. The research method used descriptive quantitative with survey technique. The respondents consisted of 245 students of class XI Science from three Adiwiyata Senior High Schools in Tangerang City. The instruments used in this study were tests and questionnaires. Ecological literacy was measured using multiple choice tests and questionnaires, environmental awareness was measured using a questionnaire, academic ability was measured by using the total national exam scores of students when in Junior High School, and environmental problem-solving skill was measured using essay tests. The results showed that the majority of students had ecological literacy scores with basic categories, environmental awareness scores with very good categories, academic ability scores with moderate categories, and scores for environmental problem-solving skill with enough categories. Based on the results of the study, other schools are expected to also be able to implement the Adiwiyata program so that students can develop ecological literacy, environmental awareness, academic ability and environmental problem solving skills.

Keywords: Academic Ability, Ecological Literacy, Environmental Awareness, Problem-Solving Skills.

INTRODUCTION

The environment is the main pillar of all life including human life. The environment covers the physical environment (air, water, land, natural resources, plants and animals) around humans (Chopra, 2016). The environment plays a role as a source of human economic activity to obtain raw materials to fulfill their lives. The impact is caused if the use of the environment is carried out in an excessive manner that is reducing the quality of the environment to provide supporting factors for the living system adequately and the emergence of various environmental problems.

Environmental problems occur in almost every region of Indonesia, especially in Banten. Banten is one of the industrial areas that have potential to damage the environmental balance. Banten consists of several regions with the highest population density, namely in the Tangerang City area reaching 13,602 inhabitants/km2 (Banten Environmental & Forestry Service, 2017). Tangerang City with a high population density will increase resource requirements. Exploitation of excessive resources to meet needs will have an impact on decreasing environmental carrying capacity and the emergence of various environmental problems. Environmental problems that still occur in Tangerang City include 78.6% of households experiencing routine flooding (annual), 46.4% of households accessing water sources that are at risk of contamination, and 91.7% of households not doing waste sorting (Environmental Health Risk Assessment, 2014). Problem-

solving skills need to be developed in order to overcome environmental problems.

The environmental problem-solving skill is individual's skill to find solutions in response to the differences between the current environment and the expected environment (Hesse et al., 2015). Problem-solving skills do not only use basic thinking skills but also require complex mental activities and various cognitive skills. Problem-solving skills are needed to have confidence and act in accordance with problem-solving steps (Saygili, 2017). The environmental problem-solving skill can be developed through the Adiwiyata program.

The Adiwiyata is a caring and cultured school program (Caddafie et al., 2017; Desfandi & Disman, 2017). The aim of this program is to create schools that care about the environment and are able to participate and implement efforts to preserve a sustainable environment. It is hoped that through the Adiwayata program each member of the school can be involved in activities towards a healthy environment so as to form school members responsible for efforts to preserve and protect the environment through good school governance. The Adiwiyata program helps to introduce students in environmental education (Landriany, 2014).

The environmental education is a way of creating knowledge, understanding, values, attitudes, skills, abilities and awareness among individuals and social groups towards environmental protection (Abbas & Singh, 2012; Erharbor, 2016). The main purpose of environmental education is to educate and encourage individuals, especially students to be responsible and develop positive attitudes and behaviors towards the environment. Environmental education can develop students' ecological literacy (Tidball & Krasny, 2011).

The ecological literacy aims to increase the awareness of individuals to make or make decisions and act as a response to environmental issues (Jordan et al. 2009; Cid & Pouyat 2013; Lewinsohn et al., 2013). Ecology literacy can develop students' skill to use knowledge about ecology, ways of thinking to enjoy, appreciate, or study the environment. Ecological literacy tries to introduce and update students' understanding of the importance of global environmental awareness, in order to create a balance between human needs and earth's capacity (Pitman & Daniels, 2016).

Various studies have been carried out regarding ecological literacy. The average ecological literacy score for men is higher than for women (Pitman et al., 2016). Generally, men have greater freedom to explore the environment with greater distance so that they can remember information in more detail than women. In addition, increasing ecological literacy scores is significant for students participating in environmental activities (Pitman et al., 2017). Students who are actively involved in environmental activities have a better level of knowledge and environmental awareness.

Environmental awareness is sensitive to various environmental problems (Omoogun et al., 2016). Environmental awareness is important for students because students are the next generation that will maintain the sustainability of environmental functions in the future. Environmental awareness can change perceptions and lead to change in attitudes as a condition for behavior changes and actions towards the environment (Hadzigeorgiou & Skoumios, 2013). Various studies on environmental awareness have been carried out. Students living in urban areas have higher environmental awareness than in rural areas (Akhter & Piyush, 2015; Badoni, 2017; Biswas, 2017). Generally, city dwellers live in polluted environments, making them more aware of environmental problems than villagers. Environmental awareness has a positive relationship with ecological behavior (Sharma, 2017). Environmentally conscious students will have better environmental knowledge.

Knowledge of the environment possessed by students can make students environmentally be friendly, so they can

find effective solutions to solve various environmental problems. Knowledge is a part of the academic ability. Academic ability is positively correlated with study hours (Ali et al., 2013). Class attendance also shows a strong relationship with academic abilities (Kassarnig et al., 2018). Furthermore, motivation is a fundamental factor for academic success that stimulates individuals to continue to be interested and committed or trying to achieve goals (Amrai et al., 2011; Kusurkar et al., 2011; Gbollie & Keamu, 2017).

Based on the background explanation, there have been no studies analyzing ecological literacy, environmental awareness, academic ability, and environmental problem solving abilities in Adiwiyata schools in Tangerang City. Therefore, it is necessary to conduct an investigation into the study of ecological literacy, environmental awareness, academic ability, and environmental problem-solving skill at Adiwiyata School in Tangerang City.

METHOD

Population and Sample

The method used in this research was the descriptive quantitative method. The sample in this study was students of class XI Science selected by using simple random sampling technique using the Slovin formula and obtained a sample of 245 out of 637 students. This research was conducted at SMAN 2, SMAN 4, and SMAN 5 Tangerang City which had implemented the Adiwiyata program. The Adiwiyata is a program from the Environment Ministry in collaboration with the Education and Culture Ministry that makes formal education (primary, junior high and high school) the target (Rachman & Maryani, 2017) This research was conducted in August 2018, in the odd semester of the 2018/2019 academic year.

Ecological Literacy

The ecological literacy was measured by multiple choice tests and questionnaires. Ecological literacy consists of three dimensions namely caring, practical competence, and knowledge (Mcginn, 2014).

Table 1. The Grid of Ecological Literacy

No.	Ecological Dimension	Indicator	The Number of Items
1.	Caring	Have the desire and responsibility to reduce negative impacts on the environment	30
2.	Practical Competence	Actions were taken to reduce negative impacts on the environment	30
3.	Knowledge	a. understanding of species and their habitat	3
		b. climate change and global pollution	3
		c. energy sources	3
		d. environmental carrying capacity	3
		e. ecosystems succession	3
		f. biotic interactions or relationships between species in certain ecosystems	3
		g. biodiversity and threats	3
		h. water cycle and food webs	4

(Source: Mcginn, 2014)

Furthermore, the ecological literacy scores obtained were categorized according to Table 2.

Table 2. Interpretation Criteria for Ecological Literacy Scores

Score Range	Ecological Literacy Criteria
< 60%	Illiterate
60-69,9%	Low
70-79,9%	Basic
80-89,9%	Standard
90-100%	High

(Source: Mcginn, 2014)

The validity of the dimensions of caring and practical competence was calculated using Pearson Product Moment formula, while reliability was calculated using Cronbach's Alpha. The validity of the knowledge dimension is calculated using Biserial Point formula, while reliability is calculated using the KR-20 formula (Sugiyono, 2017).

Environmental Awareness

The environmental awareness variable was measured by questionnaire. The questionnaire consisted of 40 items which were developed based on five dimensions, namely the causes of pollution, soil, forest and air conservation, energy conservation, conservation of human health, and conservation of wildlife and livestock (Badoni, 2017). The grid of environmental awareness instruments is shown in Table 3.

Table 3. The Grid of Environmental Awareness Instruments

No.	Environmental Awareness Dimension	The Number of Items
1.	Causes of pollution	8
2.	Soil, forest and, air conservation	8
3.	Energy conservation	8
4.	Human health conservation	8
5.	Conservation of wildlife and animal husbandry	8
		40

(Source: Badoni, 2017)

Furthermore the environmental awareness scores obtained were categorized according to Table 4.

Table 4. Interpretation Criteria Environmental Awareness Score

Score Range	Criteria
0-20	Very Bad
21-40	Bad
41-60	Enough
61-80	Good
81-100	Very God

(Source: Riduwan, 2009)

The validity of the environmental awareness questionnaire was calculated using Pearson Product Moment formula, while the reliability coefficient was calculated using Cronbach Alpha formula (Sugiyono, 2017).

Academic Ability

The academic ability was measured by using the total national exam scores of students when students were in the junior high school level. Academic achievements can be demonstrated through academic ability and performance in the previous class (Fauzi, 2013). Furthermore, the scores of academic abilities obtained were categorized according to Table 5.

Table 5. Interpretation Criteria Academic Ability Score

Score Range	Criteria
0-49	Low
50-74	Moderate
75-100	High

(Source: Ganyaupfu, 2013)

Environmental Problem-Solving Skill

The environmental problem-solving skill was measured using essay tests consistied of 20 questions. The instrument was developed based on four aspects namely exploring and understanding, representing and formulating, planning and implementing, monitoring and reflection (Organization for Economic Cooperation and Development, 2017). The grid of instruments for environmental problem-solving skill was shown in Table 6.

Table 6. The Grid of Environmental Problem-Solving Skill Instruments

No.	Aspect	Indicator	The Number of Items
1	Exploring and Understanding	Identify environmental problems.	5
2	Representing and Formulating	Linking information that was known to compile new information.	5
3	Planning and implementing	Planning solutions for solving environmental problems.	5
4	Monitoring and reflection	Plan a form of monitoring or	5

	supervision.
Total	20

(Source :Organization for Economic Cooperation and Development, 2017)

The answer score was assessed based on the criteria in the assessment rubric. The score of the environmental problem-soving skill obtained then categorized according to Table 7.

Table 7. Interpretation Criteria Environmental Problem-Solving Skill Score

Score Range	Criteria
0-20	Very Bad
21-40	Bad
41-60	Enough
61-80	Good
81-100	Very God

(Source: Riduwan, 2009)

The validity of solving environmental problem-solving skill test was calculated using Pearson Product Moment formula, while reliability is calculated using Cronbach Alpha formula (Sugiyono, 2017).

Data analysis

The prerequisite test of the analysis carried out was the normality test (Kolmogorov Smirnov test at $\alpha = 0.05$) and homogeneity test (Bartlett test at $\alpha = 0.05$). The research hypothesis test used a linear regression test (F-Test at $\alpha = 0.05$) and correlation (calculating the correlation coefficient at $\alpha = 0.05$ with Pearson Product Moment formula). The process of data analysis is done through SPSS 20. The next step is to determine the coefficient of determination through the formula: r_{xy}^2 x 100.

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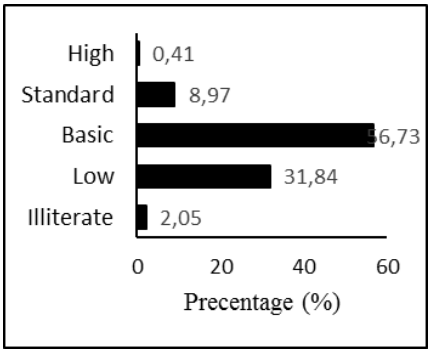
RESULT AND DISCUSSION

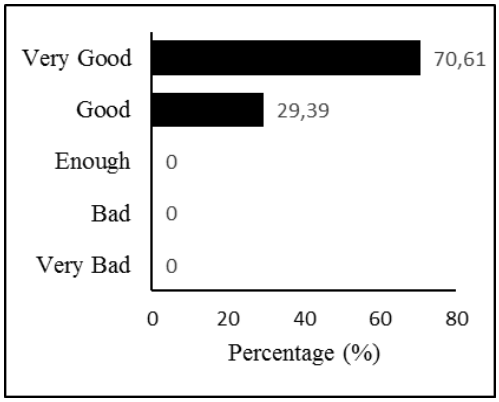
Data Description

Based on the results of the study, the highest ecological literacy score was 93, the lowest score was 53, and the average score was 72. The majority of students had a score of ecological literacy with the basic category of 139 students (56.7%) and the lowest in the category high ie 1 student (0.41%) out of 245 students. It can be concluded, that is the majority of students at SMAN 2, SMAN 4, and SMAN 5 Tangerang City who have Adiwiyata status have an ecological literacy score with a basic category. The ecological literacy category is found in Picture 1.



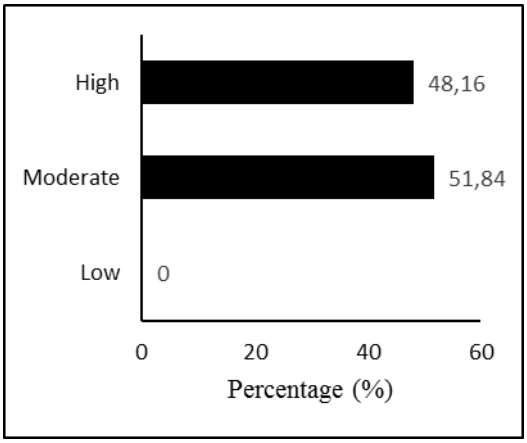
Picture 1. Percentage of Ecology Literacy Score Category

Based on the results of the study, the highest environmental awareness score was 96, the lowest score was 63, and the average score was 84. The highest percentage of the environmental awareness score category was in the very good category of 70.61% (173 students). The lowest percentage in the environmental awareness score category is in the bad and very bad category, which is 0% (0 students). It can be concluded, that the majority of students at SMAN 2, SMAN 4, and SMAN 5 Tangerang City who have Adiwiyata status have a score of environmental awareness in a very good category. The environmental awareness score category was adapted from Riduwan (2009) and shown in Picture 2.



Picture 2. Percentage of Environmental Awareness Score Category

Based on the results of the study, the highest academic ability score was 95, the lowest score was 53, and the average score was 74. The majority of students had a score of academic ability with a moderate category of 127 students (51.84%) and the lowest in the low category of 0 students (0%) out of 245 students. It can be concluded that the majority of students at SMAN 2, SMAN 4, and SMAN 5 Tangerang City who have Adiwiyata status have academic ability scores in the medium category. Academic ability score categories are in Picture 3.



Picture 3. Percentage of Environmental Awareness Score Category

Based on the results of the study, the highest score for environmental problem-solving skill was 83, the lowest score was 5, and the average score was 45 The majority of students have a score of environmental problem-solving skill with enough categories as many as 122 students (49.8%) and at least in the very good category, 1 student (0.41%) out of 245 students. It can be concluded, that the majority of students at SMAN 2 Tangerang City, SMAN 4 Tangerang City, and SMAN 5 Tangerang City who have Adiwiyata status have scores of environmental problem solving-skills at enough categories. The score categories for environmental problem-solving skill are listed in Picture 4.

Discussion

Based on the results of the study, most of the ecological literacy scores obtained by students were in the basic category. Individuals with basic categories of ecological literacy can already be said to be 'ecological literacy' individuals. 'Ecological literacy' individuals have enough knowledge, care, and competence to live by maximizing the positive impact on the environment and finding solutions to solve various current environmental problems (Mcginn, 2014). Students are said to be ecologically literate if they have basic knowledge of ecology as a tool in developing the environmental problem-solving skill. In addition to knowledge about ecology, students must also have a sense of responsibility towards the environment so that they have good problem-solving skills based on this knowledge and responsibilities (Mcginn, 2014). Ecological literacy contributes to empowering students to think and act based on awareness and perception rather than ignorance. Ecological literacy can be developed through an Adiwiyata status school.

Based on the results of the study, the criteria as Adiwiyata status at SMAN 2, SMAN 4 and SMAN 5 Tangerang City are still functioning properly. One of Adiwiyata's criteria is increasing student awareness about the environment. This was realized through the formation of environmental awareness in a very good category in the three schools. Individuals with good environmental awareness know about the existence of environmental problems, have the commitment and skills needed to minimize negative impacts on the environment (Sengupta, 2010). In addition, individuals have had very good attitudes, values, and responsibilities towards the environment so they can find the right solution in solving environmental problems. The implementation of environmentally schools is an effort to open up insight and management of the basic environment and raises awareness to address a broader range of environmental problems (Dasrita *et al*., 2015). Students who are environmentally friendly relate to students' academic abilities.

Academic ability includes student knowledge. Based on the results of the study the majority of students have academic ability scores with a moderate category. Moderate categories of academic abilities show that students have sufficient knowledge and skills so that they can influence attention and interpretation of new information from their environment. Knowledge is part of academic ability. There was a significant positive relationship between environmental knowledge and the ability to solve environmental pollution problems (Sigit *et al*., 2017).

Another factor that affects academic ability is the number of hours of sleep. The results showed that limiting sleep time in adolescents only 5 or 6 hours a night for several nights had a noticeable impact on cognitive performance and especially on memory ability (Jiang *et al*., 2011; Sigman *et al*., 2014; Lo *et al*. , 2016). Most teenagers today tend to have limited hours of sleep because they are required to fulfill learning tasks from school so that the academic abilities that are formed tend to be less than the maximum or still in the sufficient category. Another factor is the intensity of physical exercise in schools such as exercise can improve academic ability (Sigman *et al*., 2014; Ruiz-Ariza *et al*., 2017). It can be concluded, that students can have better academic abilities if students are directed to regular exercise. Factors such as energy supply, nutrition, response to stress hormones and environmental pollution can potentially affect brain function, including the learning process (Thomas *et al*., 2018). Students can have better academic abilities if the learning process is carried out in a healthy or not polluted environment.

Based on the results of the study, it is known that the majority of students have scores of environmental problem-solving skill with sufficient categories. The problem-solving skill requires high-level thinking skills. This can be formed through knowledge in the form of questions and reasoning (Ulutas, 2017). It can be concluded that the majority of students in this study already have sufficient knowledge to form the problem-solving skill that are needed. A senior has broader knowledge and leads to better problem-solving performance (Wang & Chiew, 2010). Based on this explanation, the students' problem-solving skill will develop with age and experience. Students use problem-solving skills to find solutions to eliminate the factors that keep them away from the goal.

CONCLUSION AND RECOMMENDATION

The majority of students at SMAN 2 Tangengan City, SMAN 4 Tangerang City, and SMAN 5 Tangerang City who have implemented the Adiwiyata program have ecological literacy scores with basic categories, environmental awareness scores with very good categories, academic ability scores with moderate categories and environmental problem-solving skill score with enough categories. Based on the results of the study, other schools are expected also to be able to implement the Adiwiyata program so that students can develop ecological literacy, environmental awareness, academic ability and environmental problem solving skills.

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