

Critical Thinking Profile and Environmental Literacy Analysis of Al-Washliyah Labuhanbatu University Biology Education Undergraduate Students

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Abstract

Critical thinking plays a crucial role in enhancing environmental literacy by fostering the ability to analyze, evaluate, and understand complex environmental issues. The purpose of this study was to analyze the profile of critical thinking and environmental literacy of biology education students at Al-Washliyah Labuhanbatu University. This research is descriptive quantitative in which data were collected through observation and questionnaires. critical thinking indicators are simple explanations, building basic skills, inferring, making further explanations and strategies and environmental literacy indicators knowledge, cognitive skills, attitudes and behaviors related to environmental stewardship. The results showed that the mean score of CT skills ($M=13.81$, $SD=3.52$) was weak and below the optimal average ($M=17.1$, $SD=5.0$) and the environmental literacy profile shows that for the knowledge indicators the average is 61.25% with a sufficient category, for the cognitive skills indicators 63.95% with a sufficient category, for the attitude indicators 76.53% with a good category, for the environmentally responsible behavior indicators 53.92% with a poor category. Critical thinking skills of biology students at Al-Washliyah Labuhanbatu University is not favorable and environmental literacy for the ecological knowledge aspect is still at a moderate level, which means that some ecological concepts such as biogeochemical cycles are not well understood.

Keywords: *Critical thinking; Environmental literacy; Undergraduate students*



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INTRODUCTION

The development for critical thinking process for biology students, various strategies can be employed based on the research findings. Implementing Research Based Learning has been shown to positively impact students' critical thinking skills, with students responding well to this approach and showing improvements in open thinking and idea generation (Mussabekov et al., 2023). Additionally, utilizing cooperative learning methods like the jigsaw model has been proven effective in enhancing critical thinking abilities among students, as evidenced by the significant differences in critical thinking skills between students using cooperative learning and those in conventional settings (Daryanes & Sayuti, 2023). Moreover, incorporating problem-solving models in biology courses has been found to significantly improve students' critical thinking skills compared to traditional lecture methods, highlighting the effectiveness of problem-solving approaches in fostering higher-order thinking (Utami & Nurcahyo, 2023). Lastly, the "student as researchers" strategy has been identified as a successful method for enhancing critical thinking skills, with students showing substantial improvements in their ability to express ideas and think critically after participating in this approach (Daryanes et al., 2023). By integrating these research-based strategies, educators can effectively cultivate critical thinking skills in biology students, promoting deeper understanding and analytical thinking in the field.

Critical thinking plays a crucial role in enhancing environmental literacy by fostering the ability to analyze, evaluate, and understand complex environmental issues (Filyanina, 2016; Nadiroh et al., 2019). Environmental literacy involves having the knowledge, skills, and attitudes necessary to comprehend and address environmental challenges effectively (O'Donoghue, 2018). Studies have shown that critical thinking skills are essential for individuals to contribute to environmental preservation efforts, as they enable individuals to think critically about environmental problems and develop innovative solutions (Krejci et al., 2020). By integrating critical thinking into environmental education through interactive teaching materials and problem-solving activities, individuals can enhance their eco-literacy and become more actively engaged in environmental stewardship, ultimately leading to a more sustainable relationship between individuals and their environment (Kaya & Elster, 2019).

To enhance critical thinking for improved environmental literacy, various studies suggest effective strategies. Implementing research-based ecosystem and water pollution electronic modules in a Problem-based Learning (PBL) approach significantly enhances students' critical thinking skills (Wahyuningsih et al., 2023). Developing eco-literacy-based interactive teaching materials (EITM) has shown validity in promoting critical thinking skills among students (Adebisi, 2023). Exposure to e-learning modules on environmental change has been found to inspire students to seek information independently, fostering critical thinking abilities (Sukro et al., 2021). Additionally, incorporating visual literacy interventions in science courses, such as identifying values, trends, and making projections, has shown promising results in improving students' academic success and critical thinking skills (Pursitasari et al., 2019). Furthermore, integrating environment-based STEAM projects in chemistry learning through project-based learning has been effective in developing students' critical thinking skills and

environmental awareness (Satriawan et al., 2022). These approaches collectively contribute to nurturing critical thinking for enhanced environmental literacy. Undergraduate students should be able to think critically when dealing with problems and current issues. Currently, environmental issues are still lurking in Indonesia due to the low knowledge of environmental sustainability so that the SDGs appear. Therefore, the aim of this study is to analysis the critical thinking skills and environmental literacy of biology education undergraduate students.

METHOD

This type of research is quantitative descriptive. Data was collected using observation techniques and questionnaire completion. The sample in this study was biology students at Al-Washliyah Labuhanbatu University. There were 63 people in total. The instruments used include a critical thinking test and an environmental literacy test and questionnaire. Indicators of critical thinking skills measured include making simple explanations, building basic skills, inferring, making further explanations and strategies. Indicators measure environmental literacy, which includes knowledge, cognitive skills, attitudes and behaviors related to environmental stewardship. Critical thinking data will be collected by means of a 14-question essay test on environmental problems. The test will take 50 minutes to complete. The MSELI questionnaire, modified for Indonesian students, was used to collect data on environmental literacy.

The data were analyzed using descriptive analysis in three stages. First, by determining the profile of each variable using the value of each indicator in the norm category. The results of critical thinking are grouped into 5 norms or categories, see Table 1.

Table 1. Categories of Critical Thinking

Categories	Criteria
81-100	Very Good
61-80	Good
41-60	Sufficient
21-40	Less
1-20	Very Less

Environmental literacy scores were classified into 5 categories: excellent (86 to 100 points), good (76 to 85 points), fair (60 to 75 points), poor (55 to 59 points) and very poor (below 54 points). Second, critical thinking skills and environmental literacy were assessed using the percentage scores for each indicator. Thirdly, it describes or illustrates as it is, so that the use of research findings is applicable at the time, which is not necessarily relevant for use in the future. Therefore, it does not always require a research hypothesis and does not require the treatment or manipulation of variables. Therefore, it does not always require a research hypothesis and does not require treatment or manipulation of variables.

RESULTS AND DISCUSSION

Critical Thinking Profile

This study aims to analyze the profile of critical thinking and environmental literacy of biology education students, Al-Wasliyah Labuhanbatu University. The results showed that the mean score of CT skills ($M=13.81$, $SD=3.52$) was weak and below the optimal average ($M=17.1$, $SD=5.0$). Apparently, the mean score of critical thinking skills of biology students at Al-Wasliyah Labuhanbatu University is not favorable. This finding is consistent with previous studies conducted in Indonesia that reported low levels of critical thinking among university students (Girinzio et al., 2023). Table 1 shows the results of the critical thinking test for biology students.

Table 1. Mean Score of Critical Thinking Skills

Critical Thinking Skills	Mean	SD
Simple Explanations	3.53	1.09
Building basic skills	3.60	1.65
Inferring	5.89	2.31
Explanations	4.29	2.64
Strategy	5.90	2.13

The mean score of simple explanations ($M = 3.53$, $SD = 1.09$), building basic skills ($M = 3.60$, $SD = 1.65$), inferring ($M = 5.89$, $SD = 2.31$), explanations ($M = 4.29$, $SD = 2.64$), Strategy ($M = 5.90$, $SD = 2.13$) compared to other studies, fewer were obtained. The profile of critical thinking skills is the focus of the environmental knowledge courses played by the lecturers through lecture material on environmental problems and pollution. The learning model used is collaborative learning with stages or syntax as follows: 1) presenting the problem; 2) inviting group discussion to solve the problem; 3) managing tasks and roles of group members to discuss; 4) realizing group responsibility; 5) making work and presenting the results of the work; and 6) making process and result evaluations. Indicators of concern in this critical thinking skill include making simple explanations, building basic skills, inferring, making further explanations, and strategies.

Profile of Environmental Literacy

Indicators of environmental literacy include environmental knowledge, environmental attitudes, environmental problem-solving skills and responsible behavior, environmental problem-solving skills and responsible behavior. The environmental literacy profile shows that for the knowledge indicators the average is 61.25% with a sufficient category, for the cognitive skills indicators 63.95% with a sufficient category, for the attitude indicators 76.53% with a good category, for the environmentally responsible behavior indicators 53.92% with a poor category. Environmental literacy Students are in the medium category (Tabel 2).

Table 2. Environmental Literacy

Indicators	Percentage (%)	Category
Knowledge	61.25	Sufficient
Cognitive skills	63.95	Sufficient
Attitude	76.53	Good
Environmental responsible behavior	53.93	Poor

The results show that environmental literacy for the ecological knowledge aspect is still at a moderate level, which means that some ecological concepts such as biogeochemical cycles are not well understood. For the aspect of attitudes towards the environment, a good position means that students do not fully agree that humans can dominate the use of nature to meet their needs, and they agree that human activities can disrupt or contribute to the environmental balance.

DISCUSSION

On the basis of the research results, it can be seen that the critical thinking skills of the students in relation to the environment are unfavorable. Students' critical thinking about the environment is low due to various factors identified in the research papers. Studies have shown that students' critical thinking skills regarding environmental issues, such as global warming and pollution, are generally categorized as low (Nurhayati et al., 2024). Factors influencing this include situational factors, dispositional factors, lack of exposure to critical thinking modules, and the need for eco-literacy-based interactive teaching materials to enhance critical thinking skills (Yusuf, 2022). The integration of research-based modules, e-learning platforms, and problem-based learning approaches has been suggested to significantly improve students' critical thinking abilities in relation to environmental topics (Ritonga et al., 2021). Therefore, addressing these factors through innovative teaching methods and engaging materials is crucial in fostering higher levels of critical thinking among students when it comes to environmental issues (Aufa et al., 2021).

Low critical thinking in college students can be attributed to various factors. These include issues like low motivation, self-regulation, belief and confirmation biases, framing, social pressure to conform, and poor assessment of probability and risk (Bekbayeva et al., 2022; Aston, 2023). Additionally, the imbalance between language competence and critical thinking ability due to an overemphasis on language knowledge can hinder the development of critical thinking skills in students (Franco et al., 2017). Gender differences, GPA, admission types, and individual backgrounds also play a role in influencing students' critical thinking skills and dispositions (Akmam et al., 2019). Understanding these factors and implementing strategies like differentiated learning, exploring human factors affecting critical thinking, and enhancing students' critical thinking abilities can help address the challenges and improve critical thinking among college students.

The critical thinking skills of the students on the indicator of analysis are low with a value of $M = 3.53$ and $SD = 1.09$. The critical thinking ability of college students tends

to be low on analysis indicators due to various factors identified in the research papers. Studies have shown that students often struggle with providing detailed information, such as drawing illustrations, when analyzing and interpreting problems (Ndahawali et al., 2020). Additionally, research on physics students revealed that students scored only 33% in the ability to build basic skills and 25% in the ability to conclude when solving optical geometry problems, indicating a deficiency in analytical skills (Nurrahmah et al., 2022). Furthermore, a study focusing on critical thinking in listening skills found that students scored 65% in analysis skill, categorizing it as medium, suggesting room for improvement in analytical abilities (Purwoko et al., 2022). These findings collectively highlight the need for targeted interventions and educational strategies to enhance college students' analytical thinking skills and improve their overall critical thinking abilities.

The critical thinking skills of the students on the indicators of strategy have a higher average value than the other indicators ($M = 5.90$, $SD = 2.13$). The high critical thinking ability of college students on indicators of strategy and tactics can be attributed to the implementation of effective teaching methods that promote critical thinking skills. Studies have shown that strategies like problem-based learning, research, case studies, and argumentation-based learning enhance students' critical thinking abilities by emphasizing active student participation and teamwork (Daryanes et al., 2023). Additionally, the "student as researchers" strategy has been proven to significantly improve students' critical thinking skills, with notable increases in the ability to express ideas and draw appropriate conclusions (Zhang, 2022). Furthermore, college English teachers recognize the importance of teaching critical thinking as a skill, which makes the learning process more meaningful and encourages students to develop critical thinking as a habit (Zhang, 2021).

The profile of students' environmental literacy is in the medium category. The results show that students' attitudes are in the good category (76.53%). Several factors influence the environmental attitude of students. These factors include environmental knowledge, daily habits at home, self-awareness to care for the environment, exposure to organizations engaged in environmental activities, values, social environmental factors, and the influence of family and friends. Studies have shown a significant correlation between students' environmental knowledge and their environmental care attitude (Sasea et al., 2023). Additionally, the development of pro-environmental attitudes in children is crucial for the future, requiring instilling knowledge about nature and its benefits (Ismail et al., 2022). Furthermore, factors such as knowledge, skills, crop management, and motivation have been identified as significant influencers of attitudes toward environmental sustainability (Qodriyanti et al., 2022). Moreover, the influence of values, social environmental factors, and the role of family and friends in shaping pro-environmental attitudes have been highlighted in research involving Lithuanian schoolchildren (Jančius et al., 2021; Evert et al., 2021).

The profile of environmental literacy in the indicator of environmentally responsible behavior is in the poor category. Environmentally responsible behavior in college students may be low due to a variety of factors identified in the research. Studies have shown that there is a disconnect between environmental values and actual behaviors, known as the "value-action gap," where students express concern about climate change but struggle to translate these beliefs into action (Mouchrek et al., 2023). Additionally, a lack of sustainable knowledge and poor attitudes towards sustainability have been

observed among college students, with greater knowledge not necessarily translating into more sustainable behavior (Wang et al., 2022). Furthermore, the cognition, willingness, and motivation for low-carbon lifestyles among college students are often lacking, making it difficult to change behaviors in the short term (Zhang et al., 2023). Integrating social values and personal values has been suggested as a way to shape pro-environmental behavioral intentions among college students, emphasizing the importance of instilling prosocial values to promote sustainable actions (Null & Asirvatham, 2022).

CONCLUSION

The mean score of CT skills (M=13.81, SD=3.52) was weak and below the optimal average (M=17.1, SD=5.0). Apparently, the mean score of critical thinking skills of biology students at Al-Washliyah Labuhanbatu University is not favorable. The environmental literacy profile shows that for the knowledge indicators the average is 61.25% with a sufficient category, for the cognitive skills indicators 63.95% with a sufficient category, for the attitude indicators 76.53% with a good category, for the environmentally responsible behavior indicators 53.92% with a poor category. The results show that environmental literacy for the ecological knowledge aspect is still at a moderate level, which means that some ecological concepts such as biogeochemical cycles are not well understood.

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