Ecoliteracy Study About Lake Toba On High School Students

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Abstract act
Responding to the increasingly critical condition of the Lake Toba ecosystem over time, including in the Toba Regency area, research related to ecoliteracy needs to be carried out. The purpose of this study is to measure the level of ecoliteracy abilities of high school students in Toba Regency based on 3 aspects (cognitive, affective, and behavior) and how the relationship between the three aspects of ecoliteracy abilities. The method used in this research is a survey method with a descriptive quantitative approach. Data collection techniques were carried out using tests, distributing questionnaires, and FGD activities. The results showed that the ecoliteracy abilities of students were in the "medium" category, with $\bar{x} = 106.76$ which gave different values to each aspect measured. Cognitive and behavioral aspects are in the "medium" category, while affective aspects are in the "high" category. Through this study, the Pearson correlation test results were also obtained (p>0.05) which showed that there was a significant relationship between cognitive, affective, and behavioral aspects with overall ecoliteracy abilities.

Keywords : Lake Toba, Ecoliteracy, Students

Introduction

Lake Toba has enormous natural wealth and cultural uniqueness in North Sumatra, making it one of the super-priority destinations in Indonesia. Even since July 2020, UNESCO has designated Lake Toba as the Toba Caldera UNESCO Global Geopark which has a commitment to three aspects, namely nature conservation, geological education, and sustainable development.

Although it has received recognition from the national and even international arena, ironically the conditions and ecosystems of Lake Toba appear to be increasingly critical from time to time due to ecological damage that is still ongoing due to the utilization of various natural resources that are not in accordance with their functions (KLH, 2014). Several studies related to environmental issues that have emerged in the Lake Toba area today include deforestation in the upstream area by certain groups of people and companies, water pollution through floating net cage (KJA) activities and various other types of waste, forest fires, floods and landslides that threaten human life (Garno et al., 2020; Mahulae et al., 2020; Simandjorang & Kennedy, 2023).

Based on the information presented on the Toba Caldera Geopark website (2021), referring to the commitment of Lake Toba as a national earth park, the education sector is one of the main focuses recommended by UNESCO in managing the Toba Caldera Geopark area. Education has a very important role in changing the behavior and views of the community (including students) towards the environment so that they have an understanding and attitude to protect, love and preserve the environment or in other words, ecological literacy / have good ecoliteracy skills. The importance of the role of educational institutions in building the ecoliteracy movement is seen in (Code, 2019) description which emphasizes that ecoliteracy can affect learning, methodology, and curriculum.

Ecoliteracy or ecological literacy is a form of literacy that specifically studies the relationship between humans and the environment to support sustainable development (Al-anwari, 2014)so that students have a good understanding of the environment which ultimately influences their attitudes. In line with Capra (2013), ecoliteracy is a person's ability to understand ecological principles and live in accordance with these principles in organizing and building a sustainable life. Previous research revealed that ecoliteracy is positively related

to environmental care. When a student is instilled with good ecological literacy skills, they will have high environmental knowledge and can improve their attitudes and behavior towards environmental protection and management (Syah et al., 2021); (Kavaz et al., 2021).

A person's ecoliteracy ability is based on cognitive (knowledge and understanding of ecological concepts), affective (values and attitudes towards the environment), and behavioral (actions and practices that contribute to environmental sustainability). Nadiroh & Siregar (2019) stated that aspects of knowledge and behavior play an important role in building good ecoliteracy among students. Seeing the condition of Lake Toba, which is increasingly critical at this time, shows that there is still a low level of ecoliteracy / ecological literacy skills possessed by the community, including students who live around the Lake Toba area. This is supported by research conducted by Lubis & Djulia (2018) which states that there are still many students who think that the Lake Toba area is only a tourism object. In addition, they only have knowledge about the importance of nature conservation around Lake Toba, but it has not been manifested in their learning activities.

An issues-based education curriculum focused on the surrounding environment can support the development and competence of ecoliteracy in high school students (Liang et al., 2018).But in fact, based on the results of preliminary observations made at several high schools in Toba Regency, it was found that the lesson plans or teaching modules used by Biology teachers in the classroom on the material on "environmental change" in class X still contain material in general, in other words, content related to Lake Toba has not been promoted and maximally utilized by teachers and students as a source of learning literacy at school.

Based on these various phenomena, to respond to the various environmental issues that arise in the Lake Toba region, the urgency of this research is to measure the ecoliteracy skills of high school students in Toba Regency as one of the efforts that can be made through the education sector in the context of proper and sustainable utilization and conservation of Lake Toba. In addition, the purpose of this study is to see how the relationship between cognitive, affective and behavioral aspects with the overall ecoliteracy abilities of students.

Method

The method used in this research is a survey method with a descriptive quantitative approach. This research was conducted in high schools in Toba Regency which are located around the outskirts of Lake Toba area and close to the geosite location in Toba Caldera geopark, namely SMAN 1 Laguboti, SMAN 1 Siantar Naruomonda, SMAN 1 Lumban Julu, SMAN 1 Balige, SMAS Bintang Timur 1 Balige. Determination of sampling using *purposive sampling* technique is 1 class XI IPA from each of these schools.

Before starting to collect data, the research instrument was first developed and tested for feasibility through several tests such as validity test, reliability test, difficulty test and differentiation test. All instruments developed were adapted to the environmental change material that occurred in the Lake Toba region. The data collection techniques used are through 1) multiple choice tests: to measure the cognitive aspects of students as many as 25 questions, where the instruments are prepared based on the indicators of Class X SMA Learning Outcomes on the material "environmental changes" and adopt the components of the cognitive aspect assessment of NAAEE (2011); 2) distribution of questionnaires: to measure the affective and behavioral aspects of students, as many as 32 statements where the instruments are adopted from several studies, namely the NEP scale (Dunlap et al. (2000); NAAEE (2011), Liang et al. (2018) and ; 3) FGD (*Focus Group Discussion*) activities: to obtain supporting information for the data from the test results and questionnaires of students.

The data were analyzed with descriptive statistics using the help of the SPSS 26 application. The analysis of research data was carried out by calculating the average score obtained by students on each aspect of ecoliteracy measured. The cognitive aspect was scored with 1 for each correct answer and 0 for the wrong answer. Meanwhile, the questionnaire measuring the affective and behavioral aspects was scored using a Likert scale (1-4). Then the score of each aspect of the ecoliteracy ability is interpreted based on the criteria contained in Table 1.

Table 1. Criteria for the level of Students' Ecoliteracy Ability

| Aspects	Low	Medium	High
Cognitive	0 – 8	9 – 1 6	1 7 – 25
Affective	15 – 30	31 – 45	46 – 60
Behaviour	17 – 34	35 – 51	52 – 68
Total Ecoliteracy Ability	32 – 72	73 – 112	113 – 153

(Source: Modified from McBeth *et al.,* 2008)

Results and Discussion

The data obtained in this study is in the form of a total score of students' ecoliteracy skills obtained from the three aspects measured (cognitive, affective and *behavior*). Then the score is categorized into 3 levels, namely high, medium and low. The results of descriptive statistical analysis of the total score of students' ecoliteracy skills at 5 high schools in Toba Regency are presented in Table 2 below:

Table 2. Results of Statistical Analysis of Students' Ecoliteracy Ability

Descriptive statistics					Rank Mean			Level
N	Min	Max	Mean	Std. Dev	School	N	Mean	
170	79	140	106.76	9.44	SMAN 1 Laguboti	34	110.32	Medium
Eco-literacy					SMAN 1 Siantar Narumonda	34	105.62	Medium
					SMAN 1 Lumban Julu	34	110.03	Medium
					SMAN 1 Balige	34	105.76	Medium
					SMAS Bintang Timur 1 Balige	34	102.09	Medium

Based on the data contained in Table 2, it can be seen that the average score of ecoliteracy skills of high school students in Toba Regency is included in the "medium" category with $\bar{x}$ = 106.76. The highest average score of ecoliteracy skills was found among students at SMAN 1 Laguboti with $\bar{x}$ = 110.32 and the lowest average score was found at Bintang Timur 1 Balige Private High School with $\bar{x}$ = 102.09. This can also be seen from the percentage of the level of ecoliteracy skills of high school students in Toba Regency presented in Figure 1. From the 170 student respondents, 77.6% have a "medium" level of ecoliteracy skills and 22.4% are "high", and there are no respondents who have low ecoliteracy skills.
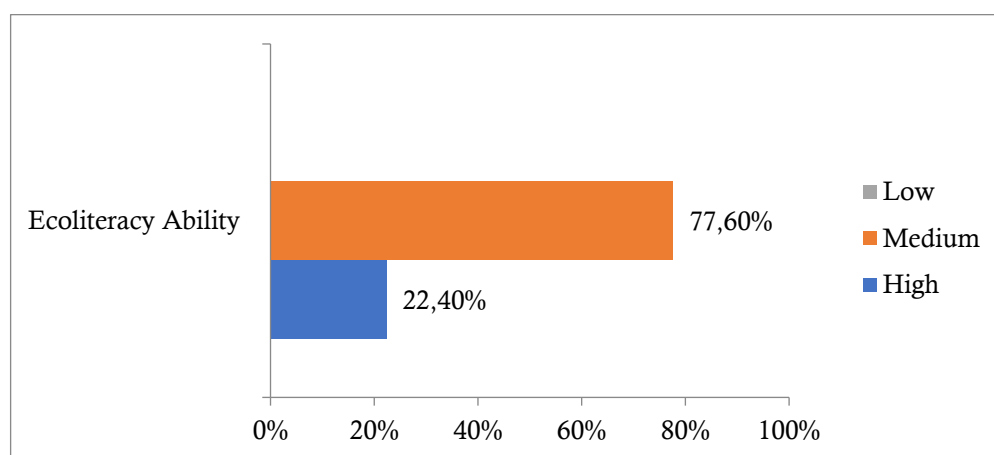
Figure 1. Percentage Level of Students' Ecoliteracy Ability

By looking at the comparison of the average score of ecoliteracy skills owned by each students, significant differences were found in several schools used as research locations. Through FGD activities, it can be seen that this difference arises due to several factors such as the background of students, demographic conditions, activities held by schools, the KBM process in the classroom, as well as extracurricular activities or organizations that students participate in. This is in line with Spínola (2020), which mentions several factors

that influence the level of ecoliteracy skills of students including situational factors, personality, desire to act, students' background, gender, and adopted norms.

The concept of ecoliteracy allows one to be able to develop a better sustainable human character. Research by Suharja et al. (2023) and Ha et al. (2023) showed that a person with a high level of ecoliteracy ability can provide a good understanding in ecological actions towards environmental problems around him. Schools are the ideal place to develop good ecoliteracy skills through the integration of environmental education within the school environment. In this regard, the role of teachers is crucial in integrating environmental concepts and providing direct learning experiences related to the environment through various strategies, thus developing students' ecoliteracy character in various aspects.

The ecoliteracy skills measured in this study focus on 3 aspects, including cognitive, affective, and behavior. The three aspects are measured using different instruments, so the research data obtained are also different. The measurement results on each of these aspects are presented in Table 3.

Table 3. Results of Statistical Analysis of Students' Ecoliteracy Aspects

Aspect	Descriptive statistics					Category
	N	Min	Max	Mean	Std. Dev	
Cognitive	170	7	23	15.78	3.04	Medium
Affective	170	33	58	46.77	3.64	High
Behavior	170	24	68	44.21	7.39	Medium

Through Table 3, it can be seen that the ecoliteracy skills of students in the cognitive ($\bar{x}$ = 15.78) and behavior ($\bar{x}$ = 44.21) aspects are in the "medium" category, while the affective aspect ($\bar{x}$ = 46.77) is in the "high" category. This shows that the ability of students in cognitive and behavioral aspects still needs to be improved through various applications of various programs that can improve the ecoliteracy skills of students, especially those related to the Lake Toba ecosystem. The percentage of the ability score category of all learner respondents in each aspect is presented in Figure 2.
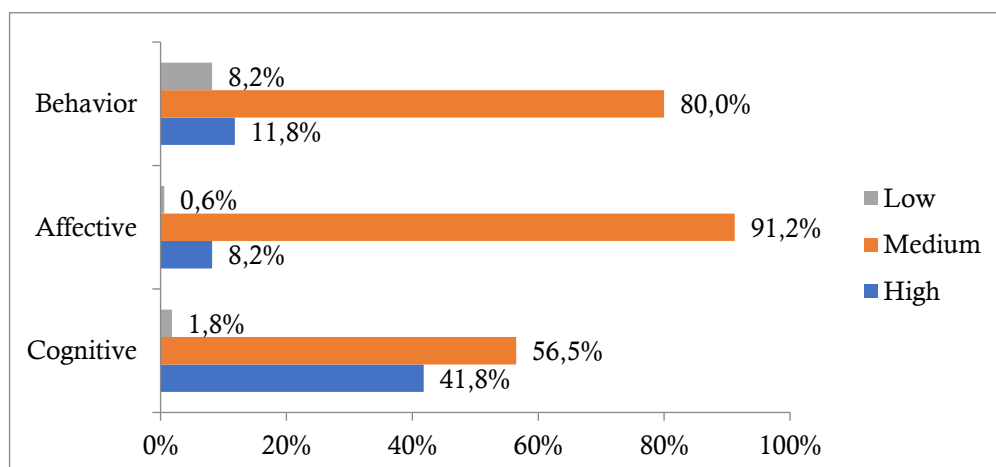

Figure 2. Percentage Categories for Each Aspect of Students' Ecoliteracy

Through FGD activities, it was found that students had never studied environmental issues occurring in the Lake Toba area because the topic of "Environmental Changes" was not discussed in detail and was sometimes skipped altogether. Additionally, based on the analysis of the teaching materials used by high school Biology teachers throughout Toba Regency, content related to Lake Toba has not yet been integrated into the Biology curriculum for 10th grade. This is evident from the IPK (Competency Assessment Indicators) in the K-13 Curriculum and the TP (Learning Objectives) in the Merdeka Curriculum prepared by high school teachers in Toba Regency, which so far have focused more on general knowledge without a specific emphasis on the local ecosystem, including Lake Toba.

Furthermore, the programs implemented by schools, such as the P5 program (Pancasila Student Profile Strengthening Project) in the Merdeka Curriculum, have not yet included the theme of "sustainable living" directly related to efforts to protect and conserve the Lake Toba area. This lack of focus has resulted in students not fully understanding the Lake Toba ecosystem and the ongoing issues within it, as well as not being accustomed to applying ecological principles around Lake Toba due to the lack of prior learning experiences. This finding is consistent with the statement by (Ozsoy et al, 2012) that students' low environmental literacy (ecoliteracy) is not caused by the amount of environmental teaching materials in schools, but rather by the lack of a school environment that can provide direct learning experiences for students to interact with the environment.

In the process of developing students' ecoliteracy skills, it is crucial to pay attention to the knowledge aspect as a foundational basis to understand and respond to the surrounding environment, ultimately achieving the sustainable ecosystem desired by everyone. However, ecoliteracy should not only focus on increasing environmental knowledge but also on understanding the importance of basic ecological awareness to determine responses or behaviors toward the environment. The goal of ecological behavior is to acquire new skills, make informed decisions, actively participate in the environment, and enable individuals to communicate effectively with nature. Ultimately, it can be said that attitudes and behaviors cannot be formed instantly but require a continuous process.

Next, the results of the correlation test analysis between the aspects of ecoliteracy measured in this study are presented in Table 4 below:

Table 4. Correlation Test Results of Ecoliteracy Aspects

Aspect	Cognitive	Affective	Behaviour	Ecoliteracy Ability
Cognitive	-	0.003	0.121	0.419
Affective	0.003	-	0.119	0.480
Behavior	0.121	0.119	-	0.868
Ecoliteracy Ability	0.419*	0.480*	0.868*	-

Note: * (p < 0.01)

The correlation analysis data contained in Table 4 shows that there is no significant relationship between cognitive and affective aspects (r = 0.003; p = 0.482), cognitive and behavior (r = 0.121; p = 0.058) and affective and behavior (r = 0.119; p = 0.061). This indicates that students who have high cognitive abilities do not necessarily have high affective or behavioral abilities, and vice versa. The results of this study contradict some previous research results (Wulandari et al. (2021); Spínola, 2020) which show that there is a significant relationship between the three aspects, where the higher the level of knowledge possessed by students, the greater the influence in increasing the value of attitudes (affective) which then later also affects the formation of environmentally responsible behavior.

Meanwhile, through the correlation analysis of each aspect measured (cognitive, affective and behavior) with the overall ecoliteracy skills of students, a very significant relationship was found (r = 0.419; 0.480, 0.868 and p < 0.01). This strong positive relationship indicates that an increase in each aspect of ecoliteracy will affect the increase in ecoliteracy skills possessed by students as a whole. This is in line with Wulandari et al. (2021) which states that knowledge, attitudes, and behavior in environmental literacy are interrelated, namely knowledge can affect behavior, attitudes can affect behavior, and knowledge and attitudes can jointly affect behavior.

(Koçoğlu et al., 2023) mentioned that the first requirement to become an environmentally literate individual or in other words to have high ecoliteracy skills, is to build ecoliteracy based on knowledge and attitudes. Environmental literacy starts with knowledge. Then, after environmental knowledge and attitudes are acquired, ecological literacy turns into a behavioral dimension. Enhancing cognitive knowledge about environmental issues must be complemented by developing positive attitudes and strong motivation (affective) to promote pro-environmental actions (behavior). Thus, it can be concluded that education integrating these three aspects holistically can significantly improve students' ecoliteracy skills, empowering them to become active agents of change in environmental conservation.

Conclusion

Based on the results of research and discussion, it can be concluded that the ecoliteracy skills of high school students in the Toba Regency related to the Lake Toba ecosystem are in the "medium" category with

an average value of 106.76. Detailed ecoliteracy data measured in this study show different results in each aspect measured. The results showed that students had cognitive and behavior abilities in the "medium" category, while their affective abilities were in the "high" category. This shows that the ecoliteracy skills of students in the cognitive and behavioral aspects still need to be improved and further developed through various programs carried out at school to support efforts to use and conserve the Lake Toba area in a sustainable manner. Then, through the Pearson correlation test, it was found that there was a very significant relationship ($p < 0.01$) of a strong positive nature between cognitive ($r = 0.419$), affective ($r = 0.480$) and behavioral ($r = 0.868$) aspects of the ecoliteracy skills possessed by students.

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