BESTARI: Jurnal Pendidikan dan Kebudayaan
https://jurnalstkipmelawi.ac.id/index.php/JBPK
E-ISSN: 2746-8062

Development of Discovery Learning-Based Student Worksheets in Environmental Ecopedagogy for University Students

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Abstract

Ecopedagogy is a field of study that examines the environment through exploration of the natural surroundings. The discovery learning approach has the potential to enhance ecopedagogy instruction supported by student worksheets. This study aimed to develop discovery learning-based student worksheets for the ecopedagogy course within the Elementary Teacher Education program. The study employed the Research and Development (R&D) method using the 4D model (Define, Design, Develop, Disseminate). The results indicate that the developed student worksheets are suitable for instructional use. Ecopedagogy is a course that requires direct field observation. The dissemination phase involved 20 university students from the Elementary Teacher Education program. In conclusion, this study successfully developed discovery learning-based student worksheets for the ecopedagogy course.

Keywords: Student Worksheet, Ecopedagogy, Discovery Learning

Submitted: 11 October 2026; Reviewed: 26 October 2026; Accepted: 31 October 2026
DOI: 10.46368/bjpd.v7i2.5479

Pengembangan Lembar Kerja Mahasiswa Berbasis Discovery Learning dalam Ekopedagogik Lingkungan untuk Mahasiswa Perguruan Tinggi

Abstrak

Ekopedagogik merupakan sebuah ilmu yang mempelajari kajian tentang lingkungan hidup yang harus dieksplorasi dari alam sekitar. Pendekatan discovery learning berpotensi membuat pembelajaran ekopedagogik menjadi lebih meningkat digunakan dengan berbantuan lembar kerja mahasiswa. Tujuan dari penelitian ini adalah untuk mengembangkan lembar kerja mahasiswa berbasis discovery learning pada ecopedagogy untuk mahasiswa program studi pendidikan guru sekolah dasar. Metode penelitian yang digunakan dalam penelitian ini adalah dengan research and development (R&D) dengan menggunakan pendekatan define, design, develop, disseminate (4D). Hasil dari penelitian ini menunjukkan bahwa hasil dari pengembangan menunjukkan bahwa produk lembar kerja mahasiswa dapat digunakan untuk pembelajaran. Mata kuliah ekopedagogik merupakan sebuah mata kuliah yang memerlukan observasi lapangan secara langsung. Diseminasi diberikan kepada mahasiswa program studi pendidikan guru sekolah dasar dengan jumlah 20 mahasiswa. Kesimpulan dari penelitian ini adalah bahwa pengembangan lembar kerja mahasiswa berbasis discovery learning pada mata kuliah ekopedagogik.

Kata Kunci: lembar kerja mahasiswa, ekopedagogik, discovery learning

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INTRODUCTION

Ecopedagogy is a course that examines the role of the environment within specific settings, such as university campuses or schools. Ecopedagogy has a vital role in fostering a deeper understanding of the environment among students. One potential topic for study involves observing the plant life found within the campus environment. Plant observation entails identifying various plant species in the surrounding area and conducting a descriptive analysis of the observed specimens. Ecopedagogy serves as a supporting course that equips students with knowledge regarding the environment (Kinyota, 2021; Misiaszek, 2020; Rodrigues, 2018).

Discovery learning is one instructional strategy that can be employed in this context. This approach prioritizes out-of-classroom learning through the exploration of the surrounding environment (Sari & Harjono, 2016; Syafi'i et al., 2014; Umam et al., 2019; Winarni et al., 2020). Discovery learning enhances the meaningfulness of the educational experience, as students gain valuable insights by directly observing their surroundings. Findings from these observations can be recorded on student worksheets, which document the data gathered on the various plant species examined in the field. The use of student worksheets is essential for supporting ecopedagogy instruction.

Student worksheets are documents that capture students' thoughts and observations regarding their environment. They provide instructions and guidelines for the activities to be carried out during a learning session. These worksheets can be integrated with various instructional models and represent an innovative learning tool capable of enhancing student competencies specifically creative and critical thinking skills, as well as communication and collaboration abilities. Collaboration skills are among the abilities that students must possess in the 21st century, particularly those at the university level.

Previous research indicates that the use of worksheets can improve learning outcomes in the 21st-century educational landscape (Atasoy & Ergin, 2017; Santoso et al., 2021; Utami et al., 2016; Verdina et al., 2018). They provide a structured guide for students to record their field observations. Effective student worksheets must prioritize readability, ensuring that instructions are clear and that there is adequate space for recording observational data. Other relevant research findings indicate that discovery learning can foster curiosity among students, thereby influencing their learning motivation. Findings from other studies confirm that the use of instructional models generally encourages university students to exercise their critical thinking skills.

Given these points, there is a pressing need to develop discovery-learning-based student worksheets for the ecopedagogy course. This urgency arises from the current lack of student worksheets specifically addressing ecopedagogy based on the discovery-learning model. Consequently, it is essential to develop worksheets that are more relevant to the evolving needs of 21st-century higher education. Therefore, the aim of this study is to develop discovery-learning-based student worksheets for the ecopedagogy course within the Elementary Teacher Education study program in University of Mohammad Husni Thamrin.

METHODS

This study employs the 4D research and development method, which comprises four primary stages: define, design, develop, and disseminate (Thiagarajan et al., 1974). The 4D model is a research and development framework focused on creating instructional products. The process begins with the "define" stage, identifying the need for a student worksheet, which is carried out by administering a survey questionnaire to students. In the 'define' phase, a questionnaire was administered to gather information regarding the status of student worksheets in the Elementary Teacher Education study program in University of Mohammad Husni Thamrin. The survey was conducted in October 2026. A total of 10 students, serving as representatives of the Elementary Teacher Education students, were selected as respondents. The findings from this stage serve as the basis for the subsequent "design" stage. The second stage involves designing the student worksheet to be developed. The third stage entails the actual development of the instructional product (the student worksheet) and includes a validation process involving two instructional experts. The validation categories are presented in the following table.

Table 1. Score validation category

Percentage Score	Categories	Eligibility Statement
81 % - 100%	Very Valid	Can be used without repair
61 % - 80%	Valid	Can be used with minor improvements
41 % - 60%	Less Valid	Can be used with major improvements
21 % - 40%	Invalid	Must not be used
0% - 20%	Very Invalid	Must not be used

Source: (Akbar, 2013)

The fourth stage involves the dissemination of the student worksheets developed during the research. Data analysis was conducted using descriptive statistics by comparing the average scores for each category.

RESULTS AND DISCUSSION

The results from the 'define' phase indicate that the majority of respondents completed the questionnaire reported that worksheets for ecopedagogy are not yet available at the university level, highlighting the need for further development. These findings serve as the foundation for the subsequent 'design' phase. The resulting design outlines three key features of the developed worksheets: the materials consist of two student worksheets incorporating ecopedagogical content, with a predominant green color scheme. The results of this develop stage indicate that the student worksheet consists of two sheets, each serving a distinct explanatory function. The layout of the student worksheet is shown in the following figure.



Figure 1. Results of the student worksheet development for Sheet 1



Figure 2. Results of the student worksheet development for Sheet 2

The validation results indicate that the assessment by instructional experts falls into the "very valid" category. This demonstrates that the student worksheet is suitable for use in ecopedagogical instruction. The validation results for the student worksheet are presented in the table below.

Table 2. The results of expert validation regarding the student worksheet

No	Expert	Score	Category
1	First-Leaning Expert	87.50	Very Valid
2	Second-Learning Expert	87.50	Very Valid

The detailed results of the validation for each item and indicator, as assessed by the learning expert, are presented in the following table.

Table 3. Validation results by individual item

Items	Score from Learning Expert I	Skor Ahli II
1. Activity instructions are presented systematically	3	4
2. The student/learner worksheet contains essential activities	4	4
3. Instructions are presented in a context appropriate for project-based learning	3	3
4. The student/learner worksheet can be used across various topic	4	4
5. The activities presented help enhance Higher-Order Thinking Skills (HOTS)	4	3
6. The language adheres to standardized spelling rules	4	3

Items	Score from Learning Expert I	Skor Ahli II
7. The language used is appropriate for the given context	3	3
8. The language used is communicative	3	4
9. The sentences used are clear and easy to understand	3	3
10. Sentence structures are complete and follow grammatical rules	4	4

The fourth stage of this research involved dissemination, specifically by distributing the student worksheets to 20 university students in the Elementary Teacher Education program at University of Mohammad Husni Thamrin. The research results confirm that these worksheets are suitable for use in the instruction of fifth-semester students in the Elementary Teacher Education program. Furthermore, the findings indicate that the developed worksheets can enhance the quality of learning for students participating in field-based coursework, specifically in the area surrounding the University of Mohammad Husni Thamrin in Jakarta.

The study demonstrates that the student worksheet represents an innovation in the context of ecopedagogy. Student worksheets are instructional tools that should be incorporated into lesson planning for 21st-century education (Boulden, 2021; Chalkiadaki, 2018; Talmi et al., 2018). This aligns with the demands of 21st-century learning, which prioritizes critical thinking, higher-order thinking, communication, and collaboration skills. Fundamentally, the worksheets train students to think critically while observing issues in their immediate environment, serving as a practical implementation of a more comprehensive approach to learning.

The innovative student worksheet represents a form of holistic instructional development. Students are introduced to theoretical concepts via textbooks and subsequently engage in practical exercises through these worksheets. Ecopedagogy is a course that emphasizes direct exploration of the natural environment (Kinyota, 2021; Misiaszek, 2020). Integrated into the course, the worksheets provide a structured space for students to record their observations of the surrounding environment. These recorded observations serve as an indicator of the students' proficiency in applying the discovery learning method. This worksheet potentially effectively to boost learning outcomes and motivation, these worksheets should be integrated with relevant instructional models such as discovery learning, project-based learning, or problem-based learning.

Active learning approaches that prioritize discovery learning offer several benefits, including fostering a deeper understanding among students. Such approaches provide students with direct field experience and help cultivate their critical thinking skills. The first benefit is a deepening of student understanding; direct observation presents real-world conditions more tangibly, allowing students to explore the actual situation. These observations provide data that can be recorded on student worksheets. Second benefit is that students witness facts firsthand in the field, leading to more accurate data collection. Ultimately, this approach utilizing discovery learning in the field potential to enhances university students' critical thinking skills. This occurs because students are trained to identify real-world problems on-site, analyze the situation, and devise solutions to the issues at hand.

Ecopedagogy is a course that inherently requires fieldwork for effective study. It is a discipline demanding a detailed understanding of the environment to ensure its future sustainability. Real-world facts offer greater clarity than the theories found in textbooks. Field-based instruction presents detailed information, enabling students to analyze situations and exercise their critical thinking abilities. Student worksheets serve as a potential supplement to improve the quality of field-based ecopedagogy instruction. This aligns with the principles of direct environmental learning, which prioritize understanding the surrounding natural environment through firsthand observation (Meitiyani et al., 2022; Nwankwoala, 2015; Wang et al., 2022). Conducting classes via direct observation, supported by student worksheets, has the potential to significantly deepen students' understanding of the subject matter.

CONCLUSION

Based on the research findings, it can be concluded that student worksheets based on discovery learning within an ecopedagogy framework are suitable for use in university courses. Dissemination was conducted with 20 students from the Elementary Teacher Education program. Ecopedagogy is a course that prioritizes direct field observation to gather facts that accurately reflect actual conditions on the ground. Future research should aim to measure the effectiveness of these ecopedagogy-based, discovery-learning student worksheets.

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