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The Impact of Environmental Based Physics Learning on Students' Concept Mastery and Ecopreneurship Management

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Abstract

Strengthening ecopreneurship plays an important role in preparing students for success in the life and career of students, but this skill is not well trained in learning physics. Therefore, the purpose of this study was to analyze the impact of environment-based physics learning on students' mastery of concepts and ecopreneurship. This research is a quasi experimental research with one group pretest and posttest design. The research subjects were 29 students of the physics education study program, Surabaya State University, Indonesia, who programmed basic physics courses. The data collection technique used a conceptual mastery test instrument and ecopreneurship. The data analysis technique used the Kolmogorov-Smirnov test, Paired t-test, Wilcoxon test, and N-Gain. The results showed a significant increase in students' mastery of concepts and ecopreneurship at $\alpha = 5\%$, with mean N-gain of 0.63 and 0.60, respectively, within the moderate criteria. Thus, environment-based physics learning has a significant impact on increasing student mastery of concepts and ecopreneurship.

Keywords: Ecopreneurship; environment; physics learning; concept mastery

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INTRODUCTION

Today, the development of science and technology causes various problems in human life and the environment (Dewantara et al., 2018; Saludung et al., 2018). The environment as a place for human life and other living things to be preserved. Therefore, the world of education (including physics education) must be able to create creators and innovators to overcome environmental problems, or what is known as ecopreneurship (Adinugraha, 2017; Greene, 2012). Ecopreneurship is a combination of the words "ecological" and "entrepreneur" which accurately describes an entrepreneur who has environmental awareness (Masjud, 2020). Therefore, strengthening ecopreneurship in physics learning facilitates scientific innovation and new technological discoveries (Martini et al., 2018). The main task of educators is not enough to equip students with physics and technology, they also design and create creative products to overcome environmental problems (Haris et al., 2018). Strengthening ecopreneurship is not only technical and management, but also emphasizes the development of creativity, personality, and independence in learning. Students develop various creative products based on the environment as a form of representation of knowledge, attitudes, and skills to overcome environmental problems.

In the era of globalization, environmental damage is still a major problem and global issues (Haris et al., 2018; McEwen, 2013). More and more entrepreneurs will increase business activities and further damage the environment (Masjud, 2020). Therefore, strengthening ecopreneurship in education has attracted the attention of academic researchers (Setyawati et al., 2018); including Faculty of Math and Natural Science (FMNS), Universitas Negeri Surabaya (Unesa). FMNS Unesa as a higher education provider that focuses on the education of math and natural science sector supports the implementation of the Indonesia's national curriculum framework characterized by Ecopreneurship. This curriculum has three pillars, namely Eco opportunity, Eco Innovation, and Eco Commitment (Martini et al., 2018; Novita et al., 2018). Ecopreneurship is a concept of developing the world of entrepreneurs by paying attention to its sustainability aspects from ecological, social and economic aspects. An ecopreneur does not only pursue profit, but also cares about the quality of the environment (Manju, 2016). Ecopreneuership is expected to be a concept for developing the world of entrepreneurs in a better direction in the future (Saludung et al., 2018). Thus, the development of ecopreneurship at FMIPA Unesa is expected to be a reference for other universities that want to produce professional and character MIPA teachers and scientists.

In fact, the results of the study by Setyawati et al. (2018) found that ecopreneurship research that was published in the Scopus journal from 1978 to 2018 studied more of business-management (38%), computer science (25%), engineering (24%), social sciences (22%) , economic (15%), while environmental science is only 15%. So far, science learning has not involved students in managing the surrounding environment (Martini et al., 2018); Moreover, applying physics concepts in designing and designing creative products to solve problems in their environment (Dewantara et al., 2018; Nisa & Hariyono, 2019). This is reinforced by the results of observations and interviews of researchers with students that basic physics courses have been focused on memorizing physics concepts and formulas, and solving problems mathematically. Students are not used to connecting the physics concepts they have learned with their application in solving problems in their environment, let alone designing or creating creative products. Therefore, researchers feel the need to train ecopreneurship in basic physics courses.

Strengthening ecopreneuship as the key to the birth of young entrepreneurs in the future gets the main attention in this research. Ecopreneurship needs to be trained from an early age in learning physics in higher education, one of which is in basic physics courses. One of the efforts made by researchers is to apply environment-based physics learning. Understanding the environment as a basis for thinking and acting to solve environmental problems (Haris et al., 2018). Students can be exposed to the latest science issues and presented learning objectives, they are guided to identify and construct physics concepts, then design and create creative products, and communicate them in front of the class. At the end of the lesson, the lecturer facilitates evaluation and reflection along with the follow-up. This environment-based physics learning is in accordance with constructivism theory (Eggen & Kauchak, 2013). Students construct their own knowledge and skills through interactions with other people and the environment. Students build further knowledge, design works, and even create new works that are useful for solving problems (Martini et al., 2018; Novita et al., 2018). The integration of the environment in learning physics allows students to actively participate in becoming creative, innovative, and independent individuals in overcoming environmental problems.

Based on the above problems, this study wants to analyze the impact of environmental-based physics learning on students' mastery of concepts and ecopreneurs, which can be seen from whether there is a significant difference between the pretest-posttest scores and the level of improvement. Strengthening ecopreneurship makes physics learning more meaningful. In addition, students can actively participate in mastering the physics concepts taught, improve problem-solving skills, and try to build entrepreneurship in their lives.

METHOD

This research is a quasi-experimental research to determine the impact of environment-based physics learning on students' mastery of concepts and ecopreneurship. The research trial used one group pretest and posttest design, O1 X O2 (Sugiyono, 2016). The learning process begins with the initial test (O1); where students are asked to work on the conceptual mastery test instrument and ecopreneurship. The test instruments are presented in Table 1.

Table 1. Concept Mastery and Ecopreneurship Test Indicators

Indicators		Validity	
		Score	**Criteria**
Mastery of concepts	1. Distinguishing the concept of effort and energy	3.33	VV
	2. Determine the greatest effort by the force of gravity	3.00	V
	3. Identify and describe the amount of kinetic energy and potential energy in each situation.	3.33	VV
	4. Calculating the kinetic energy at a certain position.	3.33	VV
	5. determine the greatest kinetic energy at a certain height and can provide the reason	3.33	VV
Ecopreneurship	1. Formulate problems in the phenomenon of energy consumption in Indonesia	3.00	V
	2. Find the causes of problems in the energy consumption phenomenon in Indonesia	3.00	V
	3. Find creative ideas to solve problems in the energy consumption phenomenon in Indonesia	3.00	V
	4. Representing a graph of energy demand and production	3.33	VV
	5. Analyze and predict the graph between energy demand and production	3.00	V
	6. Make decisions according to the predictions on the graph between energy demand and production	2.67	V
	7. Find at least 2 environmental problems.	3.00	V
	8. Finding creative ideas to solve problems based on the potential of the existing environment	3.33	VV
	9. Designing creative projects to solve problems in the environment around them.	3.33	V
Cronbach Alpha		**0.67**	**Reliabel**

Note = VV : Very Valid; V : Valid

Based on Table 1, design of the initial test instrument to measure 5 indicators of concept mastery and 9 indicators of ecopreneurship. Before being used, this test instrument has been validated by three physics learning experts. The validation results show that the two test instruments are valid and reliable as the research instrument. Furthermore, researchers applied environment-based physics learning (X). The subjects of the trial were 29 students of the physics education study program at the State University of Surabaya, Indonesia, consisting of 20 women and 9 men. The research was conducted from March to December 2018 on business and energy materials. During the learning process, 2 observers observed the implementation of the learning and the results are presented in Table 2.

Table 2. Environmental Based Physics Learning Implementation

Learning Implementation		Observation Result	
		Score	**Criteria**
Introduction	Presents issues to motivate	3,50	Very Good
	Delivering learning objectives	3,00	Good
Core activity	Identifying concepts	3,50	Very Good
	Constructing a concept	4,00	Very Good
	Identifying the problem	4,00	Very Good
	Resolving issues (design consultation)	3,00	Good
	Finalizing the problem (presentation design)	3,00	Good

Learning Implementation		Observation Result	
		Score	Criteria
	Resolving issues (product presentation)	2,50	Good
	Reflection	3,50	Very Good
Conclusions	Closing Formulate	3,50	Very Good
	Reflection on learning	3,00	Good
	Follow-up	3,50	Very Good
Learning atmosphere	Matching teaching and learning activities with learning objectives	4,00	Very Good
	Lecturers are enthusiastic.	3,50	Very Good
	Ease of reference	2,50	Good

Based on Table 2, lecturers are able to carry out each stage of environment-based physics learning well. In this lesson, lecturers present science issues and convey learning objectives, guide students to identify and construct physics concepts, design or create creative products, and communicate them in front of the class, then evaluate and reflect and follow up. The value of student concept understanding and ecopreneurship is the total score obtained divided by the maximum score then multiplied by 100. The level of students' improvement was calculated by using the N-gain equation (Hake, 1998) with criteria: 0.00-0.29 (low); 0.30-0.69 (moderate); 0.70-1.00 (high). Furthermore, to determine the significance of the impact of environmental-based physics learning, the pre-test and post-test data were calculated using statistical tests assisted by SPSS 16.0. The statistical test begins with the normality test. When the data is normally distributed, the statistical test is continued with the Paired t-test. However, if the data is not normally distributed, the Wilcoxon test is chosen (Sugiyono, 2016). Decision-making criteria: If the value is sig. (2 tailed)> 0.05; then there is no significant difference between the pre-test and post-test data. Conversely, if the value is sig. (2 tailed) <0.05; then there is a significant difference.

RESULTS AND DISCUSSION

Environmental-based physics learning is not only to practice physics concepts, but also to improve ecopreneuship skills. The results of the analysis of students' understanding of physics concepts and ecopreneurship are presented in Table 3.

Table 3. Student Mastery of Concept and Ecopreneurship

Students	Concept Mastery				Ecopreneurship			
	Pre-test	Post-test	N-Gain	Criteria	Pre-test	Post-test	N-Gain	Criteria
M1	43	75	0.56	Moderate	66	78	0.35	Moderate
M2	33	77	0.66	Moderate	60	85	0.63	Moderate
M3	70	90	0.67	Moderate	36	76	0.63	Moderate
M4	30	75	0.64	Moderate	56	80	0.55	Moderate
M5	35	75	0.62	Moderate	28	75	0.65	Moderate
M6	36	76	0.63	Moderate	28	67	0.54	Moderate
M7	45	82	0.67	Moderate	50	78	0.56	Moderate
M8	30	82	0.74	High	52	80	0.58	Moderate
M9	50	92	0.84	High	30	78	0.69	Moderate
M10	56	90	0.77	High	34	70	0.55	Moderate
M11	27	70	0.59	Moderate	68	83	0.47	Moderate
M12	65	85	0.57	Moderate	36	78	0.66	Moderate
M13	59	80	0.51	Moderate	56	78	0.50	Moderate
M14	44	77	0.59	Moderate	30	68	0.54	Moderate
M15	74	92	0.69	Moderate	46	80	0.63	Moderate
M16	57	73	0.37	Moderate	62	82	0.53	Moderate
M17	50	85	0.70	Moderate	22	78	0.72	High
M18	72	90	0.64	Moderate	30	85	0.79	High
M19	57	80	0.53	Moderate	34	80	0.70	Moderate
M20	45	76	0.56	Moderate	40	85	0.75	High
M21	49	77	0.55	Moderate	30	75	0.64	Moderate
M22	40	80	0.67	Moderate	30	75	0.64	Moderate

Students	Concept Mastery				Ecopreneurship			
	Pre-test	**Post-test**	**N-Gain**	**Criteria**	**Pre-test**	**Post-test**	**N-Gain**	**Criteria**
M23	67	85	0.55	Moderate	32	76	0.65	Moderate
M24	54	80	0.57	Moderate	36	78	0.66	Moderate
M25	50	90	0.80	High	56	78	0.50	Moderate
M26	50	85	0.70	Moderate	68	83	0.47	Moderate
M27	50	85	0.70	Moderate	50	78	0.56	Moderate
M28	45	82	0.67	Moderate	32	76	0.65	Moderate
M29	67	85	0.55	Moderate	40	85	0.75	High

Based on Table 3, The pre-test results show that the students' mastery of concepts and ecopreneurship is generally still low. As many as 26 out of 29 students have low mastery of the initial concept. In addition, all students have low ecopreneurship. Otherwise; after being applied environment-based physics learning; students' mastery of concepts and ecopreneurship is getting better, even though there are still 2 students who score below 70.The level of improvement from pre-test to post-test is presented briefly in Figure 1 and Table 5.

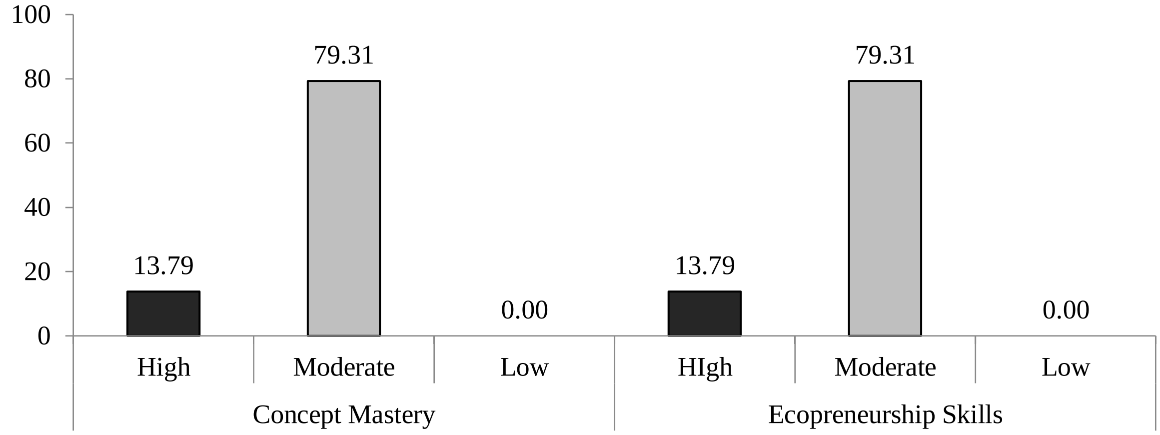

Figure 1. Level of Students' Concept and Ecopreneurship Mastery

Based on Figure 1; The N-gain value of students shows the level of improvement in student mastery of concepts and ecopreneurship in moderate (73.91%) and high (13.79%) criteria. Through environment-based physics learning, every student is able to actively participate in improving their mastery of concepts and ecopreneurship properly. This finding is reinforced by the results of the analysis of the N-gain mean presented in Table 4.

Table 4. Mean N-gain Value of Concept Mastery and Ecopreneurship

Competence	Pre-test mean	Post-test mean	N-Gain	Criteria
Concept Mastery	50.00	81.76	0.63	Moderate
Ecopreneurship	42.68	78.21	0.60	Moderate

The pre-test data (Table 4) shows that students' mastery of concepts is better than their ecopreneurship, even though both are in low criteria. The results of the researchers' interviews with students obtained information that although the basics of energy business materials had been studied in junior and senior high school, the concept of energy effort in basic physics courses was felt to be more difficult to learn. Meanwhile, the low level of ecopreneurship is because they feel they have not been used to learning physics. This finding is supported by the results of the study by Setyawati et al. (2018) that ecopreneurship received less attention from environmental science researchers from 1978 to 2018. Students are less involved in managing the environment, designing and designing environmental-based creative products (Martini et al., 2018; Nisa & Hariyono, 2019).

Otherwise; Post-test data (Table 4) shows better mastery of the concept and ecopreneurship. In addition, the N-gain mean value showed an increase in the criteria of being moderate. This is consistent with Table 2 in that students are able to understand the environmental issues that have been presented. They write their creative ideas to identify and construct energy business concepts in science issues, then design and create creative products, and communicate them well. Through interactions with other people and their environment, students can construct their own understanding of concepts and ecopreneurship (Eggen & Kauchak, 2013; Martini et al., 2018). Students as prospective entrepreneurs are expected to care more about their environment (Masjud, 2020). Thus, environment-based physics learning is able to encourage students to actively participate in being creative, innovative, and independent in designing and creating solutions to environmental problems.

Furthermore, to determine the significance of the impact of environment-based physics learning will be determined based on statistical tests assisted by SPSS 16.0. This test begins with the normality test using the Kolmogorov-Smirnof test and will be continued with the Paired t-test / Wilcoxon test. The results of statistical tests are presented in Table 5.

Table 5. Results of the Kolmogorov-Smirnov Test, Paired T-Test, and Wilcoxon Test

Learning Outcome	**N**	**Kolmogorov Smirnov**		**Paired T-Test**				**Wilcoxon Test**	
		Asymp. sig. (2-tailed)	**Normal Distribution**	**Mean**	**t**	**df**	**p**	**Z**	**p**
Concept Mastery	29	0.200 0.200	Yes Yes	-0.317	-16.94	28	0.000		
Ecopreneurship	29	0.004 0.028	No No					-4.706	0.000

The Kolmogorov-Smirnov test results (Table 5) show that the pre-test and post-test data on concept mastery are normally distributed. This data was then tested by paired t-test so that the mean value = 0.317; and at the degree of freedom (df) = 28 the value of t = -16.94 is obtained. This data is significant, because $p < 0.05$. Meanwhile, the Kolmogorov-Smirnov test results on the pre-test and post-test ecopreneurship data were not normally distributed. Therefore, the data is continued with the Wilcoxon test. The results of this test obtained z value = -4,706 and the data is significant, because $p < 0.05$. In addition, the t and z values are negative; means that there is an increase in student understanding of concepts and ecopreneurship in basic physics courses.

Students' mastery of physics and ecopreneurship concepts can be significantly improved through environment-based physics learning. Physics as part of natural science makes the environment the main foundation for thinking and behaving in identifying problems and alternative solutions (Haris et al., 2018; Nisa & Hariyono, 2019). Strengthening ecopreneurship in physics learning facilitates scientific innovation and new technological discoveries (Martini et al., 2018; Saludung et al., 2018). Students are involved as developers, inventors, and agents of innovation for society to make good use of the resources in their environment (Saludung, 2018). Creative products that have been produced by students such as: ozone generator-based sterilizers to produce sterile water, a plastic press with the use of environmentally friendly heat energy, drowsiness-relieving wristbands, use of indoor plants as natural cooling devices, use of foul water through water distillation, power plants using water turbines exploiting Lake Unesa, and wind power plants.

The limitation of this research is that students' creative products are still limited to the design of activity proposals as an ecopreneurship task in Basic Physics courses. The resulting creative products are still limited to creative and imaginative ideas, not yet creating creative products. In addition, the students' mastery of physics concepts was better than their ecopreneurship (Table 4). Learning ecopreneurship is felt to be more difficult than learning to master physics concepts. Strengthening ecopreneurship requires mastery of concepts and good creative processes (Adinugraha, 2017; Novita et al., 2018). In other terms, ecopreneurship is a bridge between mastered physics concepts and creative processes in solving environmental problems. Another weakness is the increase in students' mastery of physics and ecopreneurship concepts in moderate criteria. Therefore, reference studies and further research are still needed to facilitate students in designing and creating appropriate creative products to solve environmental problems.

CONCLUSION

Strengthening ecopreneurship in physics learning is needed to provide success in student life and career. In this study, environment-based learning has a significant impact on increasing students' mastery of concepts and ecopreneurship can be improved in moderate criteria. Strengthening student ecopreneurship strongly supports the implementation of ecopreneurship-based KKNI.

RECOMMENDATION

However, the resulting product designs are still limited to creative and imaginative ideas. The next research is to facilitate students to be able to create effective and efficient creative products.

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