



## An analysis of elementary students' ecological literacy growth within science project-based learning

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**Abstract.** Ecological literacy is not only environmental knowledge but also a critical mindset that integrates science, ethics, and action. This mixed-method analysis analyzes the ecological literacy skills of PGMI students in the science course through project-based learning (PBL). Data were collected through tests, interviews, and observations, then analyzed quantitatively and qualitatively using a triangulation approach. Test results indicated strong performance on indicators of ecological knowledge, systematic thinking, ecological empathy, and critical-evaluative thinking, but only adequate performance on the action indicator. These findings align with the interviews and observations: the majority of prospective teachers possess good ecological knowledge, as evidenced by PjBL projects that use eco-friendly materials and demonstrate adequate critical thinking, yet concrete actions in the environment remain underdeveloped. The recommendations of this study are to strengthen community-based campus programs,

such as environmental internships and collaborations with elementary schools, to implement concrete actions, so that ecological literacy has a tangible impact on the community and learning in elementary schools.

## Introduction

Currently, Indonesia is facing environmental crises, including deforestation, water pollution, and flooding. Mangrove degradation has intensified coastal erosion in Aceh alone, and Java's rivers are plagued by more than a million tons of plastic debris every year (KLHK, 2025; Prabawati & Frimawaty, 2025). Global environmental crises caused by humans, exacerbated by climate change and biodiversity loss, require a major transformation in the human perspective towards nature. The younger generation's lack of ecological consciousness is the cause of this; it is necessary to improve ecological literacy at the elementary school level. Enhancing teachers' and aspiring teachers' comprehension of ecological literacy might help them develop this skill.

The integration of environmental awareness into science education is important to instill, especially for prospective primary teachers, to minimize future environmental damage. Currently, however, the idea of science education in higher education is centered on a positivistic method that distinguishes between scientific facts and moral principles. This will affect pupils' literacy abilities, particularly their ecological literacy, which will remain abstract and devoid of profound significance. Several studies have found that prospective teachers' ecological literacy remains low, with minimal understanding of basic ecosystem and sustainability concepts, making it difficult to integrate these

into learning. This phenomenon is evident from a national survey showing that only 30-40% of students in elementary school teacher education (PGSD) can critically analyze environmental issues, exacerbating their unpreparedness as future educators (Permata et al., 2026).

This is also relevant to the results of a preliminary study conducted on science learning in the Madrasah Ibtidaiyah Teacher Education (PGMI) study program, which found that students' ability to understand science material using the project-based learning model was good, but their ability to develop a mindset about the importance of environmental awareness still needed guidance. Therefore, there is a need to strengthen students' ecological literacy skills during the learning process and to integrate them into the teaching process at school.

Ecological literacy is a person's ability to understand how natural systems interact and to take moral action to preserve nature (Salasabila et al., 2024). For students studying to become elementary school teachers, it is very important to expand their knowledge of the concept of "Eco-Science," a rationale that unites the principles of science with those of spirituality, as Khalifah fil Ardh (Rohman et al., 2024). The gap between mastery of scientific theory and a lack of ecological awareness in higher education environments underscores the need to select an appropriate learning model to integrate ecological literacy.

Other studies have found that ecological literacy, especially among prospective biology teachers, requires a solid conceptual understanding, pedagogical integration in the curriculum, institutional support, and a transformative orientation towards sustainable education. Conceptually, research by Kidman & Casinader (2019) confirms that even if teachers have their own environmental literacy, it does not mean students can master it as well. This shows that if prospective teachers are not equipped with adequate ecological literacy, their ability to develop this literacy in students will be limited. A number of studies in Indonesia Salasabila et al. (2024) show that prospective teachers' understanding of ecological literacy remains limited to the cognitive realm, without being accompanied by concrete actions (Fodouop, 2025; Taufik et al., 2024). The gap between the ideal conditions and the mastery of ecological literacy shows that this literacy has not been optimally integrated.

Despite the growing emphasis on participatory approaches, outdoor learning, and digital integration, pedagogical research on integrating ecological literacy into learning programs has revealed that environmental teaching practices in formal education remain textbook-based and teacher-centered (Lynch, 2024; Rediani, 2024; Adawiah et al., 2024). In addition, it was found that the use of appropriate learning models, such as group-based project learning, field learning, or interdisciplinary learning, has not been implemented optimally (Maisarah et al., 2026). As a result, the ecological literacy of prospective teachers is still theoretical and not yet ready to be translated into creative pedagogical action in the classroom.

Another study found that institutionally, policies and collaborative processes in several study programs do not yet fully support the strengthening of ecological literacy competencies among prospective teachers. For future learning transformation, there needs to be a comprehensive strengthening of prospective teachers' competencies through training for lecturers and increased use of appropriate learning resources.

According to several earlier studies, ecological literacy theory emphasizes the capacity to comprehend human-environment relationships but does not incorporate a project-based, contextual strategy for aspiring elementary school teachers. Therefore, there is a need to integrate appropriate learning models, including project-based learning. The PjBL model according to Krajcik Juuti et al. (2021); Krajcik (2018) has proven to be effective for general science literacy, but

has not been elaborated specifically for ecological literacy in elementary school science courses that focus on early childhood education. This gap causes ecological literacy theory to be fragmented from practical application in teacher education.

Project-based learning has great potential to make learning experiences more interesting for students. In this type of learning framework, students are encouraged to participate actively, and the teacher's role tends to be more facilitative, enabling students to be more creative and dynamic (Pan et al., 2023). In addition, teachers are also responsible for assessing students' work so that it can be applied more effectively in everyday life. The PjBL learning model, which focuses on direct involvement through simple projects, will provide students with space to think critically, solve problems, and learn effectively (Widana et al., 2021).

Previous research has extensively addressed ecological literacy among elementary school students, focusing on the impact of ecotourism on environmentally conscious behavior or the implementation of project-based learning (PjBL) for general science literacy at the school level. However, there has been no study on strengthening ecological literacy specifically for students in the Madrasah Ibtidaiyah Teacher Education (PGMI) program through the PjBL model in science courses. The limitations of some previous studies remain descriptive at the school level and overlook the prospective needs of PGMI teachers to integrate ecological literacy into the Merdeka Curriculum and SDG 4.7, particularly in the Indonesian context, with pressing issues of deforestation and pollution. Furthermore, there is a lack of in-depth empirical evidence regarding the effectiveness of PjBL in developing holistic competencies (knowledge, empathy, action) among PGMI students. This study focuses on a specific analysis of PGMI students' ecological literacy via PjBL in science courses to produce an applicable model for learning in elementary schools.

Based on the analysis of the issues raised, the researcher was interested in examining the ecological literacy skills of prospective Madrasah Ibtidaiyah teachers through project-based learning in science courses, specifically their understanding of cognitive aspects and their implementation in daily life. The research questions for this study are: (1) What is the level of ecological literacy among prospective elementary madrasah teachers? (2) What are the students' perceptions of the application of ecological literacy in teaching? (3) What challenges are encountered in developing ecological literacy? The hypothesis of this study is that prospective elementary school teachers who learn through Project-Based Learning (PBL) will demonstrate improved ecological literacy compared to students who learn using conventional methods, because they are directly involved in solving real-world environmental problems.

The objectives of this study include: (1) To determine the level of ecological literacy among prospective elementary madrasah teachers; (2) To analyze students' perceptions regarding the application of ecological literacy in learning; and (3) To analyze the challenges encountered in developing ecological literacy.

## Method

This study employs a mixed-methods research design, which is an approach that combines qualitative and quantitative methods within a single study. The use of this method aims to provide a broader and deeper understanding than would be possible with a single approach alone. According to Creswell & Plano Clark (2018), mixed methods is a research design that involves the collection, analysis, and integration of quantitative data (such as questionnaires or tests) and qualitative data (such as interviews or observations). This approach is preferred by researchers because the advantages of one data type can offset the disadvantages of the other. Mixed approaches can be used to address complex research topics that a single approach cannot

adequately address. The Sequential Design model is employed in conjunction with an Explanatory design. In this model, the researcher first collects and analyzes quantitative data (e.g., the Literacy Test), followed by the collection of qualitative data (e.g., Interviews) to help explain the quantitative results in greater depth (Creswell, 2014).

The research flow to analyze the ecological literacy skills of prospective teacher students is shown in Image 1.

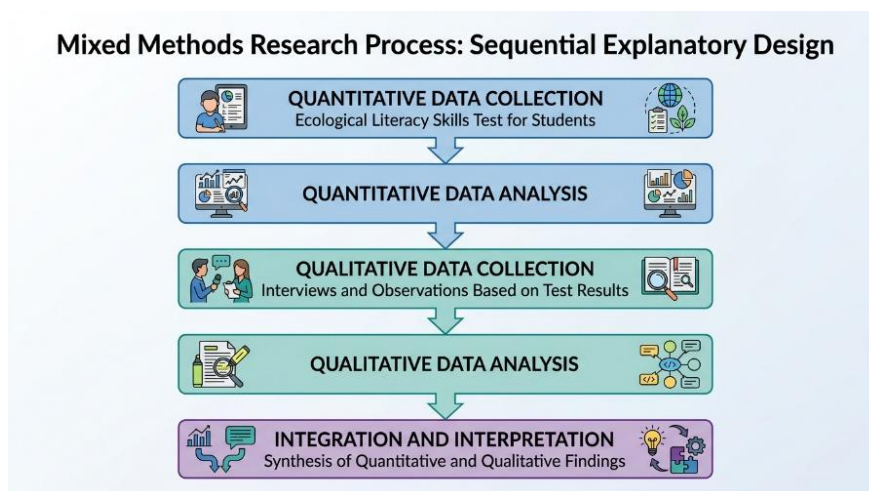


Image 1. Mixed Methods Research Process

### ***Sampling techniques***

The subjects in this study were 67 first-semester students majoring in Madrasah Ibtidaiyah Teacher Education (PGMI) at IAIN Lhokseumawe. The sample for this study was selected using purposive sampling, with a predetermined number of participants (7 for interviews and 67 to assess ecological literacy). The selection of the 67 students as test respondents was based on two courses at the same grade level that had already implemented science education using the Project-Based Learning model. This sample allows the collection of quantitative data on the growth of ecological literacy after the project is completed.

The Maximum Variation Sampling technique (a form of purposive sampling) was used to select a sample of 7 individuals from a total of 67 students. The following criteria were used: 2 students with the highest ecological literacy scores, 3 students with average/mid-range scores (to observe the impact of PjBL), and 2 students with the lowest scores (to comprehend the constraints or barriers to ecological literacy).

### ***The data collection techniques***

The data collection techniques used were tests, interviews, and observations. The grid for the ecological literacy test questions is in Table 1, and the grid for the interview instrument related to ecological literacy is in Table 2.

Table 1. Grid – Grid of Ecological Literacy Test Questions

No	Aspects of Ecological Literacy	Indicator	Number of Questions
1	Ecological Knowledge	Understanding the basic principles of ecology and the laws of science.	3
2	Systems Thinking	Able to see the connection between	3

No	Aspects of Ecological Literacy	Indicator	Number of Questions
		human activities and environmental impacts.	
3	Ecological Empathy	Caring for other living creatures and the sustainability of nature.	3
4	Critical Thinking	Able to evaluate solutions and the impact of technology on the environment.	3
5	Action Competence	The ability to design and implement concrete actions for the environment.	3

Adapted from Golema (Golema, 2016).

**Table 2.** Ecological Literacy Interview Instrument Grid

No	Aspects of Ecological Literacy	Indicator	Number of Questions
1	Ecological Knowledge	Understanding the basic principles of ecology and the laws of science.	2
2	Systems Thinking	Able to see the connection between human activities and environmental impacts.	2
3	Ecological Empathy	Caring for other living creatures and the sustainability of nature.	3
4	Critical Thinking	Able to evaluate solutions and the impact of technology on the environment.	2
5	Action Competence	The ability to design and implement concrete actions for the environment.	2

### ***The Ecological Literacy Test's Validity and Reliability***

The validity and reliability of the test questions measuring ecological literacy skills used to gather quantitative data were examined. Three of the 13 test questions that were subjected to a validity test using SPSS 23 at a 5% significance level had an r-table value of 0.240. Table 3 displays the validation findings.

**Table 3.** Results of the Ecological Literacy Test Question Validation Test

Question item	r Count	r Table	Output
1	0.542	0.240	Valid
2	0.489	0.240	Valid
3	0.112	0.240	Invalid
4	0.601	0.240	Valid
5	0.345	0.240	Valid
6	0.108	0.240	Invalid
7	0.213	0.240	Invalid
8	0.523	0.240	Valid
9	0.330	0.240	Valid
10	0.346	0.240	Valid

Question item	r Count	r Table	Output
11	0.541	0.240	Valid
12	0.442	0.240	Valid
13	0.547	0.240	Valid

The following stage involves a reliability test on legitimate questions, with Cronbach's Alpha values used to assess them. The findings will indicate the level of reliability of the questions. The reliability test results are shown in Table 4.

**Table 4.** Results of Cronbach's Alpha Reliability Interpretation

Reability Statistic	N of items
Cronbach's Alpha	10
0.782	

The Cronbach's Alpha value is 0.60, indicating that the value  $0.782 > 0.60$ , according to the reliability test results for the ecological literacy test questions computed in SPSS 23. This indicates that the instrument falls into the Sufficient category and is therefore deemed reliable.

### ***Analysis Data***

The data analysis techniques used were quantitative and qualitative. The data collected from the study were processed using descriptive analysis techniques by calculating scores based on data obtained from science literacy test scores calculated using the following formula:

$$\text{Value} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100\%$$

The percentage data was then converted into qualitative criteria. The criteria for ecological literacy are shown in Table 5.

**Table 5.** Ecological Literacy Assessment Criteria

Value	Category
80 – 100	Very Good
61 – 79	Good
41 – 60	Fair
0 – 40	Not Good

Adapted From Murti (Murti et al., 2025).

The data from interviews and observations were analyzed qualitatively using data triangulation techniques. Miles and Huberman Miles (2014) state that qualitative data analysis can be carried out in several stages, namely: (1). Data Reduction, which involves summarizing, selecting key points, focusing on important matters, and identifying themes and patterns. This provides a clear picture and makes it easier for researchers to collect further data. (2). Data Display, which explains the presentation of data in qualitative research. Data can be presented as brief descriptions, charts, relationships between categories, flowcharts, and the like. (3). Drawing Conclusions, which explains that the initial conclusions presented are still temporary and will change if strong supporting evidence is not found in the next stage of data collection. Conclusions in qualitative research may answer the research questions formulated at the outset, but they may not, because, as mentioned earlier, the problems and research questions in qualitative research remain provisional and will evolve after the research is conducted in the field.

## Results and Discussion

This research is a descriptive qualitative study conducted with prospective Madrasah Ibtidaiyah (MI) teachers, namely first-semester students in the MI/SD science course. The purpose of this research is to analyze the ecological literacy skills of prospective teachers, including their level of understanding and implementation in daily life. Data for this research were collected through tests, interviews, and observations.

The research process was carried out by administering test questions to 67 students, followed by interviews and observations of prospective teacher students' ecological literacy abilities through PjBl learning in the MI/SD science course. The indicators used in this study, as test questions and guidelines for interviews and observations, included ecological literacy skills such as ecological knowledge, systematic thinking, ecological empathy, critical and evaluative thinking, and action skills.

### *The results of ecological literacy exams administered to prospective teacher students*

The initial stage involved administering a test assessing prospective teachers' cognitive ecological literacy skills. The test consisted of 10 essay questions. The results of the ecological literacy skills test are shown in Table 6.

**Table 6.** Results of the Ecological Literacy Test for Prospective Teacher Students

No	Aspects of Ecological Literacy	Value	Criteria
1	Ecological Knowledge	72	Good
2	Systems Thinking	74	Good
3	Ecological Empathy	75	Good
4	Critical Thinking	70	Good
5	Action Competence	60	Fair
Average		70.2	Good

The ecological literacy skills of prospective teachers were rated as acceptable for indicators of ecological knowledge, systems thinking, ecological empathy, and critical thinking, but remained in the adequate category for action competence. In general, their cognitive ecological literacy skills were within the acceptable category.

### *Prospective Teachers' Perceptions of Ecological Literacy*

Furthermore, to assess prospective teachers' ecological literacy skills, interviews and observations were conducted. The interviews focused on exploring information related to ecological literacy skills from cognitive and attitudinal perspectives, using the interview grid, with 8 questions asked of 7 prospective teachers.

In terms of ecological knowledge, the interview results showed that the majority of students already knew the basic concepts of ecology, namely its meaning and benefits, but only 3 students understood the legal basis of science well. This was relevant to the observation results, where, in carrying out projects related to science material, 65% of students were enthusiastic about completing their practice well, according to the procedures. However, in their reports, they were still unable to analyze it thoroughly and accurately, and the references used remained minimal. This is an excerpt from a statement of a prospective elementary madrasah teacher interviewed in this study.

*The way I understand ecological literacy is the ability to protect the environment, or, in other words, to maintain environmental balance. For example, it involves explaining the impacts of deforestation, such as the current occurrence*

*of floods and other forms of environmental damage, or understanding the carbon cycle. This can later be explained to students through science projects, such as waste recycling and other initiatives (R2).*

More recently, some students are still struggling to understand the concept of good ecological literacy.

*I'm not too familiar with ecological literacy yet. From my perspective, ecological literacy is more about learning about nature and different ecosystems, much like how we study science, and will most likely be linked to the occurrence of floods and other calamities (R5).*

### ***Prospective Teachers' Critical Thinking Skills Regarding Ecological Literacy***

For the second indicator, thinking systems, interviews revealed that most students understood and explained the relationship between human activities and their environmental impact well. This is relevant to the observation results, where, in completing the project, students performed well (80%) by protecting the environment by cleaning up the remaining materials used and using environmentally friendly materials. In the project report, they also explained the impacts and solutions to environmental damage caused by human actions. The results of interviews with two respondents revealed that:

*Understanding ecological literacy is undoubtedly connected to the idea of cause and effect, which holds that everything that occurs in the environment, including environmental harm, has a cause. Reusing items, particularly plastic debris that may eventually break down into microplastics, is one modest step we can take to safeguard the environment. Children in elementary school can be taught this (R1).*

*Learning about ecological literacy naturally involves the natural environment, such as not littering, which can cause flooding (R4).*

### ***Ecological Empathy Among Prospective Teachers***

For the ecological empathy indicator, interviews with students revealed that they currently understand the environmental damage occurring and have begun to recognize the need to protect the environment. However, in practice, some students still fail to protect the environment properly; for example, they litter. This statement is relevant to direct observations made during the project, which showed that there were still groups that were unable to maintain environmental cleanliness properly (45%), but there were also groups that were aware of the importance of protecting the environment and reminded other groups to maintain cleanliness before and after class.

*Empathy can be generated when someone personally experiences the effects of environmental devastation, thereby improving awareness of the need to better protect the environment, particularly in one's immediate surroundings. For example, we might begin with ourselves: during this science project, we inevitably employed a large number of waste-generating materials. To ensure cleanliness, my group members and I normally organize the trash before disposing of it. This is just one small thing we can do on campus (R2).*

*I recognize the importance of maintaining the environment, such as keeping it clean, but sometimes staying mindful of this requires extra effort, and I still find myself littering without realizing it (R3).*

### ***Critical And Evaluative Thinking Among Prospective Teachers***

Regarding critical and evaluative thinking, the results of the interview analysis indicate that it remains at a medium-low level. The majority of respondents (70%) mentioned the negative impacts of technology, such as e-waste and high energy consumption from data centers, but only 30% linked them to local issues in Aceh (deforestation for digital infrastructure). In terms of solutions, 60% of students considered technological solutions (such as smart farming applications) effective

for sustainable agriculture, but were unable to identify their environmental impacts, including dependence on electricity and battery waste. They were also found to be unable to analyze comprehensive costs and benefits by considering the product life cycle. Furthermore, the observations show that the majority of students are not yet able to develop critical and evaluative thinking skills regarding the negative impacts of environmental damage caused by human actions and technology. Only 40% of students can analyze accurately and relate it to issues such as deforestation in Aceh.

*The technology of the present day is inextricably linked to the discussion of environmental degradation. For example, the development of towers, which, without our knowledge, is already harming the environment by eliminating green spaces and deforestation, such as in Aceh, has evident environmental consequences, particularly in terms of causing flooding and landslides (R6).*

*In my perspective, technology and environmental degradation are not inextricably linked; in fact, technology may make people's jobs simpler, as we see in agriculture and plantations, where technology has resulted in higher yields (R2).*

### **Action Competence Of Prospective Teachers**

For the last indicator, namely action competence, the interviews revealed that the majority of students already had the desire to plan environmental actions after participating in PjBL-based science learning, but no concrete steps have been taken on campus or at home so far. The majority of students said their actions were limited to themselves and their classmates, as they were encouraged to keep the classroom clean. Based on the observations, there were no visible student actions related to applying ecological knowledge to protect the environment. The current focus is only on the planning stage, which is to minimize plastic waste by bringing drink bottles and not littering.

*My ecological literacy has increased, and my friends and I feel more accountable to the environment and ourselves as a result of scientific education utilizing the Project-Based Learning (PBL) paradigm. I'm now initiating environmental action plans that start with my immediate surroundings, including keeping my home, classroom, and campus clean. I'll also start utilizing my own reusable water bottle to reduce plastic waste. I haven't yet taken more significant steps, though; in the future, I might start a campaign to cut down on microplastic trash and maintain a green environment by planting the appropriate plants (R2, R3, R7)*

### **Discussion**

The results of this study show that pre-service teacher students' attitudes and cognitive capacities differ in their ecological literacy. The competencies for action and attitude are still in the reasonably adequate group, despite the indicators for ecological knowledge, systems thinking, and analytical skills falling into the adequate category. This situation demonstrates a value gap, whereby a high degree of cognitive environmental awareness is not matched by the capacity to act sustainably and consistently to safeguard the environment.

This is consistent with [Villarosa \(2025\)](#), which shows that respondents frequently hold strong ecological ethics and feelings yet exhibit poor adoption of a low-carbon lifestyle. According to additional research, this obstacle is likely due to a lack of support for concrete action in both the family and university environments. Although students' academic ecological literacy has advanced to the functional and communicative stages, independent environmental citizenship has not yet been attained ([Suryamti et al., 2021](#); [Thi & Thu, 2018](#)).

The Project-Based Learning (PjBL) paradigm has been demonstrated to be a successful intermediary between ecological empathy and conceptual comprehension ([Poerwati et al., 2025](#)).

Pre-service teachers not only theoretically understand environmental degradation through collaborative projects that address local issues, but they also begin to internalize environmental ethics, such as the moral rejection of single-use plastics, within the project framework.

By analyzing the connections between human activity and environmental deterioration, Project-Based Learning (PjBL) enables students to develop systems-thinking skills. According to [Setyowati et al. \(2024\)](#), when PjBL is used in conjunction with environmental literacy, it has a greater synergistic effect on students' Higher Order Thinking Skills (HOTS) than when used alone. It should be noted, nevertheless, that PjBL's ability to promote social responsibility remains largely contingent on the relevance of the topics it addresses.

Through the use of eco-friendly resources as learning media in the PjBL model, for example, student teachers have been able to develop critical thinking skills to understand the effects of environmental damage and the solutions. This is consistent with a study by [Erlina et al. \(2023\)](#), which showed that aspiring scientific instructors are prepared to use project-based blended learning and to create eco-friendly 3D teaching tools. Their technical proficiency in creating sustainable learning materials and their thorough understanding of the concept of Education for Sustainable Development (ESD) propel this preparedness ([Agustika & Diputra, 2025](#); [Anwar et al., 2025](#)).

Another study indicated that, when coupled, Project-Based Learning and ecological literacy had a substantial positive influence on students' higher-order thinking skills, compared with using Project-Based Learning alone or either learning model independently ([Setyowati et al., 2024](#); [Ayu & Afrianto, 2025](#)). [Arif & Maryani \(2023\)](#) demonstrated that students from three academic programs had moderate environmental understanding. Geography Education students have the most outstanding and in-depth understanding of the environment and pollution among all study programs. On the other hand, Mathematics Education students recorded the top marks notably in environmental problem-solving skills.

While Project-Based Learning (PjBL) increases students' intention to act, tangible actions in everyday life remain limited. This phenomenon demonstrates that cognitive commitment has not yet fully matured into autonomous pro-environmental habituation, thereby confirming the discrepancy between intention and actual behavior ([Evi Yupani & Widana, 2023](#); [Fabio et al., 2025](#); [Feo, 2026](#)). This aligns with the findings of [Putri et al. \(2025\)](#), which indicate that students tend to engage in creative thinking and waste recycling only within the framework of formal projects. According to [Wibowo et al. \(2024\)](#), such dependence on external instruction suggests that ecological literacy practices remain reactive to academic tasks rather than manifesting as long-term personal endeavors. The failure to take meaningful steps, as evidenced by research showing that students create eco-friendly products only when mandated, suggests that extrinsic motivation continues to outweigh intrinsic motivation. The necessity of ecological literacy for pre-service primary school teachers is crucial, as they serve as transformative agents shaping future students' competencies ([Piter & Ziraluo, 2025](#)).

The results of the study show that while there is a clear willingness to take tangible action for the environment after engaging in PjBL learning, there are still very few real steps. This could be caused by a number of factors, such as the fact that ecological learning is often incomplete and narrowly focused on short-term goals, which prevents habits from forming. Additionally, the campus ecosystem does not fully promote pro-environmental activities, such as less strict plastic-free regulations or a minimal waste management system, even though students were able to express critical analysis of the material. According to [Damayanti et al. \(2025\)](#), concrete activities, such as recycling, remain task-centric rather than autonomous. This is pertinent to research that claims that concrete actions can be formed from dependence on instructions. The transformation from

"knowing" to "doing" requires continuous guidance, intervention, and strengthening of a supporting ecosystem that goes beyond the classroom.

## Conclusion

This study comes to the conclusion that using the Project-Based Learning (PjBL) model in science classes improves the ecological literacy of aspiring elementary school teachers, especially in the domains of knowledge, empathy, and critical and evaluative thinking, all of which received a "good" rating. However, there is a gap in the action skills component, where the scores fall into the adequate category. This suggests that although prospective elementary school teachers have strong cognitive ecological literacy, they still struggle to take specific actions that have a positive environmental impact. It is advised that colleges, especially those at the faculty and program levels, enhance the curriculum by implementing mentorship programs that emphasize sustaining tangible actions beyond course assignments through community service activities. It is advised that educators create initiatives that are more precise and quantifiable to motivate students to venture beyond their comfort zones and participate in ecological activities that have a noticeable impact. Therefore, improving ecological literacy will not only be an academic accomplishment but also a practical skill that can be applied in elementary schools and the community.

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