

# Environmental literacy profile of prospective new biology teachers at Universitas Maritim Raja Ali Haji based on cognitive aspects about climate change

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**Abstract.** Various environmental problems that arise due to climate change have had a major impact on human survival. Therefore, it is necessary to create environmental awareness, which is the main thing that anyone, including students, needs to have. Students have the potential to increase community environmental literacy. However, this potential needs to be increased and its profile explained, especially for new students. This research describes the environmental literacy profile of new student biology teacher candidates at Universitas Maritim Raja Ali Haji (UMRAH) in terms of cognitive aspects of climate change. This descriptive research uses essay questions about climate change. These questions were given to all new students of UMRAH Biology Education Study Program class 2022 as samples taken using total sampling techniques. Based on the research results, the environmental literacy profile of prospective new biology teachers at UMRAH in terms of cognitive aspects about climate change is in the sufficient category.

## 1 Introduction

Currently, in the world, many events cause environmental damage. One of these events is climate change. Various environmental problems that arise due to climate change have had a major impact on human survival, including in Indonesia. Climate change must concern everyone so that it does not worsen the earth's conditions. Many human activities impact the environment's survival and other living creatures [1]. These impacts that have been felt provide opportunities for someone to learn better through education. Education that discusses the environment a lot is often known as environmental education. Environmental education is the key to environmental change that humans desire [2]. The reason is that humans can understand the importance of protecting and preserving the environment in depth.

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In order to obtain good environmental education, a person needs to increase and develop individual environmental literacy. One way is through education obtained at college. Higher education is an inseparable part of developing and improving literacy. Universities must produce students, especially prospective teachers, who have the best competencies and are useful for society, including environmental literacy skills. Universitas Maritim Raja Ali Haji (UMRAH), one of the state universities in Indonesia, also has the same task.

However, the potential of prospective teacher students needed to increase environmental literacy requires appropriate and concrete steps. These potentials still need further improvement to maximize them, including for new students. Increasing environmental literacy skills, especially for new student biology teacher candidates at UMRAH, has yet to be carried out much. It needs to be done so that new students who are prospective biology teachers have the skills to encourage the public to realize the importance of preserving the environment through a comprehensive understanding of environmental literacy when they have the opportunity to become teachers in the future. Apart from that, currently, there is still no known picture of the environmental literacy profile of new students who are prospective biology teachers, especially when viewed from the cognitive aspect of climate change, especially at UMRAH as one part of developing basic teacher skills, so this needs to be revealed in order to determine the next step in efforts to increase environmental literacy in the future.

This research aims to describe the environmental literacy profile of new student teacher candidates at UMRAH in terms of cognitive aspects of climate change. The benefit of this research is a basis for thinking more deeply about the environmental literacy profile of new student biology teacher candidates who focus on climate change.

## 2 Method

This research was conducted in April-June 2023. This descriptive research used an instrument in the form of essays test questions given in the form of a case related to climate change issues. The test questions were given to all new students of the Biology Education Study Program class 2022 as a sample using a total sampling technique. The test research instruments grids refer to aspects of environmental literacy focused on cognitive aspects, as seen in the following table [3,4].

**Table 1.** Environmental Literacy Aspect

No.	Environmental Literacy Components	Question Indicator
1	<b>Environmental Knowledge</b>	Through the text provided, students are able to:
	a. Environmental basics	analyze the impact of environmental events that occur correctly.
	b. Ecological system	link the impact of human activities to environmental change correctly.
2	<b>Cognitive Skills</b>	Through the text provided, students are able to:
	a. Environmental problems	find the causes of environmental problems that occur as a result of human conflict correctly.
	b. Environmental analysis	determine what actions can positively improve and maintain the environment.
	c. Various solutions related to environmental issues	create various solutions or alternatives to overcome environmental problems in the future.

After that, the results of the answers to each question are assessed with a score based on the assessment rubric as seen in the following table.

**Table 2.** Rubric for Grading Essay Questions about Climate Change

Question	Criteria and Scores				
	4	3	2	1	0
Analyze the impact of melting permafrost on Earth!	Students are able to answer questions according to the content of the text, around 85-100%	Students are able to answer questions according to the content of the text, around 61-84%	Students are able to answer questions according to the content of the text, around 25-60%	Students are able to answer questions according to the content of the text, around 1-24%	Does not provide an answer at all, or the answer given is not related to the question asked.
Analyze which human activities can cause this impact!	Students are able to answer questions according to the content of the text, around 85-100%	Students are able to answer questions according to the content of the text, around 61-84%	Students are able to answer questions according to the content of the text, around 25-60%	Students are able to answer questions according to the content of the text, around 1-24%	
What other environmental problems will occur because of human conflict?	Students are able to answer questions according to the content of the text, around 85-100%	Students are able to answer questions according to the content of the text, around 61-84%	Students are able to answer questions according to the content of the text, around 25-60%	Students are able to answer questions according to the content of the text, around 1-24%	
What positive actions can improve and maintain environmental conditions in the world?	Students are able to answer questions with very positive and easy answers to improve and maintain the current environment.	Students are able to answer questions positively, more effort is needed to improve and maintain the current environment	Students are able to answer questions positively, it is not easy to improve and maintain the current environment.	Students are able to answer questions with negative answers to improve and maintain the current environment.	
Give solutions or alternative solutions to environmental problems like this so they can be anticipated in the future!	Students are able to present solutions that are very innovative and have never been thought of by anyone else.	Students are able to present innovative solutions, but there are still very few people who have done it	Students are able to present innovative solutions, but many people have already done this.	Students are able to present solutions that are less innovative or less clear.	

Then, the average score obtained is calculated. After that, the percentage results will be calculated and converted into an interpretation referring to the following table. [3]

**Table 3.** Interpretation of Literacy Environment from Aspect Cognitive

Percentage	Interpretation
0-19	Very not good
20-39	Not good
40-59	Enough
60-79	Good
80-100	Very good

### 3 Results and Discussion

#### 3.1 Analysis Results Ability Cognitive Student Every Question

Five questions about climate change were given to new UMRAH biology teacher candidates. Following are the results of the analysis of the ability literacy student environment from the aspect of climate change.

##### 3.1.1 Results of Analysis of Students' Cognitive Abilities on the First Question

The results of the first question analysis can be seen in the following table.

**Table 4.** Results of Analysis of Cognitive Aspects Related to Environmental Literacy in The First Question

Question	Score Frequency					Average	Percentage	Criteria
	4	3	2	1	0			
Analyze the impact of melting permafrost on Earth!	18	23	14	8	1	2.77	55.31	Enough

This first question is given to provide an overview of new students' basic knowledge about the phenomenon of melting permafrost on Earth. Based on Table 4, students have sufficient basic knowledge about melting permafrost on Earth. A total of 23 students were able to provide good answers based on the text that had been given. This result proves that at least students have clear enough environmental knowledge about this event as a basis for forming concern for the environment. Several other studies show that environmental education, which can provide basic environmental knowledge, relates to environmental literacy and self-efficacy beliefs. This is certainly very helpful in forming other aspects that support environmental literacy. [5,6].

##### 3.1.2 Results of Analysis of Students' Cognitive Abilities on the Second Question

The results of the second question analysis can be seen in the following table.

**Table 5.** Results of Analysis of Cognitive Aspects Related to Environmental Literacy in The Second Question

Question	Score Frequency					Average	Percentage	Criteria
	4	3	2	1	0			
Analyze which human activities can cause this impact!	8	21	16	12	7	2.17	43,44	Enough

This second question is given to provide an overview of how students can analyze various human activities that can cause the melting of permafrost on Earth. As a result, 21 students were able to analyze the incident. Some of the answers most often made by students (especially those who got scores of 4 and 3) are following several articles found [7–9] about human activities that caused this event to occur, such as global warming, which causes sea temperatures to rise (63,2%), there is excessive use of plastic waste (32%), and the rest answered that the processing of dangerous chemicals by industrial companies, which are also very numerous, can cause contamination in water and land. However, there were still seven students who were unable to analyze the problems presented in the text. These results also note a need for follow-up action to increase new students' broader knowledge about environmental literacy so that these results can be even better.

### 3.1.3 Results of Analysis of Students' Cognitive Abilities on the Third Question

The results of the third question analysis can be seen in the following table.

**Table 6.** Results of Analysis of Cognitive Aspects Related to Environmental Literacy in The Third Question

Question	Score Frequency					Average	Percentage	Criteria
	4	3	2	1	0			
What other environmental problems will occur because of human conflict?	4	27	23	6	4	2.33	46.56	Enough

This third question is given to find out students' opinions about other environmental problems that can occur due to conflicts created by humans. As a result, as many as 27 students could analyze the incident. In detail, ecosystem damage (74.07%), high levels of pollutants released into the environment (11.11%), and the remainder answered the reduction in water, land, and air resources. However, seven students still gave answers that needed to match the questions' context.

### 3.1.4 Results of Analysis of Students' Cognitive Abilities on the Fourth Question

The results of the fourth question analysis can be seen in the following table.

**Table 7.** Results of Analysis of Cognitive Aspects Related to Environmental Literacy in The Fourth Question

Question	Score Frequency					Average	Percentage	Criteria
	4	3	2	1	0			
What positive actions can improve and maintain environmental conditions in the world?	0	50	8	3	3	2.64	52.81	Enough

This fourth question is given to determine students' opinions about what positive things can be done to improve and maintain environmental conditions due to the melting of permafrost on Earth. As a result, students were kept from giving a very positive answer, which was easy for everyone to do. However, as many as 50 students gave answers regarding positive actions that require greater effort to impact the environment. For example, saving electricity and water, recycling waste, and protecting nature better. It means that cognitively, most students can provide ideas regarding actions that need to be taken to overcome environmental problems when needed. Special environmental literacy skills to provide and carry out positive actions are necessary so that new students are expected to have a general understanding of sensitivity to the environment [10].

### 3.1.5 Results of Analysis of Students' Cognitive Abilities on the Fifth Question

The results of the fifth question analysis can be seen in the following table.

**Table 8.** Results of Analysis of Cognitive Aspects Related to Environmental Literacy in The Fifth Question

Question	Score Frequency					Average	Percentage	Criteria
	4	3	2	1	0			
Give solutions or alternative solutions to environmental problems like this so they can be anticipated in the future!	0	1	58	2	3	1.89	37.81	Not good

This fifth question is given to determine to what extent students can provide solutions or recommendations to anticipate this event happening again. As a result, no one could provide an innovative solution that no one had ever thought of. In general, students can only provide solutions that many other people have done to overcome the problem of climate change. The solution most frequently created by all students was reducing greenhouse gas emissions (82.4%). Two people who scored 2 answered "doing climate change management," which is too broad and not specific enough, making it difficult to do. Students' ability to provide innovative solutions still needs to be retrained. This result occurs because there still needs to be more literature studied by new students and specifically examined how to improve the professional abilities of teachers and prospective teachers, even independently, especially related to environmental literacy [11].

### 3.2 Results of Analysis of Students' Environmental Literacy Ability Levels

Based on the results of calculating scores and percentages for each previous question, the results of grouping environmental literacy levels based on the cognitive aspects of each student were then obtained. The results can be seen in the following table.

**Table 9.** Students' Environmental Literacy Ability Level

Interpretation	Number of Students	Percentage
Very good	7	10,94
Good	33	51,56
Enough	16	25,00
Not good	5	7,81

Very not good	3	4.69
<b>Total</b>	<b>64</b>	<b>100</b>

Based on Table 9 presented, it is known that as many as 33 students have good environmental literacy skills. It means that more than half of the students who worked on this question had good basic knowledge about climate change. However, there are still eight students whose cognitive abilities regarding environmental literacy could be better or better. Students with low cognitive abilities related to environmental literacy will impact other things in the future. A person's low environmental literacy ability can make it difficult to make various decisions on utilizing natural resources to maintain and preserve them sustainably [4]. Apart from that, students' low cognitive abilities related to environmental literacy can impact a person's low level of concern for the environment. Environmental literacy and environmental concern have a strong correlation, so if someone has a low cognitive level regarding environmental literacy, no one may not be concerned for the environment around them. [10].

### 3.3 Result of Interpretation Analysis of New Students' Environmental Literacy Abilities Based on Environmental Literacy Components

If viewed from the components of environmental literacy measured, the results are shown in the following table.

**Table 10.** Interpretation of Students' Environmental Literacy Levels Based on Cognitive Aspects of Climate Change

<b>Environmental Literacy Components</b>	<b>Percentage</b>	<b>Interpretation</b>
<b>Environmental Knowledge</b>		
a. Environmental basics	55, 31	Enough
b. Ecological system	43, 44	Enough
<b>Cognitive Skills</b>		
a. Environmental problems	4 6,56	Enough
b. Environmental analysis	52, 81	Enough
c. Various solutions related to environmental issues	37.8 1	Not good
<b>Average</b>	47.19	<b>Enough</b>

Based on the table presented it can be seen that although most students have good environmental literacy skills in general, these results only guarantee that some components of environmental literacy possessed by students are also good. This can be seen from the data in the table that the interpretation of the assessment of the environmental literacy components measured is only in the sufficient category. When students are asked to provide solutions related to environmental issues such as climate change, many only provide solutions that many others have already done. Not a single student could provide an innovative solution that no one had ever thought of or an innovative solution, but only a few did it. This can be influenced by several factors, such as a weak understanding of the concepts of environment, minimal issues known to the relevant students' environment, limitations related to theories that students can obtain environment, and design curriculum or planning not much learning touch on problem environment. However, The research subjects involved here are new student biology teacher candidates. [12,13]

## 4 Conclusion

The environmental literacy profile of prospective new biology teachers at Universitas Maritim Raja Ali Haji based on cognitive aspects about climate change was dominated by good-ability students. The environmental literacy profile of prospective new biology teachers at Universitas Maritim Raja Ali Haji based on cognitive aspects of climate change was in the sufficient category.

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