

Student Worksheets Integrated with the Discovery Learning Model on Environmental and Terrestrial Ecosystem Topics

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ABSTRAK

Masalah lingkungan bisa diatasi dengan berbagai cara salah satunya dengan jalur pendidikan. Tujuan dari penelitian ini adalah untuk mengembangkan lembar kerja siswa berbasis pada model Discovery Learning yang digunakan untuk siswa jenjang Pendidikan Anak Usia Dini (PAUD), Sekolah Dasar (SD), Sekolah Menengah Pertama (SMP), Sekolah Menengah Atas (SMA). Metode yang digunakan dalam penelitian ini adalah dengan research and development dengan tahapan pengembangan ADDIE (Analyze, Design, develop, Implement, Evaluate). Hasil dari penelitian ini menunjukkan bahwa produk lembar kerja siswa yang terintegrasi Discovery Learning sudah layak digunakan dalam pembelajaran. Topik ekosistem darat menjadi sebuah hal penting dikarenakan wawasan mengenai ekosistem darat perlu dikenalkan sejak dini kepada siswa.

ABSTRACT

Environmental problems can be addressed in various ways, one of which is through education. The purpose of this study is to develop student worksheets based on the Discovery Learning model used for students at the Early Childhood Education, Elementary School, Middle School, and High School levels. The method used in this study is research and development with the ADDIE development stages (Analyze, Design, Develop, Implement, and Evaluate). The results of this study indicate that the student worksheet product integrated with Discovery Learning is suitable for use in learning. The topic of terrestrial ecosystems is important because insight into terrestrial ecosystems needs to be introduced to students from an early age.

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Introduction

Environmental education implemented across various levels of education is essential and should be continuously developed. This is particularly important because numerous environmental

problems still require effective and sustainable solutions. Common environmental issues include global warming, climate change, acid rain, air pollution, and many other forms of environmental degradation (Hamada et al., 2021; Istiana & Awaludin, 2018; Mainzer & Luloff, 2017). These problems may arise, in part, from students' limited knowledge and understanding of environmental issues. Previous studies on environmental education have demonstrated that efforts to strengthen and further develop environmental education can and should be continuously pursued.

One example of previous research is the development of an eco-friendly website integrated into biology education (Fitriani et al., 2018). The findings indicated that the developed website met the required validity criteria for use in the learning process. The criteria for a valid website included ease of media access, readability of the presented content, and its ability to improve students' environmental knowledge scores. These findings confirm that website development can serve as an effective approach to enhancing the quality of students' learning related to environmental issues.

Another study related to environmental education focused on developing environmental learning through mangrove-based education. One approach involved the development of an Environmental Education Community Network learning model (Sigit et al., 2020). This model was designed to introduce students to mangrove planting activities in coastal areas as part of the learning process. Through this program, students are expected to develop a better understanding of mangrove ecosystems and their ecological importance. The development of such educational models is highly valuable for supporting the continuous improvement of students' environmental knowledge and awareness in the future.

One approach to further developing environmental education, particularly on topics related to the environment and terrestrial ecosystems, is through the development of student worksheets. Environmental learning supported by well-designed worksheets can help attract students' attention and enhance their engagement in the learning process. Student worksheets can also be integrated with instructional models such as Discovery Learning. This model emphasizes teamwork and interaction among students while encouraging them to explore their surrounding natural environment (Bahtiar & Dukomalomo, 2019; Sari & Harjono, 2016; Syafi'i et al., 2014). Based on these considerations, student worksheets integrated with the Discovery Learning model can be developed to improve students' knowledge of environmental education at the primary and secondary education levels.

Methodology

This study employed a Research and Development (R&D) method by adapting the Analyze, Design, Develop, Implement, and Evaluate (ADDIE) development model (Branch, 2009). The product developed in this study was a student worksheet integrated with the Discovery Learning model for environmental education at the Early Childhood Education (ECE), primary, and secondary education levels. The topic addressed in the developed worksheet focused on terrestrial

ecosystems. The research process began with an analysis of problems encountered in the field. The next stage involved designing a student worksheet integrated with the Discovery Learning model. The resulting design was then implemented in the subsequent stage through the development of the Discovery Learning-integrated student worksheet. The developed worksheet was subsequently validated by involving several experts in learning and instruction. The validation results were then interpreted according to the categories presented in Table 1. The developed product was considered suitable for use in the learning process once it met the criteria for the valid category.

Tabel 1

Media Product Validation Categories

Score Percentage	Category	Feasibility Criteria
81 % - 100%	Highly Valid	Can be used without revision
61 % - 80%	Valid	Can be used with minor revisions
41 % - 60%	Less Valid	Can be used with major revisions
21 % - 40%	Invalid	Not suitable for use
0% - 20%	Tidak Valid	Not suitable for use

Source: (Akbar, 2013).

Results and Discussion

The findings of this study indicate that the developed student worksheet was categorized as valid and feasible for use in classroom learning. The development of student worksheets represents an innovative approach to enhancing the quality of environmental education. The results of the development of the Discovery Learning-integrated student worksheet for students at the Early Childhood Education (ECE) level are presented in Figure 1. In this activity, students were assigned to observe and record the flowers and trees found in their surrounding environment.

LEMBAR KERJA SISWA
TOPIK: EKOSISTEM DARAT
 untuk jenjang PAUD

Nama : _____
 Kelas : _____

Perhatikan tanaman yang ada di sekitar area bermain kamu, kemudian gambarkan bentuk pohon dan bunga nya pada kolom di bawah ini. Kemudian warna dan berinama pohon/bunga apa saja yang kamu temukan



Pohon

1.
 2.
 3.



Bunga

1.
 2.
 3.

Figure 1. Discovery Learning-Based Student Worksheet for Early Childhood Education (ECE) Students

Another product developed in this study was a student worksheet designed for the elementary school level. The tasks provided in this worksheet were slightly more complex than those developed for the previous educational level. Students were instructed to observe and identify herbivorous, carnivorous, and omnivorous animals. The design of the student worksheet developed for elementary school students is presented in Figure 2.

LEMBAR KERJA SISWA
TOPIK: EKOSISTEM DARAT
 Nama : _____
 Kelas : _____
untuk jenjang SD

Perhatikan area pekarangan rumah kamu, tuliskan hewan apa saja yang ada di sekitar pekarangan rumah mu. Kemudian tuliskan jenis makanan dari hewan tersebut apakah herbivora, karnivora, atau omnivora dengan cara memberikan tanda panah

Nama Hewan	Herbivora	Karnivora	Omnivora
1. _____			
2. _____			
3. _____			
4. _____			
5. _____			
6. _____			
7. _____			
8. _____			
9. _____			
10. _____			
11. _____			
12. _____			

Figure 2. Discovery Learning-Based Student Worksheet for Elementary School Students

Meanwhile, the student worksheet developed for the junior high school level represents an innovative instructional resource that teachers can use as an alternative in the learning process. Students were instructed to identify and list dicotyledonous and monocotyledonous plants found in the garden surrounding the school. The design of the developed student worksheet is presented in Figure 3.

LEMBAR KERJA SISWA
TOPIK: EKOSISTEM DARAT Nama : _____
 Kelas : _____
untuk jenjang SMP

Coba kunjungi salah satu taman/kebun yang ada di sekitar sekolah, kemudian catatlah daftar nama tumbuhan beserta jenisnya (dikotil/monokotil) dan ciri khasnya

Tumbuhan Dikotil	Ciri khas Dikotil
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

Tumbuhan Monokotil	Ciri Khas Monokotil
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____
5. _____	5. _____

Figure 3. Discovery Learning-Based Student Worksheet for Junior High School Students

In general, the student worksheet developed for the senior high school level is presented in Figure 4. In this worksheet, students were assigned to design a program aimed at promoting environmental conservation, particularly within terrestrial ecosystems.

LEMBAR KERJA SISWA
TOPIK: EKOSISTEM DARAT Nama : _____
 Kelas : _____
untuk jenjang SMA

Gambarkan sebuah program yang dapat digunakan untuk pelestarian lingkungan hidup, khususnya untuk wilayah ekosistem darat. Tuliskan alat dan bahan serta tahapan pembuatan dan project tersebut.

Judul program: _____

Alat dan bahan	Langkah kerja
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
	4. _____
	5. _____

Deskripsi program: _____

Figure 4. Discovery Learning-Based Student Worksheet for Senior High School Students

The validation results of the developed product are presented in Table 3. These results were converted into validation scores and subsequently interpreted to determine the product's feasibility for use in the learning process. The detailed validation scores and their corresponding feasibility categories are presented in Table 2.

Table 2
Percentage of Student Worksheet Validation Scores

Validator	Student Worksheet Validation Score Percentage			
	ECE	Elementary School	Junior High School	Senior High School
Instructional Expert 1	82.50	92.50	90.00	90.00
Instructional Expert 2	92.50	95.00	92.50	90.00

The validation results of the developed worksheets demonstrate their potential as an innovative resource for environmental education. The Discovery Learning-based student worksheets developed in this study offer an alternative instructional medium that can be effectively integrated into the learning process. These worksheets can assist teachers in providing more comprehensive learning experiences through independent tasks that can be further developed into project-based activities. Students' independence in completing such tasks may positively contribute to the development of their skills. Moreover, the use of student worksheets can create greater variation in learning activities, making the learning process more engaging, dynamic, and responsive to students' learning needs.

Further efforts are needed to advance the development of learning, as numerous aspects of the instructional process still require improvement. Other instructional components that should be further developed include learning media, teaching materials, and learning models (Fauziyah & Jailani, 2014; Paidi, 2009; Winne et al., 2010). These instructional resources can be strengthened by incorporating relevant needs analyses that reflect students' real-life experiences and environmental contexts. Such development efforts are expected to enhance the quality of learning, particularly in terms of students' understanding and behavioral change.

Environmental education serves as a means of enriching students' knowledge and promoting positive changes in their behavior. In this context, behavioral changes may include energy conservation, transportation use, waste reduction, recycling practices, environmentally responsible consumption, and social influence. This is consistent with the framework proposed by Kaiser and Wilson, who identified these six aspects as indicators of behavioral change in learning contexts. Other competencies that need to be strengthened include collaboration and communication skills, both of which are essential for twenty-first-century learning (Karsten et al., 2015; Landa & Donaldson, 2022). These skills can be fostered through the implementation of Discovery Learning-based student worksheets. This approach is considered appropriate because the characteristics of the Discovery Learning model are closely aligned with students' learning needs and the competencies required for twenty-first-century education.

Conclusion

Based on the findings of this study, it can be concluded that the student worksheets integrated with the Discovery Learning model are feasible for use in the learning process. This conclusion is supported by the validation results provided by instructional experts. Further development of environmental education is necessary to enhance students' knowledge and promote positive behavioral changes in addressing environmental problems. Future research should extend this study through more comprehensive and advanced stages of development. A limitation of the present study is that the developed worksheets have not yet been subjected to field testing; therefore, their effectiveness in improving students' knowledge has not been empirically established.

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