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THE EFFECT OF *ECOPRENEURSHIP-BASED ENTREPRENEURSHIP* COURSES ON THE INNOVATION ABILITY OF SCIENCE EDUCATION STUDENTS

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Abstract:
The purpose of this study was to test or analyze the effect of the implementation of *ecopreneurship* on Students' ability to be innovative. This research uses a quantitative approach with the type of quasi-experiment design One group pretest-posttest. The research was conducted in the *Entrepreneurship* course for students of the Science Education Study Program in the academic year 2024/2025 odd semester. The sample selection technique used was Purposive sampling, which is part of non-probability sampling with a research sample of 33 students who took *Entrepreneurship* courses. To determine the effect of the *ecopreneurship-based learning* on Students' ability to innovate, the *Paired Sample T-Test* test was used with the help of the SPSS program. Based on the calculation of the *Paired Sample T-Test*, the Sig value is 0.000 < 0.05, which means that there is a significant effect of the implementation of *ecopreneurship* on Students' capacity for innovation. The implications of this research support sustainable innovation and can be used in other courses that require the same thing as this research. The results showed that the effect of applying the *Ecopreneurship* concept was able to encourage students' ability to innovate in making innovative environmentally friendly products, namely by developing problem-solving skills, creating innovative ideas, designing and producing product innovations and preparing students to become entrepreneurs who have the ability to innovate.

Keywords: ecopreneurship, project-based learning, innovation skill

Abstrak:
Tujuan penelitian ini adalah untuk menguji pengaruh penerapan *ecopreneurship* terhadap kemampuan berinovasi mahasiswa. Penelitian ini menggunakan pendekatan kuantitatif dengan jenis *Quasi eksperiment desain One group pretest-posttest*. Penelitian dilakukan dalam mata kuliah Kewirausahaan pada mahasiswa Program Studi Pendidikan IPA tahun ajaran 2024/2025 semester ganjil. Teknik pemilihan sampel yang digunakan adalah *Purposive sampling* yaitu bagian *non-probability sampling* dengan sampel penelitian sebanyak 33 mahasiswa yang mengambil mata kuliah kewirausahaan. Data dikumpulkan dengan menggunakan angket respon *ecopreneurship* dan kemampuan berinovasi. Untuk mengetahui pengaruh penerapan *ecopreneurship* terhadap kemampuan berinovasi mahasiswa, digunakan *Uji Paired Sample T-Test* dengan bantuan program SPSS. Berdasarkan perhitungan *Uji Paired Sample T-Test* diperoleh nilai signifikansi, yaitu 0,000 < 0,05 yang berarti bahwa terdapat pengaruh yang signifikan penerapan *ecopreneurship* terhadap kemampuan berinovasi mahasiswa. Implikasi penelitian ini mendukung inovasi keberlanjutan dan dapat digunakan pada mata kuliah lain yang memerlukan hal sama dengan penelitian ini. Hasil penelitian menunjukkan bahwa berpengaruhnya penerapan konsep *Ecopreneurship* mampu mendorong kemampuan berinovasi mahasiswa dalam membuat produk inovatif ramah lingkungan yaitu dengan mengembangkan keterampilan memecahkan masalah, menciptakan ide-ide inovatif, merancang dan menghasilkan inovasi produk serta mempersiapkan mahasiswa menjadi wirausahawan yang memiliki kemampuan berinovasi.

Kata kunci: *ecopreneurship*, *project based learning*, keterampilan inovasi

INTRODUCTION

Creativity and innovation are essential in responding to the challenges of the 4th Industrial Revolution. Students have great potential to tackle these challenges. Education is the first step in nurturing creative and innovative individuals. Students who learn theory without sufficient practical experience will find it difficult to apply the knowledge they have acquired. The importance of innovative skills in *Entrepreneurship* lies in the ability to tackle real-world challenges. Few students are capable of generating new ideas in *Entrepreneurship*.

Data from Statistics Indonesia (August 2021) shows that around 11.69% of unemployed people are diploma and bachelor's degree graduates, indicating that most graduates prefer to be job seekers rather than job creators (entrepreneurs). This reflects a mismatch between higher education curricula and industry needs, as well as a gap in the development of innovation and entrepreneurship competencies. Research shows that entrepreneurship education in higher education can improve entrepreneurial competencies, including innovative abilities, optimism, and initiative-taking, with achievement motivation as a key factor that strengthens these competencies.

Furthermore, BPS data from 2022 shows a decline in TPT for diploma I–III and university graduates (4.59% and 4.80%, respectively), which is also driven by entrepreneurship education initiatives that foster creativity and innovative solutions to unemployment (Sari *et al*. 2024). This data confirms that strengthening innovation and entrepreneurship competencies through entrepreneurship education and motivational support can be key to addressing high unemployment among college graduates, transforming them from job seekers to job creators.

Studies show that entrepreneurship education significantly improves students' innovation skills and entrepreneurial self-efficacy, which are prerequisites for creating new products and solutions in an entrepreneurial context (Laydes et al., 2024). Furthermore, the integration of science education with entrepreneurial characteristics, including creativity, innovation, and independent initiative, is achieved through project-based learning and soft skills development, so students not only understand natural sciences, but are also prepared to generate practical ideas and create job opportunities (Muhammad, 2023).

According to Khamimah (2021), *Entrepreneurship* is the application of creativity and innovation to solve problems and take advantage of business opportunities. Innovation is understood as the process of creating something new or a different way to provide added value that can be replicated. In this study, this concept forms the basis for the development of *ecopreneurship*, which is the application of environmentally sustainable innovation that creates economic and ecological value.

The World Health Organization (WHO) has stated that waste is anything that is no longer used, unwanted, or discarded, originating from human activities and not occurring naturally (Aulia et al. 2021). Waste management is one of the most serious environmental issues we face today, particularly in large cities, not only in Indonesia but worldwide. Daily activities of communities can generate waste, leading to its accumulation. The indifference of communities and students toward waste contributes to environmental pollution.

According to data from the Ministry of Environment and Forestry and the Ministry of Industry in the World Bank, the amount of waste accumulation in Indonesia in 2019 was 67 million tons, with organic waste accounting for approximately 60% and plastic waste approximately 15% (Marpaung et al., 2022). In 2020, waste accumulation in Indonesia reached 72 million tons per year, with approximately 36% of waste remaining unprocessed, or around 9 million tons per year. The dominant type of waste is household waste, accounting for 32.5% of total waste, with 68% of household waste being inorganic and the remaining 32% being organic (Aulia et al., 2021).

Poor waste management lowers environmental quality and threatens the lives of living things (Aulia *et al.,* 2021). The main causes are low public awareness, limited understanding of the benefits of waste management, and insufficient efforts to reuse. However, students rarely generate innovative solutions to this problem. Therefore, an *ecopreneurship* approach is needed to promote the development of creative ideas based on environmental sustainability.

An ecopreneur is an entrepreneur who cares about environmental issues or sustainability. Business activities aimed at generating profits also take into account environmental carrying capacity and strive. The objective is to lessen the effect of these actions on the environment. Combining ecology and *Entrepreneurship*, an ecopreneur can be defined as someone who is able to innovate by utilizing natural resources, even those that have been discarded, to create products with economic value that can generate profits. This activity, in addition to generating profit, serves as a manifestation

of responsibility and environmental concern, ensuring that environmental sustainability is maintained. A similar finding is supported by Aripin's (2017) research, which shows that the use of environmental education focused on the 3R principles (reuse, reduce, and recycle) can enhance environmental awareness (Pradifta et al., 2023). *Ecopreneurship* activities utilize waste as raw materials that are economically useless, but with a touch of creativity and innovation, they can produce ecopreneur products of high value (Af'idah et al., 2022).

The implementation of the *ecopreneurship* concept motivates students to create valuable products that also consider environmental sustainability (Suryaningsih & Aripin, 2022 ; Syahnaidi *et al.,* 2023). According to Salmah (2019), creativity and innovation are interrelated skills; creativity generates new ideas, while innovation implements them as real solutions. However, previous research has not extensively explored how integrating creativity and innovation through *ecopreneurship* can specifically enhance the innovative abilities of science students. Therefore, this study aims to address this gap by evaluating the extent to which *ecopreneurship* can develop students' innovation skills.

This study is supported by findings that show that the concept of *ecopreneurship* can improve students' creative and innovative thinking skills. Therefore, the learning approach applied in this study is *Project-Based Learning* (PjBL), which is oriented towards the implementation of *ecopreneurship* (Widiyaningsih, 2024). Through PjBL, students gain direct experience in developing creativity and producing innovative solutions in the form of valuable and environmentally friendly products (Juliansih *et al.,* 2023). This approach is relevant because it encourages learner-centered learning and strengthens their ability to deliver innovations that can be applied in the field of *ecopreneurship*.

The background of this study is the need to integrate the concept of *ecopreneurship*, which combines environmental sustainability with business practices, into entrepreneurship education. This approach is believed to increase students' innovation skills, especially in the Science Education Study Program at Lambung Mangkurat University. The uniqueness of this research lies in the direct application of Project-Based Learning (PjBL) with *ecopreneurship* in the learning process. Therefore, this study aims to analyze the impact of applying *ecopreneurship* through PjBL on the innovative abilities of Science Education students at Lambung Mangkurat University.

METHODS

This study used a quantitative approach with a quasi-experimental design. This design was chosen because it is suitable for the research subjects, who are Science Education students from the 2022 cohort who only comprise one class. The study employed a one-group pre-test and post-test design without a control group to measure the impact of *ecopreneurship* implementation based on *Project-Based Learning* on students' innovation abilities.

It is recognized that this design has the potential for threats to internal validity, such as the influence of external factors, maturation, or history (Creswell & Creswell, 2018). However, the use of a control group was not possible due to the limited number of classes and the need to provide the same treatment to all students to ensure equal learning experiences and avoid treatment bias (Sugiyono, 2021). To minimize threats to validity, the study was supplemented with rigorous measurement procedures, consistent treatment implementation, and comprehensive analysis of results.

Table 1. Research Design

Group	***Pre-test***	**Treatment**	***Post-test***
Student	T_1	X	T_2

Explanation:

T_1 = Pre-test
X = Treatment
T_2 = Post-test

The sampling techniques used were purposive, meaning they were carried out deliberately by considering factors that aligned with the research objectives (Lenaini, 2021). The research sample consisted of 33 students using purposive sampling from the ULM Science Education Study Program for the 2024/2025 odd semester. This study involved the implementation of the concept of *ecopreneurship* for one month through *Project-Based Learning* (PjBL), which consisted of three main sessions. The PjBL stages were adapted from George Lucas (2005) and Nababan (2023), with

modifications to highlight aspects of *ecopreneurship*. In the first session, students identified environmental waste with potential economic value and created flowcharts to analyze the market, product feasibility, and risk assessment. The second session focused on project planning and scheduling, where students developed detailed designs for their products under the guidance of instructors. The third session involved project implementation, progress monitoring, and final product presentation, which were then evaluated based on creativity, innovation, and environmental sustainability. These stages ensured that students not only understood the theoretical aspects of *ecopreneurship* but also experienced its practical application in developing innovative and environmentally friendly products.

To measure the application of the concept of *ecopreneurship*, students were given a pretest at the beginning of the *Entrepreneurship* course. After the pretest, students received treatment in the form of applying the concept of *ecopreneurship* through the Project-Based Learning (PJBL) model. This intervention was conducted over several sessions, focusing on the application of *ecopreneurship* concepts to innovative, environmentally friendly products. Following the intervention, students were administered a post-test to assess improvements in their innovative capabilities. We then analyzed the results of the pre-test and post-test. This analysis compared pre-test and post-test outcomes. It also determined the extent of improvements in students' innovative capabilities.

Data Collection Techniques

This study used the following data collection techniques Questionnaires on student responses to the implementation of *ecopreneurship* and questionnaires on innovation capabilities.The questionnaire instruments were validated by experts and tested for reliability before use. The innovation capability questionnaire was developed based on innovation capability indicators in *ecopreneurship*, such as problem-solving skills, creation of innovative ideas, design and production of innovative products, and readiness to become innovative entrepreneurs. A *Paired Sample T-Test* was used to analyze the data obtained so that the impact of *ecopreneurship* must be determined, implementation on students' innovation capabilities.

Table 2. Innovation Capability Indicators

No.	Indicator Aspects	Sub Indicator
1.	Techniques for Generating Ideas	Students are able to identify key environmental issues that require innovative solutions.
2.	Generating New Ideas	Students are able to identify opportunities and create something new by combining existing ideas.
		Students are able to combine *ecopreneurship* knowledge with innovative solutions to emerging issues.
3.	Elaboration	Students are able to create and innovate new products based on new ideas by designing, testing prototypes, and improving products based on the *ecopreneurship*material obtained.
4.	Analysis	Students are able to recognize potential risks and challenges faced in developing ideas.
		Students are able to plan, organize, and manage innovation projects from start to finish in *ecopreneurship* learning.
5.	Evaluating ideas to improve innovative creative efforts in products/projects.	Students are able to evaluate product/project development by adding new relevant values or features in accordance with *ecopreneurship* principles.

The researchers used the *Ecopreneurship* Response Questionnaire and the Innovation Ability Questionnaire, which contained 18 statements regarding students' responses to the application of the concept of *ecopreneurship* and 15 valid statements regarding innovation ability, which had been tested based on indicators of the concept of *ecopreneurship* and innovation ability. The questionnaire results

were calculated using percentage correction for the innovation ability of science education students using the following equation :

$$\text{Percentage} = \frac{total\ score\ obtained}{maximum\ score}\ x100\%$$

The categories are based on the average score calculated from the measured indicators and are categorized in Table 3.

Table 3. Categories for assessing students' innovation skills

Value Range	Category
81% - 100%	Very Good
61% - 80%	Good
41% - 60%	Fair
20% - 40%	Poor
0% - 20%	Very Poor

(Riduwan, 2020)

Research Instrument Validation

This process ensures that research tools meet the necessary standards in terms of content, construction, and integration with learning approaches. Validated research tools include questionnaires on environmental *Entrepreneurship* and innovation capabilities.

1. Expert Validation Instrument

Instrument validation in this study was carried out using expert validation and empirical validity testing (instrument testing). Expert validation was conducted by two expert lecturers from the Science Education Study Program and one expert lecturer from the Economics Education Study Program to measure the validity of the research instrument to be used in this case, namely the questionnaire. The expert and user validation values were determined using the following formula.

$$Validasi\ audience = \frac{Tse}{\text{Tsh}}\ x100\%$$

Explanation: Tse = total empiric score
Tsh = total maximum score

Table 4. Expert and User Validation Criteria

Achievement score	Category Validity	Description
25,00% – 40,00%	No valid	Not allowed to be used
41,00% – 55,00%	Less valid	Not allowed to be used
56,00% – 70,00%	Quite valid	Allowed to be used with major revisions
71,00% – 85,00%	Valid	Allowed to be used with minor revisions
86,00% – 100,00%	Very valid	Very good to use

(Akbar, 2013)

a. *Ecopreneurship* Questionnaire Validation Test

Variable X in this study is the implementation of *ecopreneurship*, which is measured using a student response questionnaire with a Likert scale regarding the implementation of *ecopreneurship*. The table showing the expert validation results of the *ecopreneurship* response questionnaire can be seen in Table 5.

Table 5. Table of Validation Results for the *Ecopreneurship* Response Questionnaire by Experts

No.	Assessment Indicator	Average
1.	Format	92%
2.	Content	92%
3.	Language	86%
Average total validity of the *ecopreneurship* questionnaire		90%
Validity of the questionnaire		Very valid, can be used without revision

b. Innovation Ability Questionnaire Validation Test

Variable Y in this study is students' ability to innovate, which will be measured using a questionnaire with a Likert scale regarding innovation ability consisting of 15 statements. The table showing the results of expert validation of the innovation ability questionnaire can be seen in Table 6.

Table 6. Table of Validation Results from Experts on the Innovation Ability Questionnaire

No.	Assessment Indicator	Average
1.	Format	92%
2.	Content	83%
3.	Language	92%
Average total validity of the *ecopreneurship* questionnaire		88,8%
Validity of the questionnaire		Very valid, can be used with minor revisions

2. Empirical Validation Test (Trial)
Results of the *Ecopreneurship* Questionnaire Empirical Test

After conducting trials on the 2021 cohort who had taken the *Entrepreneurship* course, empirical test results were obtained for the questionnaire instrument to be used for the research. The empirical test results for the *ecopreneurship* questionnaire instrument can be seen in Table 7.

Table 7. Empirical test results of the *ecopreneurship* questionnaire instrument

Declaration	Sig of Validity	Description
4,5,6,8,13,14,15,16,17,18,19,20	0,000	Valid
1	0,033	Valid
2	0,011	Valid
3	0,308	No Valid
7	0,003	Valid
9	0,029	Valid
10	0,022	Valid
11	0,001	Valid
12	0,107	No Valid

The results of the following *ecopreneurship*response questionnaire test contained 20 statements, 2 of which were invalid, namely statements 3 and 12, because their sig was > 0.05, so the invalid statements were discarded and the valid ones could be used in the study. The negative statements are statements 9, 10, 13, 14, and 19. The validity results of the *ecopreneurship*response questionnaire instrument.

Results of Empirical Testing of Innovation Ability Questionnaire

After conducting trials on the 2021 cohort who had taken the *Entrepreneurship* course, empirical test results were obtained for the questionnaire instrument to be used for the research. The empirical test results for the innovation capability questionnaire instrument can be seen in Table 8.

Table 8. Empirical test results of the innovation capability questionnaire instrument

Declaration	Sig of Validity	Description
1	0,002	Valid
2,4,6,11,19,12,14,16,17,18,20	0,000	Valid
3	0,004	Valid
5	0,058	No Valid
7	0,666	No Valid
8,15	0,001	Valid
9	0,074	No Valid
10	0,394	No Valid
13	0,090	No Valid

The results of the following test of the innovation ability questionnaire, which contains 20 statements, 5 of which are invalid, namely statements 5, 7, 9, 10, and 13, because their sig values are > 0.05, so the invalid statements are discarded, and the valid ones can be used in the research. The negative statements are statements 3, 6, 9, 12, and 18.

3. Reliability Test

Reliability refers to the idea that an instrument is trustworthy enough to be used as a tool for collecting data because it is well-designed. A trustworthy instrument will reliably produce trustworthy data (Sumadi, 2004). The method used to test the reliability of the instrument in this study is the Alpha Method. SPSS is a reliability testing method that can be used to determine whether a program is reliable by using the Cronbach Alpha statistical test.

The reliability value ranges from 0 to 1, with higher values indicating a better instrument. Specifically, the higher the value, the more reliable the instrument, as demonstrated by the *ecopreneurship* response questionnaire and the innovation capability questionnaire. The criteria for the innovation capability questionnaire to be considered reliable are that the value obtained in the statistical testing process is > 0.60. Conversely, if the coefficient value is found to be less than 0.60, it is considered unreliable (Ghozali, 2016). The reliability testing criteria can be seen in Table 9.

Table 9. Reliability test requirements for instruments

Category value	Interpretation
$\alpha \geq 0,9$	perfect reliability
$0,7 \leq \alpha < 0,9$	high reliability
$0,5 \leq \alpha < 0,7$	moderate reliability
$\alpha < 0,5$	low reliability

(Ghozali, 2016)

Data Analysis Techniques

Data analysis techniques are used to process and interpret research results objectively. The analysis is conducted on a sample that represents the population so that the research results can be applied more broadly. The following data analysis techniques were utilized in this study.

1. Normality Test

To use parametric statistical tests, a normality test was conducted. This test ensured that the data had a normal distribution (Fahmeyzan et al., 2018). Given the study's sample size of over fifty, the *Kolmogorov-Smirnov* test was employed. This test was performed using IBM SPSS Statistics 21. The Sig value (Sig.) was used as one of the factors in making decisions. If the Sig. value is greater than 0.05, the data is considered to have a normal distribution. Conversely, if the Sig value is below 0.05, the distribution is considered non-normal.

2. Homogeneity Test

The homogeneity test aims to determine the similarity of variances between two data groups (Sianturi, 2022). Decisions based on this test are made using the results of the Levene test. If the sig. value is higher than 0.05, the data are considered homogeneous. If the Sig. value is found to be less than 0.05, the data are considered non-homogeneous.

3. *Paired Sample T-Test*

T-test is useful for testing significant differences in one data group or two data groups (Mustafidah et al., 2020). The Paired T-test is performed to determine whether two related data groups have significant differences. The determination of the results refers to the Sig. (two-tailed). If the Sig. value is higher than 0.05, H_0 is adopted because there is no substantial difference. Conversely, if the Sig. value is less than 0.05, H_0 is dismissed due to the Sig of the observed difference.

RESULTS AND DISCUSSION

Data were collected using questionnaires, including the *Ecopreneurship* Concept Application Response Questionnaire and the Innovation Ability Questionnaire, which were validated through expert and empirical testing using SPSS 21.

Innovative Student Description (Application of the concept of *ecopreneurship*)

The following is a description of innovative products created by students after applying the concept of *ecopreneurship* in their *Entrepreneurship* course. These products are the result of group work by students aimed at providing solutions to environmental problems through an environmentally friendly entrepreneurial approach (*ecopreneurship*). The following images of student products demonstrate the students' innovative abilities in their *Entrepreneurship* course:

Figure 1. Product of the Class of 2022

The results of products after the application of *ecopreneurship* in *Entrepreneurship* courses on students' innovation abilities. Students are able to create products that utilize waste, such as banana peel waste into liquid organic fertilizer, leaf and flower waste into fabric dye, coconut husk waste into liquid fertilizer, water hyacinth waste into fish feed, coconut husk waste into brownies, and corn husk waste into bouquets.

Student Response to *Ecopreneurship* Concept

The application of the concept of *ecopreneurship* is incorporated into *Project Based Learning* (PJBL) based on seven main indicators, as listed in Table 10 below.

Tabel 10. Student response to the application of the concept of *ecopreneurship*

***Ecopreneurship* Concept Indicators**	**Percentage Score (%)**	**Category**
Eco-Innovation	85,60	Very Good
Awareness of Sustainable Practices	85,27	Very Good
Market Orientation	87,12	Very Good
Social Impact	80,30	Very Good
Ecopreneurial Regulations	78,03	Good
Business Model Development	85,60	Very Good
Community Engagement Strategy	83,33	Very Good
Average	83,60	Very Good

The average student response reached 83.60% (Very Good), with the highest score on Market Orientation (87.12%) and the lowest on Ecopreneurial Regulations (78.03%).

Student Innovation Ability

The data obtained from the percentage scores were obtained from questionnaires given to students before and after the treatment, as shown in Table 11 and Figure 2.

Table 11. Achievements in Student Innovative Abilities

Indicator Aspects	Sub Indicator	Percentage Score (%)	
		Pre-test	***Post-test***
Techniques for Generating Ideas	Students are able to identify key environmental issues that require innovative solutions.	70,45	93,37
Generating New Ideas	Students are able to identify opportunities and create something new by combining existing ideas.	70,83	93,18
	Students are able to combine *ecopreneurship* knowledge with innovative solutions to emerging issues.		
Elaboration	Students are able to create and innovate new products based on new ideas by designing, testing prototypes, and improving products based on the *ecopreneurship* material obtained.	71,97	95,83
Analysis	Students are able to recognize potential risks and challenges faced in developing ideas.	71,59	93,56
	Students are able to plan, organize, and manage innovation projects from start to finish in *ecopreneurship* learning.		
Evaluating ideas to improve innovative creative efforts in products/projects.	Students are able to evaluate product/project development by adding new relevant values or features in accordance with *ecopreneurship* principles.	74,49	95,20
Average before and after the implementation of *ecopreneurship*		71,87	94,23

The ensuing diagram illustrates a compilation of achievements derived from a questionnaire addressing student innovation capabilities, as shown in Figure 2.

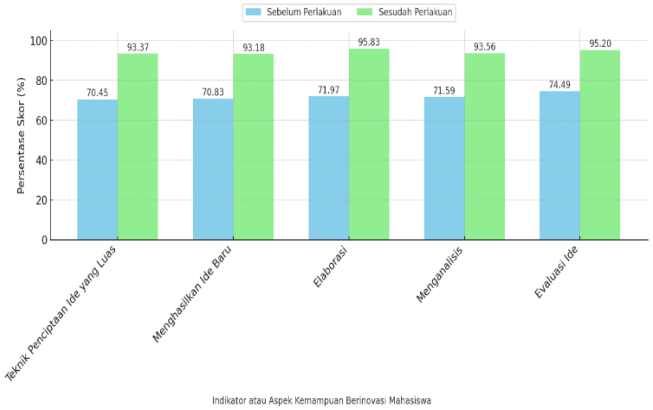

Figure 2. Innovation Ability Achievement Diagram.

Table 11 presents percentage scores of student innovation ability before and after treatment. Overall, average score increased from 71.87% to 94.23%. The results of the study demonstrated a marked increase in student innovation ability achievement before and after treatment, as indicated by significant

growth in all measured indicators. The percentage score (%) of the broad idea creation technique indicator before and after treatment increased from 70.45 to 93.37. The indicator for generating new ideas also showed an increase from 70.83 to 93.18. Furthermore, the ability to elaborate increased from 71.97 to 95.83. In terms of analysis, the score increased from 71.59 to 93.56. Finally, the indicator for evaluating ideas in improving and maximizing creative efforts and innovation increased from 74.49 to 95.20. Overall, the average score for students' innovation ability before the treatment reached 71.87 and after the treatment reached 94.23, indicating that the implementation of the treatment successfully improved students' innovation ability significantly.

The normality test ensures that the independent and dependent variables have a normal distribution. To confirm the normality of the research data, a *Kolmogorov-Smirnov* test was conducted. If the Sig > .05, the data is normally distributed, otherwise, it is not. The following table shows the results of the normality test for the *ecopreneurship* response questionnaire and students' innovation capabilities, an shown in Tables 12 and 13.

Table 12. Results of the Normality Test for the *Ecopreneurship* Response Questionnaire

Tests of Normality				
		Kolmogorov-Smirnov[a]		
		Statistic	df	Sig.
Result	Posttest	.121	33	.200

The results of the normality test for the *ecopreneurship* response questionnaire show that in the posttest, Sig. 0.200 > 0.05 normally distributed.

Table 13. Results of the Normality Test for the Innovation Ability Questionnaire

Tests of Normality			
		Kolmogorov-Smirnov[a]	
		Statistic	df
Result	Questionnaire response before treatment	.122	33
	Questionnaire response after treatment	.124	33

The results of the normality test for the Innovation Capability Questionnaire indicate a normal distribution, as evidenced by the pretest sig of 0.200 > 0.05 and the posttest Sig of 0.200 > 0.05.

The homogeneity test aims to determine the similarity of variances in questionnaire data before and after the application of the *ecopreneurship* concept. The results of the homogeneity test can be seen in Table 14 below.

Table 14. Results of the homogeneity test for innovation ability questionnaires

	Levene Statistic	df1	df2	Sig.
Pretest - Posttest	1.919	1	64	0.171

Based on Table 14, the Sig value for the pre-test and post-test data is 0.171, which means that the Sig > .05. This indicates that the variances before the treatment are homogeneous, or there is no significant difference in variance between the two groups.

The *Paired Sample T-Test* was performed to ascertain whether there was a statistically significant difference between the pre-test and post-test scores on the student innovation ability questionnaire. The results of the test are shown in Table 15 below.

Table 15. *Paired Sample T-Test* innovation ability questionnaires

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig.(2-tailed)
				Lower	Upper			
Questionnaire response before treatment - Questionnaire response after treatment	-13,364	4.689	0.816	-15.026	-11.701	-16.371	32	.000

Based on Table 15, the Sig. (2-tailed) value for the application of the concept of *ecopreneurship* on students' innovation ability is 0.000, which is smaller than 0.05, so H_0 is rejected. This indicates a significant difference between the pre-test and post-test results. This, incorporating the concept of *ecopreneurship* into *Entrepreneurship* courses significantly improves the innovative ability of ULM science students. In this application, the Sig. (2-tailed) value is also 0.000, which indicates a significant difference between the pre-test and post-test scores.

The application of the concept of *ecopreneurship* through Project-Based Learning (PjBL) in Entrepreneurship courses has been proven to significantly improve students' innovation skills. The *ecopreneurship* indicators in Table 4.1 show an important role in encouraging the creation of environmentally friendly ideas (eco-innovation), awareness of sustainable practices, market orientation, social impact, regulatory compliance, business model development, and community involvement.

The post-test results show an average innovation capability score of 83.60 (excellent category). Market orientation received the highest score (87.12), followed by business model development (85.60), eco-innovation (85.60), and sustainability awareness (85.27). Community engagement strategies (83.33) and social impact (80.30) also showed strong understanding. However, the ecopreneurial regulatory indicator still needs improvement (78.03; good category) because the treatment of business regulations was only superficial and not very in-depth.

The implementation of the *ecopreneurship* concept in entrepreneurship courses at the University of Lambung Mangkurat (ULM) has been shown to significantly increase the innovative abilities of students in the Department of Science Education. Through the Project-Based Learning (PBL) model, students are encouraged to create environmentally friendly products from recycled materials. This finding aligns with the research of Ekasari (2023) and Sun & Kim (2022), who state that PJBL effectively fosters innovative ideas through direct experience and entrepreneurial integration in product design.

The results of the study are also supported by Windisch (2024), who emphasizes the importance of innovative business projects in solving real problems; Rahayu (2023), who shows increased student confidence in developing creative ideas, and Batara and Nugroho (2024), who found that adopting *ecopreneurship* and upcycling promotes sustainable creativity through the utilization of valuable waste.

The students' innovative products, such as liquid organic fertilizer, ecoprint, organic waste briquettes, and livestock feed from vegetable waste, are a concrete example of the application of theory to practice. Statistical tests (Paired t-test) show a significant effect of *ecopreneurship* implementation on improving students' innovation capabilities, with a sig. $0.000 < 0.05$. The implications of integrating *ecopreneurship* into entrepreneurship curricula are that it can develop problem-solving, creative, and environmental awareness skills, as well as support the formation of innovative entrepreneurs who are ready to face the challenges of sustainable business.

CONCLUSION AND SUGGESTION

The results of the paired sample t-test show a significance value of $0.000 < 0.05$, so H0 is rejected and Ha is accepted. This proves that the application of the concept of *ecopreneurship* in Entrepreneurship courses has a significant effect on the innovative abilities of Science Education students. The main contribution of this study (novelty) lies in the integration of the concept of *ecopreneurship* with Project-Based Learning (PjBL), which not only increases student creativity but also encourages the creation of environmentally friendly products with economic value. Theoretically, this study expands the study of the application of *ecopreneurship* in project-based entrepreneurship

learning in the context of science education. From a practical perspective, these findings provide guidance to lecturers in designing learning activities that encourage student participation in creating innovative solutions, while strengthening awareness of environmental sustainability. At the policy level, the results of this study can be used as a basis for developing a curriculum oriented towards sustainable innovation in higher education. This study has limitations because it only involved one study program with a single group design. Therefore, further research is recommended using a broader sample, a stronger experimental design, and a longer learning duration in order to observe significant long-term impacts. *Ecopreneurship*-based learning can be an effective alternative for training students to innovate, manage ideas, and develop creativity in order to facilitate its application in business and sustainable entrepreneurship.

REFERENCES

Anggraini, R. R., Damayanti, F., & Suryaningsih, E. (2023). Implementation of *ecopreneurship*-based learning media to improve creativity in IPAS (Natural and Social Sciences) class X at SMK Putra Pakuan Bogor. *Sinasis*, 4(1), 213-216.

Arfah, M.& Syam, S. (2023). The Role of *Entrepreneurship* Education in Fostering Entrepreneurial Interest among Business Administration Students of the Polytechnic of the Indonesian Professional Education and Development Institute Makassar. *Innovative: Journal of Social Science Research*, 3(1), 557-564.

Aripin, I. (2017). 3R-oriented environmental education learning (reuse, reduce and recycle) to improve creativity and environmental care attitude. *BIO EDUCATIO:Journal of Science and Biology Education*, 2(2).

Aulia DC, Situmorang HK, Prasetya AFH, et al(2021). Increasing Community Knowledge and Awareness about Waste Management with Jepapah Messages. *Journal of Community Health Service (Pengmaskesmas)* 1(1): 62-70.

Ekasari, N., Sari, N., Siregar, A. P., & Rosyid, G. Y. (2023). Implementasi Project Based Learning sebagai Upaya Pengembangan Sikap Ecopreneurship pada Mata Kuliah Manajemen Lingkungan. *Jurnal Ilmiah Universitas Batanghari Jambi*, *23*(1), 329-333.

Ellya, F. F., Ramdhan, B., & Ratnasari, J. (2021). Profile of Creativity and Innovation Skills in Learners' Products Assisted by the Tiktok Application at MAN 2 Sukabumi City. *BIODIK: Scientific Journal of Biology Education*, 7(3)114-122. https://doi.org/10.22437/bi.

Fahmeyzan, D., Soraya, S., & Etmy, D. (2018). "Normality Test of Monthly Turnover Data for Microeconomic Actors in Senggigi Village Using Skewness and Kurtosis". *Journal of VARIAN*, 2 (1), 31-36. https://doi.org/10.30812/varian.v2i1.331.

Ghazali, N. H. M. (2016). A Reliability and Validity of an Instrument to Evaluate the School-Based Assessment System: A Pilot Study. *International Journal of Evaluation and Research in Education (IJERE),* 5(2), 148-157.

Juliansih, P., Hariyadi, B., & Anggereini, E. (2023). Development of *Project Based Learning* Worksheet for Integrated Science Learning on Peat Material *Binomial Journal*, 6(2).

Khamimah, W. (2021). The Role of *Ecopreneurship*in Overcoming Plastic Waste in Surabaya (Case Study on Asri Recycle Mojo Surabaya). *JEBDEKER: Journal of Economics, Management, Digital Business Accounting, Creative Economy, and Entrepreneur*, 2(2), 11-18.

Laydes, M., Vásquez, M., Cruz-Tarrillo, J., & Diaz, R. A. (2024). Business education, innovation skills as predictors of entrepreneurial self-efficacy in university students. *Journal of Business Economics and Management*, *25*(4), 612-627.

Lenaini, I. (2021) Purposive and snowball sampling techniques. *Journal of Historical Education StudiesResearch & Development*, 6(1), 33-39

Marpaung DN, Iriyanti YN, Prayoga D. (2022). Analysis of factors causing littering behavior in Kluncing Village community, Banyuwangi. *Preventive: Journal of Public Health* 13(1): 47-57.

Muhammad, M. (2023). Integrating Concept of Entrepreneurship Into Science Education. *IJECA (International Journal of Education and Curriculum Application)*, *1*(1), 16-23.

Mustafidah, H., Imantoyo, A., & Suwarsito, S. (2020). Development of a web-based one-sample t-test application. *Jurnal Informatika*, 8(2), 245-251.

Nababan, D., Marpaung, A. K., & Koresy, A. (2023). *Project Based Learning* (PjBL) Learning Strategy. *Journal of Social Education and Humanities*, 2(2), 706-719.

Nugroho, R. L. (2024). Bisnis Model Ecopreneurship: Studi Komparatif Tentang Upcycling Berbasis SDG Target 8.3 Inovasi Dan Kreatifitas Di Kota Bandung. *eProceedings of Management*, *11*(3).

Pradifta, I, Suryaningsih, Y., & Aripin, I. (2023). Application of *Ecopreneurship*Approach to Improve Students' Creative Thinking Ability. *Journal of Biology Pedagogy*, 1(01), 35-44.

Rahayu, S., Rizky, M., Ratumbuysang, M. F. N. G., & Hasanah, M. (2023). Improving Innovative Behavior Through Entrepreneurship Education in Economic Education Students Lambung Mangkurat University. *Jurnal Pendidikan Ilmu Sosial*, *33*(2), 264-275.

Salmah, N. Mafra, & R. Damayanti. (2019). Development of Entrepreneurial Spirit Through Creativity and Innovation of SMAN 1 Indralaya Selatan Students. *Journal of Community Service* 3(2). http://dx.doi.org/10.30734/j-abdipamas.v3i2.336.

Sari, R. M., Hartini, G., & Nisa, S. I. Z. (2024). Contribution of Young Scholars in Actualizing Overcoming Unemployment Through Entrepreneurship Education. *PROSPECT JOURNAL*, 5(1), 401.

Sari, S. C.& Putri, R., E. (2022) The effect of the PBL learning model based on science, technology, engineering, mathematics on STEM the cognitive abilities of junior high school students in Basa Ampek Balai Tapan. *Universe*, 3(1), 14-19. https://doi.org/10.24036/universe.v3il.134.

Sianturi, R. (2022). Homogeneity Test as a Condition of Analytical Testing. *Journal of Education, Social Science, and Religion*, 8(1), https://doi.org/10.53565/pssa.v8i1.507.386-397.

Sinta, K. P., Haidar, K., & Riyadi, R. (2024). The Effect of School Field Introduction and Soft Skills on the Readiness to Become a Teacher Among Students in the Economics Education Study Program. *Journal of Economic Education and Entrepreneurship Studies*, 5(2), 242-253.

Sugiyono. (2016). "*Quantitative, Qualitative and R&D Research*". Bandung Alfabeta.

Sun, X., & Kim, E. (2022). Improving student creativity through project-based learning. *Journal of Psychology and Pedagogy*, 6(4), 6295–6307.

Suryaningsih, S., & Nisa, F. A. (2021). Contribution of STEAM Project-Based Learning in Measuring Students' Science Process Skills and Creative Thinking. *Indonesian Journal of Education*, 2(06), 1097-1111.

Suwardi, D. M., Machmud, A., & Iswanti, I. (2021). The Role of *Entrepreneurship* Education on Student Innovation Mediated by the Introduction of Entrepreneurial Opportunities. *Edunomic Journal of Economic Education*, 9(1), 69. https://doi.org/10.33603/ejpe.v9i1.4595.

Syafei, D., Jalaludin, J, & Lahat, D. S. TI. E. (2021). The Effect of Innovation and Entrepreneurial Creativity on the Success of Small and Medium Enterprises in Clothing Tailors in East Batu raja District, Oku Regency. *Unbara Journal of Business Management*, 2(2), 105-127.

Syahnaidi, M. F., Prastowo, A., & Syahnaidi, M. A. Q. (2023) Implementation of *Project Based Learning* (Pjbl) to Foster Innovation Ability and Student Activeness in the Merdeka Curriculum in Madrasah Ibtidaiyah. *Pendas: Scientific Journal of Basic Education*, 8(3), 6510-6525.

Widiyaningsih, N., Susanto, M. R., & Erniasari, E. (2024). Increasing Student Creativity Through *Project Based Learning* Model on Batik Technique Material for Elementary School Class Vi Students. *Pendas: Scientific Journal of Basic Education*, 9(1), 1442-1458.

Windisch, L. (2024). *Effects of project-based learning on entrepreneurship intention and its antecedents* (Doctoral dissertation, lmu).