Environmental literacy of high school students

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Abstract. The goal of this research is to find out the environmental literacy of the tenth grade of Senior High School students. The aspects of environmental literacy presented include knowledge, cognitive skills, and attitudes towards the environment. Research applies descriptive methods. The results of the study showed that the average score of students' knowledge was 11.5 which was in the medium category, students' attitude towards environment was 28.5 which was considered as low category and cognitive skills which included issue identification was 5.4 and it was in the medium category, issues analysis with an average of 30.35 was in the low category and the student action plans with the highest percentage of 64.4% was in the form of reporting to the government and asking for a ban on land sales and there was 17.9% of students who did not have an action plan.

1. Introduction
Current environmental problems are global in nature and it is the responsibility of all components of society to participate in improving and preventing new problems [1]. The science and technology development, as well as various human activities in meeting their needs brings positive and negative consequences to the environment. Technological advancements contribute to environmental damage that various environmental problems are caused by technological advances [2]. Human activities related to the development of environmental crises [3]. Complexity of environmental problems is a result of human greed and lack of public awareness of their environment [4].

Based on these explanations, the main causes of environmental damage lies on the awareness of the environment. Awareness of the environment as one aspect of environmental literacy [5]. Environmental literacy is the individuals’ ability to understand and interpret environmental conditions and take action in maintaining, restoring and increasing the normal environment system [6]. Environmental literacy functions to improve individual’s sensitivity, knowledge, cognitive skills, attitudes and values towards the environment [7]. Environmental literacy can also be explained in the terms of mindset, and how individual’s responsibility towards the environment [8]. Optimal individual literacy will be met when each individual has knowledge, disposition, cognitive skills and attitude towards the environment [6].

Environmental literacy has four aspects i.e. knowledge, disposition which includes verbal commitment, sensitivity to the environment, cognitive skills and actions towards the environment [9]. Environmental literacy are interconnected, influence each other, and can develop progressively in each individual [10]. Environmental knowledge involves knowledge and understanding that can be used by
students in responding to the environmental situations or problems. The main content of environmental knowledge includes the knowledge of 1) physical and ecological systems, 2) environmental problems, 3) sociopolitics and 4) strategies for dealing with environmental problems [11].

Knowledge of physical and ecological systems includes the interaction and interdependence of individual organisms and populations, biogeochemical cycles, energy production and transfers, adaptation, energy flow, change and limiting factors, and humans as variables in ecosystems. Knowledge of environmental problems is related to the causes and consequence factors that exceed the limits, for example resources use and excessive pollution. Socio political system knowledge is concerned with the ecological scarcity approaches which exceeds environmental boundaries expressed in economic, political and social systems. While knowledge of strategies deal with the environmental problems by using alternative ways to solve environmental problems.

Disposition on the environment contains attitudes and values. In the disposition, there are 1) verbal commitments that reveal students’ initial attitudes toward the environment, 2) Sensitivity to the environment which can be seen from the students’ empathy to the environment with various problems, 3) locus control that is related to the extent to which students are expected to have positive reinforcement due to actions done by students, 4) intention to act related to the students’ intentions to act. Students' cognitive skills can be observed based on their ability to identify and analyze issues, evaluate solutions and propose and justify actions to overcome environmental problems. While attitude towards the environment is related to the students’ responsibility as individuals and groups in reducing and resolving environmental problems [11].

Environmental literacy is an ability that every human being needs to have. Environmental literacy as a goal to empower communities to contribute solutions to environmental problems [12]. Empowerment on community environmental literacy needs to be optimized, this is because environmental literacy is the key to sustainability of environmental preservation [13]. That formal education has a strong role in developing individuals who support the existence of the environment [1]. Environmental literacy needs to be owned by every student because in the future students who are currently studying will join the community and move or work and take a role in utilizing the environment [14].

Based on the benefits of environmental literacy for students, this study aims to determine what environmental literacy of high school students in class X have, especially on the aspects of knowledge, cognitive skills and attitudes towards the environment.

2. Methods
The method in this research is descriptive method. The research was conducted in high schools in Boja District of Kendal Regency. The data on environmental literacy aspects measured in this study include knowledge, cognitive skills and attitudes towards the environment. The instrument of this research is MSELS with the research sample is high school students of class X. Table 1 is used as the reference for determining value on aspects of environmental literacy.

| Environmental literacy aspects | Number of questions | Score range | Max Score |
|--------------------------------|---------------------|-------------|-----------|
| Knowledge                      | 17                  | 0-17        | 17        |
| Cognitive skill                | 2                   | 2-8         | 8         |
| Attitude                       | 25                  | 25-100      | 100       |

Knowledge: score range: 0-17, low 0-6; medium 7-12; high 13-17
Cognitive Skill: score range: 2-8, low 2-3; medium 4-5; high 6-8
Attitude: score range: 25-100, low 25-51; medium 52-78; high 79-100
3. Results and Discussion

Based on the results of the research, measurement for the three aspects of environmental literacy which include 1) knowledge, 2) cognitive skills (issue identification, analysis of issues and action plans) and 3) attitudes towards the environment using the MSELS instrument can be seen in Table 2.

| Aspect | P’ | S’ | KK’ |
|--------|----|----|-----|
| Score  | 332| 2394| 152 |
| Average| 11.5| 28.5| 5.4 |
| Category| Medium| Low| Medium |

Note:
P : Knowledge
S : Attitude
KK : Cognitive Skill (issue identification)

Based on Table 2, it is known that the average students’ knowledge is 11.5, student attitudes towards the environment are 28.5 and cognitive skills, especially the ability to identify issues, are 5.4. The results of this study are in accordance with [15] and [16] states that the level of environmental literacy of high school students is in the medium category.

The average score indicates that students have knowledge of the medium category. Measurement of students’ knowledge is based on knowledge of physical and ecological systems including the interaction and interdependence of individual organisms and populations, biogeochemical cycles, energy production and transfers, adaptation, energy flow, change factors and constraints.

Based on the details of the material relating to student knowledge, it is known that there are some materials that students do not have well, namely material interaction and interdependence of individual organisms and populations, energy production and transfer, and energy flow. This finding is in accordance with the results study of [17] which states that knowledge about ecology focuses on the mutual relationships between living things and their benefits. Hile the other material is the majority of students can give correct answers to questions that are conveyed through the instrument.

The knowledge condition that is known is not much different from the results of the study of [18] and [19] which states that students’ knowledge is in the low to moderate category.

![Figure 1. Percentage of Students’ Ability in Analyzing Issue](image-url)
The data in Figure 1 can be interpreted that 67.9% of students have the ability to analyze the issue and the application of scientific knowledge to provide an explanation of the problem causes and make predictions about the consequences of the problem in a low category.

Figure 2 shows the percentage of students' cognitive skills in analyzing issues that are based on social, environmental, ethnocentric, economic and legal values. It is known that the ability to analyze students' issues is related to social values with 21.4%, environmental values 25%, and ethnocentric values 0%, economic value of 46.4% and legal 21.4%.

![Diagram showing percentage of ability to analyze students' issue per value.]

**Figure 2.** Percentage of Ability to Analyze Students' Issue per Value

Based on the percentage data it can be seen that as many as 21.4% of students have the ability to analyze social issues. This means that as many as 21.4% of students have empathy, feelings for fellow humans. For the ability to analyze issues on the environment, there are 25% of the students who have this ability.

This can be interpreted those students have analytical skills related to human activities with natural resources such as plants, animals, water, air and land. While the ability to analyze ethnocentric is 0% which means that the students have no ethnocentric analysis ability. This means that students do not yet have the ability to analyze an issue related to ethnicity or culture. About 46.6% of students possessed other analytical skills related to the economy. This ability of economic analysis is related to the use and exchange money, material and services. In addition to a number of analytical skills related to the law. Based on the results of the study it is known that the students' ability to analyze the law is known as 21.4%. This means that a number of students have analytical skills related to national, state or local law.

Regarding the students' ability to analyze social, environmental, ethnocentric, environmental, economic and legal issues, the highest ability is to analyze the issue on economy and the lowest is on ethnocentric issues. Cognitive skills in the students' action plan are presented in Table 3. To find out the student action plan is done by raising problems in the research instrument. Examples of the problems presented are as follows "If in your area there is an agricultural land to be purchased by the management of the company and on that land and there is a plan to build a grand mall building". Based on these problems students are asked to determine the action plan.

**Table 3. Student Action plans**

| Action Plan                                                                 | Percentage (%) |
|----------------------------------------------------------------------------|----------------|
| Report to the government and ask to ban the sale of agricultural land       | 64.3           |
| Establish a group containing various groups to reject mall construction, with the hopes that forming a joint group can influence government decisions | 60.7           |
Table 3 states that when students are faced with problems related to the conversion of agricultural land to mall buildings, 64.3% of the students will take action plans to report the problem to the government and ask to ban the sale of the agricultural land. 60.7% of the students build a combination of various groups to reject mall construction, and hopes that this joint group can influence government decisions. 17.9% of the students organize a group of residents who have agricultural land who agree with their attitude, and write news through newspapers.

14.3% of the students circulate mall building petitions and submit this request to officials in your area, Writing a letter to the House of Representatives (DPR) and urging them to give penalty to those who forbid the sale of agricultural land. Organizing a group of residents, and those group will boycott the mall construction.

Arrange groups to hold a fundraising that is used to buy agricultural land before agricultural land is sold to mall entrepreneurs. Terrorized the mall businessman and threatened to sabotage construction equipment if the mall construction plan continued.

Do not have an action plan 17.9

4. Conclusion
This study concluded that students' knowledge was in the medium category, cognitive skills (identification of moderate category issues, low issue analysis), action plans for students 64.6% would report problems to the government and students' attitudes towards the environment is in the low category.

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References
[1] Wong C A, Afandi S H M, Ramachandran S, Kunasekaran P, and Chan J K L 2018 Int. J. Bus. Soc. 19 128
[2] Liu Q, Gong D, and Chen M 2018 J. Math. Sci. Technol. Educ. 14 2255
[3] Kaya V H, and Elster D 2019 Sustainability 11 1581
[4] Maulidya F, Mudzakir A, and Sanjaya Y 2014 Int. J. Sci. Res. 3 193
[5] Derman A, Sahin E, and Hacieminoglu E 2016 Int. J. Environ. Sci. Educ. 11 8491
[6] Fidan N K, and Ay T S 2016 Int. J. of Environ. Sci. Educ. 11 5951
[7] Tuncer G, Tekkaya C, Sungur S, Cakiroglu J, Ertepinar H, and Kaplowitz M 2009 Int. J. Educ. Dev. 29 426
[8] Ramdas M, and Mohamed B 2014 Procedia-Soc. Behav. Sci. 144 378
[9] Spinola H, 2015 Sci. Educ. Int. 26 392
[10] Daniš P 2013 Envigogika 8 1
[11] Hollweg K S, Taylor J R, Bybee R W, Marcinkowski T J, McBeth W C, and Zoido P 2011 Developing a framework for assessing environmental literacy (Washington DC: North American Association for Environmental Education).
[12] Hagood A 2013 Environ. Humanit. 2 57
[13] Farida I, Hadiansyah H, Mahmud M, and Munandar, A 2017 J. Pendidik. IPA Indones. 6 277
[14] Shamuganathan S, and Karpudewan M 2015 Int. J. Environ. Sci. Educ. 10 757
[15] Rijal M 2018 J. Phys.: Conf. Ser. 1013 012020
[16] Agfar A., Munandar A, and Surakusumah, W 2018 J. Phys.: Conf. Ser. 1013 012008.
[17] Alisov E A, Cherdymova E I, Trubina G F, Yakushev A N, Zhdanov S P, Popova O V, & Kobzar-Frolova M N 2018 Ekoloji 27 357
[18] Liang S W, Fang W T, Yeh S C, Liu S Y, Tsai H M, Chou J Y, and Ng E 2018 Sustainability 10 1730
[19] Veisi H, Lacy M, Mafiakheri S, and Razaghi F 2019 Appl. Environ. Educ. Commun. 18 25