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Development of ecopedagogy in green campus educational book based on environmental pollution cases related to biology learning

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ABSTRACT

Ecopedagogy education related to green campuses requires further innovation related to learning media. This study aims to develop a book on ecopedagogy education in a green campus based on environmental issues. The method of research and development in this study's is based on the ADDIE approach with five stages. The first stage of this research is conduct an initial data analysis, which will be the basis for developing the Ecopedagogy. The second stage is design the educational media. The third stage is the development process and validation of media experts. The fourth stage is the implementation, and the last stage of developing this book media is to conduct an evaluation given by students; the form of an assessment of the book. This study's results indicate that the ecopedagogy education media series on environmental issues on a green campus is categorized as very valid. Hence, it is suitable for use in learning activities. The results of this study indicate that the media series of ecopedagogy education can improve student learning outcomes based on the results of the pre-test and post-test. The development of learning media is essential to train students' skills in critical thinking. Suggestions for future research include implementing media on a broader scale.

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Keywords
Ecopedagogy, Green campus, Learning media

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INTRODUCTION

Environmental education is an effort to protect the environment that is feasible at various levels of education, one of which is higher education. Environmental education can be expressed differently in multiple learning activities (Muthukrishnan & Kelley, 2017; Sudhakaran et al., 2017; Zerinou et al., 2020). Ecopedagogy represents a variant of environmental education applicable within higher education, particularly concerning contemporary current issues faced by students. . (Kinyota, 2021; Okur-Berbeglu, 2015). The effort to establish a green campus is essential for the continuity of education based on sustainable development in biology learning.

Green campus is a campus concept based on sustainable development that considers environmental aspects (Locicero & Trotz, 2018; Nisar et al., 2021). Campuses implementing this program usually have programs or activities based on ecological behavior in various aspects of student life on campus. One of them is related to the role of students in preserving the environment on campus by carrying out multiple programs such as the Waste Recycling Movement, Waste Bank,

and the Zero Waste Movement (Bravo-Venegas et al., 2023; Wilson et al., 2023). This movement can start from a program in each class and then be continued in the form of community service activities, one of the tasks of the Tridharma of higher education in Indonesia.

Developing learning tools such as media is essential in improving ecopedagogy based on green campuses. Previous studies have not explained the development of ecopedagogy media in detail. This makes the development of media related to ecopedagogy urgent and needs to be carried out in this study. Likewise, associated with the green campus, many teaching materials and media still do not match the needs and relevance of 21st-century learning media. This is because implementing a green campus will be more meaningful if accompanied by implementing environmental protection behavior following the principles of sustainable development (Saracevic et al., 2022; Wesselink et al., 2017). There are several essential aspects in forming a green campus, namely aspects of energy conservation, student transportation, waste reduction, green consumption, recycling, and contributing socially. Efforts to overcome these problems can certainly be reflected in the environmental behavior of students in their daily lives. The limitations of existing media related to green campus media are more related to the content used, which is still general and not based on ecopedagogy elements. So, integration between ecopedagogy and the green campus is needed in this study.

Students' knowledge of the environment in the form of environmental learning outcomes is also essential in biology learning (Santi et al., 2019; Yusliza et al., 2020). This is because learning outcomes begin the formation of environmentally friendly behavior. Several previous studies have shown that student learning outcomes in the environment are significant and influence environmental attitudes and behavior. Other studies state that learning strategies are essential in shaping student knowledge and developing learning media. Several of these studies reinforce that educational innovation is crucial in shaping optimal student learning outcomes, especially on the issue of green campuses. Developing this ecopedagogy book is necessary because students' understanding of green campuses is still not optimal, so innovative media is needed. The need for ecopedagogy media is also relatively high, and more detailed innovation development is required related to the ecopedagogy content developed in the book, which is still unavailable in the current media. Developing ecopedagogy books is urgent because students' knowledge related to green campuses needs to be improved under student behavior based on pro-environmental behavior. Understanding the environment will be more meaningful when students study various environmental cases, so problem-based learning is vital in lectures.

Concerning environmental learning based on ecological problems, it is necessary to empower problem-based learning in lectures. Problem-based learning, in this case, is also meaningful because many aspects of problem-based learning support the formation of critical thinking skills in students. The lack of media that discusses green campuses is an innovation of this research, so this research is urgent to be carried out. This makes integrating learning media with the topic of green campus combined with learning based on environmental problems an interesting thing to study in more depth. Problem-based learning can make students better understand ecological issues, including green campuses and ecopedagogy. This study aims to develop a series of Ecopedagogy in green

campus education books based on environmental problems for students in elementary education programs and early childhood education.

METHOD

This research uses the research and development method using the ADDIE approach (analyze, design, develop, implement, and evaluate), which contains five crucial stages (Branch, 2009). The stages of ADDIE can be seen simply in Figure 1.

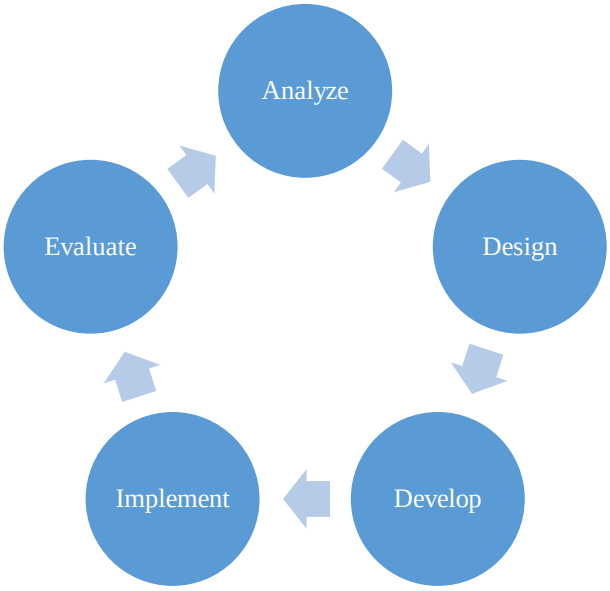

Figure 1. Research stages using ADDIE

This approach was chosen because it is easy to use and widely used for research and development of learning media. This research was conducted in July-August 2024 at Mohammad Husni Thamrin University. The first stage of this research is to conduct an initial data analysis, which is the basis for developing the Ecopedagogy in Green Campus Education book media based on environmental pollution cases. The second stage is to design the educational media that will be created. The Education Media developed is an Ecopedagogy Education series book consisting of 15-20 pages and containing 3 Chapters. The third stage of the development process were carried out using *Canva*, *Microsoft Word*, and various other supporting applications. In this stage, the validation were carried out by media experts with the following categories. The range of score and validation categories shown in Table 1.

Table 1. Range of scores and validation categories

Interval Score	Category
$3{,}25 < x \leq 4{,}00$	Very Valid
$2{,}50 \leq x \leq 3{,}25$	Valid
$1{,}75 < x < 2{,}50$	Less Valid
$1{,}00 < x < 1{,}75$	Invalid

Sources: (Ratumanan & Laurens, 2011)

The fourth stage is implementing the study program of elementary education and early childhood education at Mohammad Husni Thamrin University, which is implemented in the sense of providing the media to respondents. The last stage of developing this book media is to conduct an evaluation given by students, namely in the form of an assessment of the book.

RESULTS AND DISCUSSION

The study results show that the developed ecopedagogy book media has three chapters that discuss a Glance at Ecopedagogy, Ecopedagogy in Schools, Ecopedagogy, and Green Campus. The design results indicate that the developed ecopedagogy book is approximately 15 to 20 pages long. The results of the media development shown in Figure 2.

Figure 2. The ecopedagogy education series book that has been developed

The student-level learning was assessed using valid and appropriate categories. The validation process included evaluations by both material and media experts. The results of the material validation are presented in Table 2.

Table 2. Results of validation by material experts related to ecopedagogy books

No	Validator	Score	Category
1	Material experts I	3.76	Very Valid
2	Material experts II	3.70	Very Valid

The results of the validation of materials related to the media of the Ecopedagogy Education book show that the categories obtained about the media are valid and suitable for use in learning. The results of the media shown in Table 3.

Table 3. Results of media expert validation related to ecopedagogy books

No	Validator	Score	Category
1	Media Experts I	3.94	Very Valid
2	Media Experts II	3.94	Very Valid

The results of the implementation of media on students show that the media used in the learning of elementary education programs and early childhood education study programs have a significant category based on the t-test, which compares the experimental group and the control group. The t-test result is based on the *sig value* <0.05, which can be interpreted as the t-*count value*> t-table. The results of the statistical test using the t-test to compare pre-test and post-test scores shown in table 4.

The media developed is feasible and can be used in learning. Ecopedagogy education media is essential to shape students' character in protecting the environment. Student learning outcomes in

the context of environmental education show a close relationship between ecological learning outcomes and the use of appropriate learning media.

Table 4. Results of statistical tests using the t-test

Mean	Std. deviation	t	df	Sig (2-tailed)
21.66	15.78	5.13	13	.000

Students need an integrated learning media, which is ecopedagogy education media based on cases and environmental problems. Media that raises a problem then accompanied by a case-based learning strategy will make it easier for students to practice critical thinking skills that students should have as agents of change (Istiyono et al., 2020; Sigit et al., 2017; Suryanda et al., 2016). Critical thinking skills consist of several essential aspects, including logical and systematic thinking (Budiarti et al., 2016; Maclean & Pavlova, 2017). Cases created in the form of integrated learning media, in the form of ecopedagogy series books, will make it easier for students to practice their critical thinking skills.

In this case, the developed ecopedagogy book media has limitations related to broader access to various study programs at different faculties. This is because ecopedagogy or environmental education courses have not been intensively given to students. Undoubtedly, this innovation must be carried out in the future for better innovation. The limitations of the use of ecopedagogy books can be overcome by improving the curriculum at the tertiary level so that many study programs will be able to use this book. Ecopedagogy is an innovation that requires students to improve their critical thinking skills to a high level. These critical thinking skills certainly cannot just appear out of nowhere but must be trained by conducting more critical learning. Ecopedagogy implemented in schools conventionally needs to be improved by prioritizing the content aspect of learning. The content in ecopedagogy must, of course, be more substantial than general environmental learning.

The developed ecopedagogy book also integrates thematic characteristics of biology learning through the green campus. The theme raised in the ecopedagogy book is considered relevant because the green campus is a picture of an ideal campus environment that students can own as users of the book. The green campus will be realized by involving all ranks of students and lecturers who already understand the importance of ecopedagogy and the purpose of a green campus. Green campuses, in general, will be beneficial for students and lecturers because a comfortable campus atmosphere will provide a congenial educational environment, and there will be many abilities that students can train. The development of green campus facilities to support the achievement of green campus must, of course, be accompanied by changes in students' pro-environmental behavior so that existing facilities and infrastructure can be maintained properly (Jonell et al., 2016; Prati et al., 2017; Scopelliti et al., 2022).

Integrating books with the theme is crucial because learning media will be more meaningful with a precise integration between the theme and the competencies to be mastered. One form of integration that is relatively effective is the use of integrated learning media development. Effective learning media must, of course, follow the needs of the media and must be able to be used more effectively and efficiently in biology learning (Astuti et al., 2017; Kruikemeier et al., 2018). Effective and efficient media means that the media used must follow the time allocation planned for learning. The effectiveness of the media referred to in this context is that the media used must facilitate students'

abilities to train their competencies in learning. The student abilities referred to in the ecopedagogy approach are certainly more specific to solving environmental problems. Learning media has a role in providing information to students related to environmental issues and possible problem-solving skills.

21st-century learning media, in accordance with the needs of the times, must also be based on technology that can be used quickly and safely (Elleithy & Sobh, 2015; Martin & Betrus, 2019; Scherer et al., 2017). 21st-century education, in addition to prioritizing the 4C aspects, namely critical thinking, creative thinking, communication, and collaboration, also prioritizes the application of behavior and implementation of concepts that have been studied theoretically. 21st-century education does not only talk about general student abilities, but the abilities trained in students must be specific so that they can compete in the 21st century. One of the things that can be done is to develop ecopedagogical learning media. The developed ecopedagogy education book has advantages, including being digital-based and not in physical form to make it easier for students to use it. Students certainly need flexible and innovative learning media to support better education in the future. Ecopedagogy is indeed an appropriate framework for transforming students into participants in environmental education focused on sustainable development.

Ecopedagogy can be applied in various forms, not only as a learning medium. Ecopedagogy applied in the form of student activities can also help improve students' ability to solve environmental problems. Students can participate in solving ecological problems directly in the community. Of course, this must be done by integrating ecopedagogy activities in the form of activities in the community that have a more significant impact on environmental change. Environmental problems that usually occur and require problem-solving are related to climate change, global warming, and illegal forest destruction. Ecological damage that humans generally cause should be prevented by providing education to the students associated with the dangers and impacts of forest environmental damage (Septian, 2021). One of the problems that can be overcome is by making more fundamental curriculum changes. A curriculum following the development of the 21st century will be able to have an impact on improving the quality of student behavior, especially related to environmental protection behavior.

The curriculum that is developed should also highlight the biodiversity that exists in each region in Indonesia. It is better if various biodiversities are studied in the form of an ecopedagogy curriculum at multiple levels of education, from elementary and secondary to higher education. A relevant curriculum will certainly be able to help form student behavior that is more environmentally conscious and has broad insight related to biodiversity in their respective regions. An appropriate curriculum also plays a vital role in providing ecopedagogy content in accordance with students' needs to develop their thinking and behavior.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the media of the Education series of ecopedagogy in green campus based on environmental problems is valid and suitable for use in learning. The Education series of books used for environmental learning for elementary education programs and early childhood education students has been implemented. The results show an increase in scores before and after learning using the developed Education series

of ecopedagogy books. Suggestions for future research should use the implementation on a broader scale to see its effectiveness not only for elementary education or early childhood education program students but also for elementary and secondary school levels with a more relevant variation of the Education series of ecopedagogy books.

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