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The Effect of E-modules for Wetland Ecosystem Materials on Students' Environmental Care Attitudes in Environmental Science and Disaster Mitigation Courses

Yustina[1*], Mardatilla[2]
[1]*Biology Education Graduate Program, Faculty of Teachers Training and Education, Universitas Riau, Indonesia*
[2] *Biology Education Graduate Program, Faculty of Teachers Training and Education, Universitas Riau, Indonesia*

Abstract: This study examines E-modules' effect with case-based learning on students' environmental care attitudes. This study is quasi-experimental with students from Environmental Science and Disaster Mitigation courses at Universitas Riau as subjects. In practice, students are given a questionnaire at the beginning and end of the lesson. The research parameter is environmental care attitudes with four indicators: caring attitude, participation, sustainable environmental maintenance, and preservation. Data were collected using a closed questionnaire with four Linkert scales. Data are presented and analyzed inferentially. The research results on using e-modules with an N-gain value of 0.62 were categorized as less effective in influencing students' environmental care attitudes. A caring attitude and environmental preservation are effective among the four indicators. Indicators of participation and environmental conservation are categorized as less effective. Overall, e-modules are less effective in influencing changes in students' environmental care attitudes.
Keywords: E-module, Environmental care attitude, students

1. Introduction

National education functions to shape the character and develop a dignified nation's civilization to educate the nation's life [1]. It aims to develop students' potential to become human beings who believe, have noble characters, think at a high level, are capable, independent, democratic, healthy, and responsible. Education is a system in which all components are interrelated to achieve national education goals. The components of the education system include educational goals, students, teaching staff, and educational standards and strategies [2].

Center of Excellence (CoE) Universitas Riau: Wetland Ecosystem and Disaster Management are expected to support the realization of the vision and mission in the future. However, the initial analysis in one of the general courses, Environmental Science and Disaster Mitigation, have not found a specific discussion on Wetlands as the main study. Also, an analysis of the learning guidebook for Universitas Riau (2021) course, which includes a guide to the implementation of the University Course (MKU) learning, one of which includes Environmental Science and Disaster Mitigation courses, in the Semester Learning Plan (RPS), which does not include a discussion on wetlands in detail.

Wetlands are areas of the brackish, swamp, and peat waters, naturally formed as well as artificial, permanent and temporary with flowing or still water, as well as areas of seawater whose depth at low tide does not exceed 6 meters (Ramsar Convention) [3]. Wetlands are very beneficial both economically and ecologically for the community. Knowledge of wetlands is essential in the development of the area. The community expects an increase in understanding of wetlands through formal and non-formal education [4]. The ecological benefits of wetlands include habitat for specific ecosystems, water quality control, water storage, and flooding prevention [3]. The high biodiversity in wetlands is rich biodiversity for the region itself. Knowledge of the richness of biodiversity and the protection of wetland areas needs to be applied from an early age to improve, care for, and preserve the wetland environment [5].

One source of authentic learning in science learning is the environment [6]. Science learning is more meaningful if the environment is integrated into the learning process [7]. Students play a direct role in developing knowledge and environmental benefits for the surrounding community [8]. Problems in the wetland environment have inspired the creation of unique products by creative individuals who care about the environment and provide solutions to environmental problems in real life [9]. Based on this, knowledge of science-physics alone is not enough for students. It is necessary to improve their role and concern for the environment. Human behavior is the main factor destroying the wetland environment globally [10].

Currently, environmental damage is very concerning [7] because environmental concerns are still low [10]. Observation results show that environmental care actions in wetlands have so far only been carried out by a few groups of environmentalists, not yet cultivated in the community and the world of education. The results are

supported by [11] research that the knowledge of the academic community of UIN Iman Bonjol Padang about environmental care is very good, but the participation is still quite good. Students do not understand environmental-oriented learning [12].

Mismanagement of the environment, especially wetlands, illustrates the lack of understanding and knowledge about the uniqueness, complexity, and vulnerability of wetland ecosystems and the natural relationship between wetlands, biodiversity, carbon, and water [13]. It is necessary to improve teaching and environmental care for students. CPMK (Course Learning Outcomes) is expected to improve student competence in final assignments and research products. It can be applied in community service to increase knowledge, skills, awareness, and community participation in the environment, improving environmental sustainability and community welfare in the land area, especially wet. Students' environmental care attitude is assessed based on four indicators: caring attitude, participation, and sustainable environmental maintenance and preservation [14].

Based on the above, to support the realization of the vision and mission of Universitas Riau in promoting the Center of Excellent (CoE) UNRI: Wetland Ecosystem and Disaster Management, the authors developed a product of an E-module to increase learning resources and students' environmental care attitudes in learning Environment Science and Disaster Mitigation.

2. Methodology

2.1 Research Site

This research was conducted in March-April 2022 at the Biology Education Study Program, Universitas Riau, during the Even Semester of 2021/2022. It is quasi-experimental research. Students from two classes of the Biology Education Study Program, Department of Mathematics and Natural Sciences Education (PMIPA) Faculty of Teachers Training and Education (FKIP) Universitas Riau were the population in this study. The sample is determined by saturated sampling, a sampling technique with all populations [15]. The experimental and control groups were determined by random sampling (lottery). The experimental class uses the e-module, and the control class does not use the e-module.

2.2 Research Design

The research design was a pretest-posttest control group design (Figure 1).

Figure 1. Research Design of pretest-posttest control group design.

EC	O1	X1	O3
CC	O2	X2	O4

Description:
EC: Experimental Class
CC: Control Class
O1: The initial environmental care attitude in the experimental class
O2: The initial environmental care attitude in the control class
X1: Using e-modules
X2: Without using e-modules
O3: The final environmental care attitude in the experimental class.
O4: The final environmental care attitude in the control class.

2.3 Data Collection

The instrument used is a questionnaire to determine students' environmental care attitudes. The questionnaire used for the pretest-posttest was validated first by testing the questionnaire on 20 fourth-semester students who had studied wetland ecosystem material as respondents. The trial consisted of 30 statement items regarding the environmental care attitudes following the indicators. It contained ten invalid items, and 20 valid statement items were used. The environmental care attitude was obtained through the pretest and posttest scale so that each group obtained an initial and final score. The implementation of the research includes the pretest, the learning process of environmental care attitudes, and the posttest. The following is the outline of the environmental care attitudes (Table 1).

Table 1. Outline of the questions about the students' environmental care attitude (Modification: [14])

Indicators	***Aspects observed***
Caring attitude	1. Care for cases of damage to wetland ecosystems 2. Have a curiosity about the policy and management of wetland ecosystems 3. Disseminate correct information about environmental management
Participation	1. Reforestation in degraded wetland areas 2. Comply with policies related to sustainable environmental management 3. Provide solutions for the development of a pleasant environment
Environmental care actions	1. Maintain the cleanliness and beauty of the environment around the house, campus, and surrounding wetlands 2. Reduce electricity consumption (using energy-saving electronic devices) 3. Save water
Sustainable environmental conservation actions	1. Maintain natural ecosystems by not destroying them 2. Comply with all regulations and policies regarding sustainable environmental conservation by separating organic and inorganic waste 3. Interested in researching sustainable environmental conservation

2.4 Data Analysis

In the questionnaire, three aspects are observed on each indicator of environmental care attitude. The most appropriate answer choice is given in the column (1, 2, 3, and 4) for aspects that are implemented or not. Put a mark (√) on point 4 if the answer meets all three aspects of each indicator; Put a mark (√) on point 3 if the answer statement meets two aspects of each indicator; Put a mark (√) on point 2 if the answer meets one aspect of each indicator; Put a mark (√) at point 1 if none of the aspects meets each indicator.

The data obtained is a score. The data will be converted into a value (N). The score obtained (Sn) is divided by the maximum score (Sm) multiplied by the maximum value of 100 [16], then it determines the mean, minimum value, maximum value, and standard deviation (Sd). To determine the effect of the e-module on environmental care attitudes, the data used is in the form of a gain score (g) which is the result of reducing the posttest average (Sf) with the pretest mean value divided by the maximum value (100) minus the pretest average value. The interpretation of the gain index (g) is in Table 2 below.

Table 2. Category of Analysis Results Using Gain Score (Source: [17])

Value < g >	***Category***
> 0,7	High/Effective
0,3 – 0,7	Medium/Less Effective
< 0,3	Low/Not effective

3. Results

3.1 Students' Environmental Care Attitudes

Students' environmental care attitudes are reviewed based on the results of the pretest and posttest, which are presented in Table 3 below.

Table 3. Students' Environmental Attitudes Based on Pre-and Posttest

No	**Test**	**Number of students**	**Min score**	**Max score**	**Mean**	**Standard Deviation**
1	Pretest of the control class	20	54	69	62,7	3,656
2	Posttest of the control class	20	65	80	73,3	4,631
3	Pretest of the experimental class	21	48	65	57,8	4,675
4	Posttest of the experimental class	21	79	93	86,8	4,321

3.2 Details of the Effect of Students' Environmental Care Attitudes in the Control and Experiment Class

Students' environmental care attitudes based on the pretest and posttest of the control and experimental class (Table 4) are as follows.

Table 4. Students' Environmental Attitudes Based on Pre-and Posttest in Control and Experimental Classes

No	Indicator	Control class					Experimental class				
		Control class		Category		N-Gain	Experimental class		Category		N-Gain
		Pre	Post	Pre	Post	Control	Pre	Post	Pre	Post	Experimental
1.	Care	61,8	70,8	M	H	0,24 (Not effective)	55,5	87,1	M	VH	0,71 (Effective)
2.	Participation	52,5	62,5	L	M	0,21 (Not effective)	48,3	73,3	L	H	0,48 (Less effective)
3.	Maintenance	63,8	73	M	H	0,25 (Not effective)	60	87,9	M	VH	0,70 (Effective)
4.	Preservation	59,8	71,5	M	H	0,29 (Not effective)	55	81,2	L	H	0,58 (Less effective)
	Average	58,5	72,0	M	H	0,25 (Not effective)	54,7	82,4	L	VH	0,62 (Less effective)

Description: L = Low, M = Medium, H = High, VH = Very High

The results of a more detailed study of each indicator (Table 4) are described as follows. The caring attitude indicator in the control class with an N-gain value of 0.24 is categorized as not effective. The experimental class with an N-gain value of 0.71 is categorized as effective.

Discussion

The high value of N-gain on the caring attitude indicator in the experimental class is influenced by the provision of e-modules because, in the e-module, there are task features that stimulate students to solve cases related to problems in the wetland ecosystem with an outline of environmental care attitudes. The task features in the e-module stimulate students to understand the meaning of environmental care, design creative learning to practice caring attitudes, and habituation of environmental care in daily life by caring about cases of damage to wetland ecosystems, having curiosity about policies and wetland ecosystem management, and disseminating correct information about environmental management.

The result is in line with research by [14], which states that students' attitudes toward wetlands have increased by getting used to environmental care in everyday life. [18] states that environmental care is an attitude aimed at realizing harmony and balance between humans and the environment creating environmental people who have the attitude to protect and foster the environment and realize the responsible use of natural resources.

The indicator value of participation in the control class, the N-gain value of 0.21, is categorized as not effective. In the experimental class, the N-gain value is 0.48 in the less effective category. The low participation of environmental care in the control class is the result of ignorance or lack of understanding of cases related to wetland ecosystems and also how to participate in handling these cases. In the experimental class, the increase in the participation indicator is less effective because the task features have been given a participation outline for the wetland ecosystem, only in practice in everyday life has not been carried out by students. Students have not participated in reforestation activities in degraded wetland areas and have not fully complied with policies related to sustainable environmental management. Students also have not been involved in the community that cares about fire as an initial solution to ignorance about peatland fires and their root causes—also, not participating in waste bank activities to create a clean, neat, and beautiful environment. This is in line with research by [18], stating that the imbalance between the initial hypotheses of the research was caused to stimulate participation in environmental care not only to be realized by learning in the classroom but also to be carried out outside the campus with activities planned in a structured manner.

The environmental maintenance indicator in the control class with an N-gain of 0.25 is categorized as not effective. The experimental class with an N-gain of 0.70 is categorized as effective. In the experimental class, students have been trained with the environmental maintenance indicator outline on the task features in

the e-module. The e-module presents task features by loading cases related to wetland ecosystems. The students are stimulated to solve the case by being given a guide in the form of a content outline of environmental care attitudes on environmental maintenance indicators, including maintaining the cleanliness and beauty of the environment around the house, campus, and surrounding wetlands, reducing electricity consumption (using energy-saving electronic devices), saving water, and not throwing and burning trash anywhere. The sub-indicators tested are also students' daily habits in maintaining the surrounding environment. Research by [19] states that in improving the attitude of caring for the environment by maintaining the environment, it is necessary to provide signs or instructions to create an understanding of maintaining a good environment.

The indicator of sustainable environmental preservation in the control class with an N-gain of 0.29 is in the ineffective category, and the experimental class with an N-gain of 0.58 is in the less effective category. The use of e-modules in the experimental class has stimulated students' environmental conservation attitudes through task features where cases related to wetland ecosystems are presented, for example, sedimentation in estuary ecosystems, but have not been able to improve attitudes towards sustainable environmental preservation significantly. This is due to the preservation of the sustainable environment. The community or students, in particular, need to pay attention to several things: maintaining natural ecosystems by not destroying them, complying with all regulations and policies regarding sustainable environmental conservation, being aware of the importance of maintaining a sustainable environment, having their programs in sustainable environmental conservation such as activities routine in maintaining environmental cleanliness, reforestation and disaster mitigation, interested in researching sustainable environmental preservation. However, in practice, students have not been able to do this, especially in having a program for sustainable environmental preservation, and are interested in conducting research in sustainable environmental preservation. [20] states that increasing students' knowledge about environmental conservation is not only from educational institutions. Collaborating with parents, the community, and cleaners are essential to create people who care about environmental conservation to realize sustainable development.

The research results show that the average environmental care attitude of students in the control class is categorized as not effective, with an N-gain value of 0.25. In the experimental class, an N-gain value of 0.62 is categorized as less effective. In general, the e-module material on wetland ecosystems using the case-based learning, which was developed with the parameter indicators of caring attitude, participation, and sustainable environmental maintenance and preservation, has not been able to significantly increase students' environmental care attitudes (in the less effective category). Indicators of participation and sustainable environmental preservation are in the less effective category. This is because forming participation and sustainable environmental preservation takes a long time, and habituation by students to participate directly in the environment to overcome environmental problems. Sustainable environmental preservation must be supported by a good forum and adequately programmed by the local government so that students take part in the implementation of sustainable environmental conservation programs. For example, students are involved in researching sustainable environmental preservation.

Practicing an environmental care attitude is undoubtedly accompanied by positive habits and punishments for those who violate the regulations related to environmental sustainability that have been made. According to [21], the environmental care attitude shows efforts to prevent and repair natural damage. The attitude structure consists of three interrelated components: knowledge, feeling, and tendency to act. If one of the three attitude components is manipulated, it will affect the other components, causing a mechanism for attitude change [22].

The limitation of this research is the lack of features in e-modules that train students to be more interactive and authentic in realizing the students' essential roles in preserving the environment, especially wetlands. Based on this, environmental science courses should focus on theory and involve the environment as a natural learning resource. Students and their interactions with the environment not only improve understanding and mastery of concepts but can also develop their ideas in finding solutions to existing environmental issues. [23] emphasize that the linkages of natural science, society, technology, and the environment must be considered in determining the learning strategies to implement. In addition, the attitude of caring for the environment can be improved by integrating environmental education into the entire formal education system and school curriculum with specific pedagogical strategies that make the environment a place and source of learning [10]. [10] explains that environmental management by involving all components of society to help each other can change people's thinking in good sustainable environmental management.

4. Conclusion

The use of e-modules to improve students' environmental care attitudes from the four indicators of caring attitudes and environmental conservation is categorized as effective. Indicators of participation and environmental conservation are categorized as less effective. Overall, e-modules are less effective in influencing changes in students' environmental care attitudes. It is necessary to make improvements and specific features in the e-module so that the indicators of student environmental care are appropriately realized, and better environmental management is created.

5. References

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