



# Ecoliteracy-Based Bioentrepreneurship: Improving the Culture of Plastic Waste Processing

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**Abstract.** The Bioentrepreneurship course equips students with the entrepreneurial and ecoliteracy skills needed to face the competitive world of work. This study aims to determine ecoliteracy ability to learn Bioentrepreneurship from the biology teacher students' perspective at IKIP PGRI Pontianak. This study uses a quantitative descriptive approach. The research method used is a survey method. At the same time, the sample in this study is 35 prospective biology teacher students taking the Bioentrepreneurship course in the Biology Education Study Program, IKIP PGRI Pontianak. The results of ecoliteracy show that future biology teachers have high ecoliteracy abilities, where 66.48% of respondents strongly agree, and 23.05% agree that natural damage can occur due to environmental changes caused by human activities. Students have also been provided with skills in processing plastic waste into goods of high economic value.

**Keywords:** Ecoliteracy · Bioentrepreneurship · Plastic waste

## 1 Introduction

IKIP PGRI Pontianak is a higher education institution of science that focuses on developing Community Resources in education. It has lecturers committed to establishing themselves and carrying out the Tridharma of Higher Education activities. These demands are also increasing, so IKIP PGRI Pontianak lecturers are required to create quality graduates following the achievement targets of Higher Education IKU formulated in the Strategic Plan of the Ministry of Education and Culture. The strategic plans align with the Strategic Plan of IKIP PGRI Pontianak.

The intense competition requires graduates of IKIP PGRI Pontianak to have good academic abilities, hard skills and soft skills that can be used in the world of work, both in education and non-education. Hard and soft skills are needed, and skills in managing one's own emotions and managing emotions when building relationships with others are known as interpersonal skills [1]. Meanwhile, [2] states that improving life skills will encourage students to be more creative in managing information into products or services, such as knowledge about applying biological effects from scientific research results into marketable products. Moreover, it has a high resale economic value through Bioentrepreneurship.

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Biology Education Study Program students are not only equipped with academic skills to teach in the classroom. Still, they are also equipped with various knowledge about living things, both animals and plants. So that the Biology Education Study Program can produce productive graduates who have integrity, are creative and think critically about changes that occur in the surrounding environment.

The importance of conveying knowledge to prospective teacher students for teaching supplies later in school was conveyed by [2], and based on the results of research conducted, it can be seen that there is an increase in students' interest in entrepreneurship and life skills before and after the application of bio-entrepreneurship learning. Meanwhile, according to [3], Bioentrepreneurship positively impacts biology learning achievement, creativity, and interest in entrepreneurship. Not only through bio-entrepreneurship-based learning activities, but various bio-entrepreneurship teaching materials are still needed for the Biology material that the teacher will teach students. Development of Bioentrepreneurship Based LKS through the manufacture of Nata De Leri on conventional biotechnology materials can be applied to learning at the high school level [4]. Similar results were conveyed [5] that bio entrepreneurship-based teaching materials are effectively applied in classroom learning and can increase students' entrepreneurial attitudes and interests through making Nata de soya and Soyghurt activities.

The research carried out helps train the eco-literacy skills of prospective biology teacher students through the practice of processing plastic waste in the bio entrepreneurship course. Meanwhile, based on observations at school, students still often make a habit of consuming drinks and food packaged using plastic. The use of plastic contributes to an increase in plastic waste that is difficult to decompose naturally and endangers the survival of marine biota when wasted—carried to the sea by rivers. Students in schools prefer plastic packaging, which is risky to health and the environment, rather than using bowls, plates, and glasses which are safer for food [6]. Therefore, efforts are needed to instil knowledge about waste management theoretically and practically using plastic waste through the 3R concept (Reduce, Reuse and Recycle).

Prospective biology teachers are expected to have eco-literacy skills so that later when teaching in schools, they can integrate them into learning biology subjects. For this reason, lecturers must be able to develop printed and electronic teaching materials that can be used to develop creativity, innovation, and novelty following changing conditions that students can use to master eco-literacy skills in processing plastic waste.

Using appropriate teaching materials to teach bioentrepreneurship will facilitate the implementation of learning materials and it's can develop eco literacy. At the same time, it will be beneficial and make it easier for students to understand what is being taught by lecturers. Lecturers must be able to adapt and integrate their knowledge by adding learning activities that stimulate students' mastery of pedagogic skills, hard skills, soft skills, and eco-literacy skills. This opinion is in line with [7], which states that by developing science teaching materials, teacherpreneurship can develop students' mindsets to be more open to making science learning innovations.

Based on the background that has been described previously, prospective biology teachers are expected to have eco-literacy skills for teaching in schools after students graduate, they can integrate them into learning biology subjects. For this reason, lecturers must be able to develop printed and electronic teaching materials that can be used to

develop creativity, innovation, and novelty following changing conditions that students can use to master eco-literacy skills in processing plastic waste. This study aims to determine the ability of eco-literacy in bio-entrepreneurship learning in prospective biology teacher students at IKIP PGRI Pontianak.

## 2 Method

This study uses a quantitative descriptive approach, namely research conducted to investigate a predetermined matter. The results are in the form of a research report without any manipulation of the object or research results [7]. The research method used is a survey method which aims to determine the ecoliteracy ability of students in ecoliteracy-oriented bioentrepreneurship learning practices for students of the Biology Education Study Program, IKIP PGRI Pontianak.

This study seeks to obtain an overview of the eco-literacy-oriented learning activities of Bioentrepreneurship in processing plastic waste. The sample in this study was 35 prospective biology teacher students who took the Bioentrepreneurship course at the Biology Education Study Program, IKIP PGRI Pontianak. Data analysis was carried out by following the principles of qualitative research based on the [8], namely through data reduction, data presentation, and concluding. Data collection is done through observation of learning activities and filling out questionnaires, processed through a series of data sorting, and then presented in the form of narrative analysis to produce data conclusions that refer to the focus of the problem.

## 3 Result and Discussion

Eco-literacy can also be said to be a conscious attitude toward the environment, consciously protecting it according to their knowledge [9]. People who know ecoliteracy can be prepared to create effective, sustainable communities with all their heads, hearts, hands and souls. They already have an organic understanding of the world and participatory actions in protecting the environment [10]. This opinion is in line with the results of ecoliteracy-oriented bio-entrepreneurship learning, which is expected after gaining basic knowledge about plastic waste and waste processing technology. Students are expected to be able to design and develop creative economic businesses by utilizing recycled plastic—residual products. Meanwhile, the results of students' ecoliteracy can be seen in Table 1.

The researcher gave a modified questionnaire [11]; Meanwhile, the researcher has modified several questions adapted to the student's original conditions in West Kalimantan. These modified statements include the additional flood cases that occurred in the cities of Sintang city and Melawi, the district of West Kalimantan, in 2021. Flooding submerged thousands of houses, damaged people's agricultural land, and cut off the land route from Pontianak City to Putussibau City and its surroundings. The community felt that the material and non-material losses were huge, and schools had to be closed for up to 2 weeks. The flooding that occurred was caused by forest destruction due to the company's opening of oil palm plantations, increasing population settlements on the outskirts of the Kapuas river, and illegal gold mining activities on the riverbanks.

**Table 1.** Data on Ecoliteracy of Biology Students of IKIP PGRI Pontianak

No	Ecoliteration Statements that modified from NEP Dunlap	Strongly Disagree	Don't Agree	Agree	Strongly Agree	Total Percentage
1	Currently the earth has reached the limit of its ability to support humans, where this is influenced by the increasing number of humans.	0,00%	11,43%	22,86%	65,71%	100%
2	Humans have the right to make modifications to the natural environment, according to their needs	5,71%	17,14%	22,86%	54,29%	100%
3	Natural disasters that occur in Indonesia are caused by humans who often disturb nature, Case Examples: Conversion of forests in West Kalimantan into oil palm plantations causes flooding in several areas such as; The Flood of Sintang and Melawi City, West Kalimantan in 2021	2,86%	5,71%	14,29%	77,14%	100%
4	The intelligence possessed by humans if used properly and wisely will keep the earth awake	2,86%	2,86%	11,43%	82,86%	100%
5	The intelligence possessed by humans if used properly and wisely will keep the earth awake	5,71%	8,57%	14,29%	71,43%	100%
6	Many humans have abused environmental functions, for example cases: turning agricultural land into residential areas or industrial areas.	8,57%	8,57%	25,71%	57,14%	100%
7	Plants and Animals on Earth also have the right to Live, Grow and Develop.	0,00%	0,00%	14,29%	85,71%	100%
8	Currently, the balance of nature is still strong enough to overcome pollution and natural damage caused by developed (modern) industrial countries.	5,71%	22,86%	31,43%	40,00%	100%
9	Although humans already have special abilities (intelligence), humans are still subject to natural laws, for example: humans cannot prevent earthquakes and tsunami	0,00%	2,86%	14,29%	82,86%	100%

*(continued)*

**Table 1.** (continued)

No	Ecoliteration Statements that modified from NEP Dunlap	Strongly Disagree	Don't Agree	Agree	Strongly Agree	Total Percentage
10	Plants and Animals in West Kalimantan which are in the status of extinction or are on the verge of extinction, for example; the decreasing number of hornbills in the wild due to poaching.	5,71%	0,00%	20,00%	74,29%	100%
11	Humanity is currently facing an "ecological crisis"	0,00%	11,43%	31,43%	57,14%	100%
12	The current condition of Earth is like an "airplane" with very limited space and resources	2,86%	5,71%	28,57%	62,86%	100%
13	If the balance of nature is not maintained and begins to become fragile, then nature will get angry easily	2,86%	0,00%	37,14%	60,00%	100%
14	Humans with intelligence can learn how nature works and try to control it	2,86%	8,57%	34,29%	54,29%	100%
15	If the destruction of nature continues as it is now, then a big ecological disaster will surely occur	5,71%	0,00%	22,86%	71,43%	100%
	<b>Average</b>	<b>3,43%</b>	<b>7,05%</b>	<b>23,05%</b>	<b>66,48%</b>	

Teacher skills in learning activities are determined by the extent to which teachers are willing to develop and able to keep up with changes. Teacher skills affect students' comfort in reciprocal relationships in the learning process. The skills of a good teacher and able to master the learning process with appropriate learning strategies will provide positive results for student activities, especially in building critical thinking, creativity and student innovation. Therefore, learning strategies and teacher learning in the learning process will affect the effectiveness of learning outcomes.

Students who master ecological literacy in biology are expected to actively develop problem-solving and critical thinking skills. Ecoliteracy can bridge the development of culture and concern for the natural environment. The results of the ecoliteracy questionnaire show that prospective biology teachers have high ecoliteracy abilities, where 66.48% of respondents strongly agree, and 23.05% agree that natural damage can occur due to environmental damage. Human action and real action are needed to overcome the increasingly critical earth condition. Even natural disasters will continue to happen if humans do not take precautions. One of the efforts made is to reduce, reuse, and recycle.



**Fig. 1.** Plastic waste processing practices



**Fig. 2.** The process of making home decoration accessories from plastic waste

The bio-entrepreneurship courses teach a practical activity for processing plastic waste, which can be seen in Fig. 1 while processing plastic waste into accessories for home decoration can be seen in Fig. 2.

Ecoliteracy can not only be taught in theory but can be taught directly through various activities related to nature, such as processing plastic waste into valuable new products. Meanwhile [12] stated that the assistance activities for processing plastic waste into innovative products for coastal residents in Langa City received high enthusiasm, and the products made had a high selling value so that they could improve the economy of coastal communities. This opinion is in line with [13], which states that the people of Sungai Pandan Village, Batu Ampar District, Kubu Raya Regency can take advantage of the natural potential and regional advantages gradually and sustainably through the manufacture of eco printing products.

## 4 Conclusion

The research can conclude that prospective biology teacher students from IKIP PGRI Pontianak already know about ecoliteracy, and teachers can build ecoliteracy skills by processing plastic waste into valuable new items. The researcher hopes that the ability of ecoliteracy can be possessed by every student and can prevent damage to the earth.

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