

## Development of Conservation *E-Books* Based on Local Potential to Improve Eco-literacy of Junior High School Students

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Ai Erfariyah<sup>1\*</sup>, Dadang Jaenudin<sup>2</sup>, Irvan Permana<sup>3</sup>

<sup>1,2,3</sup>Science Education Program, Graduate School, Universitas Pakuan, Bogor, Indonesia

Corresponding Email: \*072622011@student.unpak.ac.id

### Abstract

This research aimed to develop a conservation e-book based on local potential to improve the eco-literacy of junior high school students. The development of the e-book is based on the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) which was conducted on 27 seventh-grade students using a one-group pretest-posttest design. The development instruments were in the form of validation forms, eco-literacy questions, and questionnaires as well as student response surveys to conservation e-books. Analysis was conducted on the results of validation of e-book feasibility, increase in gain value, and hypothesis testing. The results of data analysis showed that the developed conservation e-book was declared valid with a percentage of 93.20% from material experts and 93.39% from media experts. In addition, after using local potential-based conservation e-books, there is an increase in eco-literacy with an average N-Gain value of 0.65 (knowledge competency) and 0.46 (attitude competency, skills, and human relations with nature) respectively, including in the moderate category. The test of the effectiveness of eco-literacy knowledge competence using the *Paired-T Test* shows a sig. value of 0.000, as well as the competence of attitudes, skills, and human relations with a nature of 0.000. Students' response to the e-book was very good as indicated by a percentage value of 94%. Thus, conservation e-books based on local potential can improve students' eco-literacy and are effectively used in the science learning process.

Keywords: Conservation, E-Book, Eco-literacy, Local Potential.

### INTRODUCTION

As an archipelago, Indonesia has a high level of biodiversity compared to other countries in the world (Johnson et al., 2019) and is a rich natural resource that is beneficial for life (Pelupessy et al., 2021; Wilson et al., 2014). However, as the needs of life increase and people have less awareness about the importance of conservation, biodiversity is currently in decline (Jamaludin, 2022a; Skogen et al., 2018; Yeh et al., 2021). To overcome this, conservation-based education is needed (Afandi et al., 2022). Indonesia has quite a lot of conservation areas, but, from the results of numerous studies, the number of rare animal species is declining, for example, green turtle species continue to diminish due to the destruction of native habitats, polluted seas, excessive exploitation of flesh and eggs (Nurhayati et al., 2020; Pelupessy et al., 2021). Environmental destruction due to human activity is continuing and escalating even though conservation efforts have been carried out since 1970 (Kristalinawati et al., 2019). Therefore, it is necessary to provide knowledge and insights about conservation to the current generation on an ongoing and sustainable basis (Rêgo et al., 2021) so that their understanding can change their way of thinking and attitude towards the environment (Nurlaili, 2018). Conservation education is important in biodiversity conservation efforts (Makecha & Ghosal, 2017).

Teachers have an important role in linking learning with conservation as an effort to develop an environmentally conscious society so that it has an impact on their behavior on this earth (Nurlaili, 2018). In learning, students can be allowed to gain knowledge to form attitudes and behaviors aware of the environment (Chawla & Cushing, 2007). Awareness of the importance of environmental conservation is known as eco-literacy, which is the ability to understand ecological principles and their relationship with nature (Kahraman, 2022). Eco-literacy is a unity between intellectual, social, and emotional intelligence that has an impact on environmental awareness (McBride et al., 2013; Pursitasari et al., 2022). Eco-literacy is a unity between intellectual, social, and emotional intelligence that has an impact on environmental awareness (McBride et al., 2013; Pursitasari et al., 2022). Eco-literacy is in line with global policies regarding sustainable development (SDGs) which consists of 17 indicators including terrestrial ecosystem no. 14, and marine ecosystem no. 15 (Pursitasari et al., 2023; Syah et al., 2021) which need to be implemented in learning, because education is the best opportunity and most effective means to achieve sustainable development (Thirupathy & Mustapha, 2020). In addition, eco-literacy is very relevant to the goals of the SDGs to protect, restore, and improve ecosystem utilization and stop biodiversity loss (Alisjahbana & Murniningtyas, 2018). Eco-literacy ability consists of four competencies, namely knowledge, attitudes, skills, and human relationships with nature (McBride et al., 2013; Muliastari et al., 2022; Setyaningrum & Gunansyah, 2020).

The survey conducted on junior high school students in Sukabumi district showed that the level of eco-literacy is very low. Knowledge aspect obtained an average score of 8.11 out of 23 (35%). As well as aspects of attitudes, skills, and relations between humans and nature with a percentage of 44% of students still used to littering, and 50% of students perceived consuming turtle eggs because it tastes delicious. This lack of eco-literacy occurs because teachers have not optimized their learning about the importance of preserving the environment and biodiversity (conservation). In accustoming conservation attitudes, various teaching methods and relevant teaching resources are needed (Wahyuni et al., 2022). The textbooks of junior high school students that were analyzed limited the content of conservation material to the definition, types, and examples briefly. In addition, from the results of the distribution of a questionnaire to 49 science teachers in Sukabumi District regarding the use of teaching materials, it was obtained that the obstacles that were often encountered when teaching conservation material in class VII of junior high school were the teaching materials that were used (73%). IT-based teaching resources that are often used are PowerPoint (77.6%) and students who use electronic books are 24.5%. Then from the survey results, 93.3% of science

teachers expect the supply of teaching materials which include descriptions, photos, illustrations, audio, and even videos that can help the learning process in the classroom.

Based on the problem described above, the attempt that can be made is to create teaching materials that are tailored to the needs of the teacher, the characteristics of students, and the surrounding area. Teaching materials are arranged with certain systematics from the easiest to the most complicated (Malalina & Kesumawati, 2013). The utilization of technology-based teaching materials is very suitable for 21st-century learning because of the recent development of society cannot be separated and even addicted to technology (Sukmawati & Nensia, 2019). Hence, technology-integrated learning is very appropriate although essentially the role of teachers cannot be substituted with technology, however, technology can influence the teacher's various teaching approaches to increase students' knowledge capacity (Churiyah & Sakdiyyah, 2020; Huda et al., 2017). In addition to integrating with learning technology, it is possible to use the surrounding environment as a learning resource to make it more contextualized. Local potency used as a learning resource can assist students in comprehending the material through daily life so that it will feel more useful and can facilitate students to solve problems (Dolo & Kuai, 2023; Usman et al., 2019). Local potency is a particular resource that exists in a particular area (Bahri, 2016; Kahar & Fadhilah, 2019; Syarah et al., 2019). To create learning that is relevant to conservation materials, it is necessary to develop teaching materials that integrate technology and local potential. The teaching materials developed are in the form of E-Books or digital books about the Pangumbahan Beach Turtle Conservation Area, Sukabumi Regency. This area is located in Pangumbahan Village, Ciracap District, Sukabumi Regency which is part of the Ciletuh Palabuhanratu Unesco Global Geopark (CPUGG) so that it can be used as a contextual learning resource for conservation materials.

Prior conservation research has been conducted through several focuses, namely, first on learning strategies and models (Lee et al., 2019; Quazi, 2020; Rusmana, N. E. & Akbar, A., 2017; Sigit et al., 2020), second on program structures that are incorporated into curriculum content (Ramadoss, 2010), and third through community-based education (Nurhayati et al., 2020). Other research is related to the use of learning media (Mumpuni et al., 2022; Prihandono et al., 2017; F. Syah & Yustina, 2021). Citizen-science applications have also been used and can increase residents' knowledge about turtles so that there are changes in behavior and attitudes toward nature, turtles, and conservation (Santori et al., 2021). In addition, research on conservation using printed media, exhibitions, and electronic media in the form of e-modules (Asrial et al., 2022; Jamaludin, 2022b; Khairani & Titisari, 2022; Sumberartha et al., 2021) and digital booklets (Wahyuni et al., 2022a) have been developed. Research on relevant eco-literacy

related to the application of learning models (Firdausi & Wulandari, 2021a; Kahraman, 2022; Kim et al., 2017; Muliastari et al., 2022; Putri et al., 2019; Sucia et al., 2018; Vargas-Madrado, 2018), the *PhenomenonBL* model (Kadarisman et al., 2023), the use of interactive teaching materials (Rubini et al., 2023) and picture books can improve eco-literacy (Muthukrishnan, 2018). Studies about teaching materials that are locally based include (Bahri, 2016; Kahar & Fadhilah, 2019; Leksono, 2016; Maduriana & Gata, 2021; Mumpuni et al., 2022; Rosyid, 2019; Sarah & Maryono, 2014; Sukadari et al., 2023).

Previous studies on conservation show that the use of exhibition media and visiting mangrove sites can enhance knowledge and values towards mangrove conservation in Macau China (Tagulao et al., 2022). Another study stated that students were more interested in using electronic comics than printed books, and marine conservation knowledge in the experimental class was significantly different from the control class in grade sixth elementary school (Syarah et al., 2019). Another similar study showed that the use of local wisdom-based comics can help students improve their knowledge, attitudes, and skills because they get real learning (Kurniawati et al., 2017). Other research proves that web-based science learning modules can increase students' understanding of eco-literacy by 83.7 including in the high category (Firdausi & Wulandari, 2021). Then the use of biodiversity modules and textbooks based on local potential can improve learning outcomes and environmental care attitudes (Sunarsih et al., 2020; Suwarni, 2015). Furthermore, the literacy of students who use e-books is better than students who use printed books (Rvachew et al., 2017).

From the previous studies above, no study has been found on the use of conservation e-books based on local potency to improve students' eco-literacy. Therefore, the purpose of this research is to develop a local potency-based conservation E-Book to improve the eco-literacy of junior high school students implemented using one group pretest-posttest design. The local potential-based conservation E-Book was developed in the form of an information presentation in the form of text, images, photos, and videos about Pangumbahan Beach Turtle Conservation in Sukabumi Regency about conservation governance, ecology, turtle reproduction, and conservation efforts. The E-Book was created using Canva and PDF flip Corporation applications and then uploaded online.

## **METHOD**

### **Research Procedure**

This research utilized the R&D research method of the ADDIE model, namely the stages of Analysis, Design, Development, Implementation, and Evaluation.

1. The analysis consists of analyzing the needs of teaching materials, curriculum, learning materials, formulation of learning objectives, and analysis of student characteristics.
2. Design, at this stage the preparation of the E-Book is made using the Canva and PDF Corporation applications, and the results are uploaded online. Research instruments were prepared according to eco-literacy indicators, sheets of material experts, media experts, and science teachers as well as student response questionnaires.
3. Development, and produced e-books that have been validated and improved according to suggestions and comments.
4. Implementation is the stage of limited testing of conservation e-books and eco-literacy instruments on a predetermined population. Using experiments by comparing the situation before and after using conservation e-books in learning using One Group Pretest-postest Design (Sugiyono, 2019) in Figure 1.

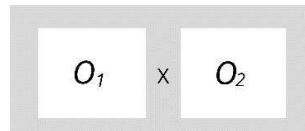


Figure 1 One Group Pretest Post-test Design

Notes:

$O_1$  = pretest

$O_2$  = post-test

5. Evaluation, at this stage the results of the trial were evaluated, and analyzed the improvement of eco-literacy and thinking skills of students before and after the trial.

### **Participant**

The participants of this study were 27 students of class VII at a junior high school in Surade, Sukabumi Regency, Indonesia.

### **Research Instrument**

The instruments used in this study are (1) Validation of e-book teaching materials, in the form of a questionnaire consisting of aspects of content feasibility, linguistic feasibility, presentation feasibility, and overall appearance feasibility; (2) Eco-literacy of knowledge competencies in the form of multiple-choice tests; (3) Eco-literacy of skills and attitudes competencies in the form of a questionnaire as presented in Table 1; (4) Student responses to e-book teaching materials in the form of questionnaires with aspects of material and understanding, appearance and motivation. Technical data analysis in this study used quantitative analysis.

Table 1. Eco-literacy Instruments

Aspect	Indicators	Instrument
Knowledge	a. Identify basic ecological principles b. Think critically and deeply about a problem c. Analyze the causes and impacts of environmental problems that exist in aspects of life d. Designing solutions to problems in the long term	Multiple Choice
Behavior	a. Cultivate feelings of empathy toward the environment b. Have an environmentally respectful and caring attitude	Questionnaire
Skill	a. Developing a tool that is needed to reduce environmental problems b. Utilizing energy sources sparingly and to the best of our ability c. Using natural resources properly	Questionnaire
Interaction between humans and the environment	a. Instill a sense of gratitude towards the surrounding environment b. Have an attitude close to nature so try to protect it c. Instilling an attitude of respect for nature and its components	Questionnaire

### Data Analysis

The data that has been collected through the instrument is then analyzed using statistics with steps:

#### 1. Validity Analysis of Conservation E-Book

The developed conservation e-book was tested for validation by two material experts and two media experts. This validation test is presented in the form of a questionnaire question with a Likert scale value of 1 to 5. (1) very bad, (2) less good, (3) quite good, (4) good and (5) very good. Then the results of the questionnaire are processed using the formula:

$$P = \frac{n}{N} \times 100\% \dots\dots\dots(1)$$

The reference criteria used to determine the feasibility of e-books are presented in Table 2. E-books can be categorized as feasible if the percentage value is more than 60 to 100. If it is below 60% then the e-book must be improved because it is not valid.

Table 2 Media Feasibility Criteria

Percentage (%)	Validity Category
81-100	Valid
61-80	Quite Valid
41-60	Less Valid
21-40	Not Valid

Analysis of the validation of e-books in the content aspect (material) was carried out using the CVR (Content Validity Ratio) method. According to Lawshe, CVR is a validation test to calculate the suitability of items with indicators measured based on several experts (Rubini et al., 2023). This validation test involved 10 science teachers. The CVR value is calculated by checking each statement item on the instrument and given a score of 1 if the answer is Yes, and a score of 0 if the answer is No. The CVR value is calculated by checking each statement item on the instrument. The formula used to calculate the CVR value is:

$$CVR = \frac{ne - \frac{N}{2}}{\frac{N}{2}} \dots \dots \dots (2)$$

The CVR calculation is accepted if the value is greater than the minimum CVR value according to the number of experts. Furthermore, the Content Validity Index (CVI) calculation was carried out for the total number of items. The CVI value is obtained from the average CVR value for yes answer items, the CVI value is calculated using the formula:

$$CVI = \frac{\sum CVR}{\text{Jumlah item yang diterima}} \dots (3)$$

## 2. Analysis of Students' Eco-literacy Enhancement

The pre-test and post-test results were analyzed for their gain value (N-Gain) to see the increase in eco-literacy based on the criteria in Table 3.

Table 3. Criteria for Eco-literacy Improvement

Limitation	Category
$g > 0,7$	High
$0,3 \leq g \leq 0,7$	Medium
$g < 0,3$	Low

## 3. Analysis of Student' Response to Conservation E-Book

The analysis results of student response questionnaires to conservation e-books are calculated and categorized according to the criteria in Table 4.

Table 4 Criteria for Assessment of Student Response Questionnaires to E-Books

Percentage	Category
$>80$	Very Good
$60 < x \leq 80$	Good
$40 < x \leq 60$	Quite Good
$>40$	Less Good

# RESULTS AND DISCUSSION

## Analysis

The teaching needs analysis shows that science teachers expect teaching materials for conservation materials equipped with varied information media and integrated with IT and the surrounding environment to make learning more contextual. In addition, the survey results

show that most students still have insufficient knowledge and attitudes towards environmental awareness and biodiversity conservation. Therefore, the E-book was developed to increase students' knowledge and have an impact on students' attitudes, behaviors, and skills towards the environment. Learning objectives were developed based on curriculum needs and adapted to eco-literacy indicators.

*Development (Design)*

The initial design of the e-book was developed based on the learning objectives that had been prepared previously along with adjustments to the indicators of eco-literacy. The e-book was made with Canva and PDF Flip Corporation applications, the result is in the form of HTML which is uploaded online. An example of an e-book design complete with material, photos, videos, images, and quizzes is presented in Figure 2.



Figure 2 Some E-Book Views Equipped with Varied Information

**Development**

E-books that have been made at the design stage are then validated by material and media experts (expert judgment) and science teachers. There is input from expert judgment which is used as a reference for product development. The results of the material expert validation are presented in Table 5.



Table 5 Material Expert Validation Result of E-Book

<b>Sub-component</b>	<b>Percentage</b>	<b>Criteria</b>
Content Validity	94.55%	Valid
Language Validity	90.00%	Valid
Presentation Validity	94.29%	Valid
<b>Mean</b>	<b>93.20%</b>	<b>Valid</b>

Based on Table 5, the results of the material expert validation of the feasibility of e-books from the aspects of content feasibility, linguistic aspects, and presentation aspects obtained an average percentage of 93.2%. When viewed from the assessment category in Table 2 regarding the criteria for the feasibility level of the conservation e-book that has been developed, it is declared valid. Of the three sub-components, the highest percentage is obtained in the content feasibility sub-component of 94.55%, this shows that the presentation of local potential-based conservation e-book material follows the learning objectives, the content of the material is relevant to the local potential raised and there is a connection with eco-literacy. The e-book includes knowledge about conservation and its benefits, the basic biology and ecology of sea turtles, and their protection efforts. On certain pages, there are scientific facts and interesting facts to increase knowledge transfer. This is following the opinion that the repetition of information in several forms can improve knowledge and attitude outcomes (Dimopoulos et al., 2009). The language sub-component has the lowest percentage of 90.00% but is still included in the valid category. Furthermore, the results of media expert validation are presented in Table 6.

Table 6 Media Expert Validation Result of E-Book

<b>Sub-component</b>	<b>Percentage</b>	<b>Criteria</b>
Language Validity	93.33%	Valid
Presentation Validity	92.28%	Valid
Display Validity	94.29%	Valid
<b>Mean</b>	<b>93.29%</b>	<b>Valid</b>

From the results of media expert validation in Table 6 on the aspects of language, presentation, and overall appearance, a percentage of 93.29% was obtained. The percentage value indicates that the conservation e-book is declared valid. The highest percentage is obtained from the display feasibility sub-component which is 94.29%. This shows that the e-book has a very attractive cover, page, and colour selection adapted to the development of junior high school students. The selection of fonts and ease of reading greatly affects students' interest in reading. The writing of words and sentences needs to be considered because it affects the interest of readers (Aristyasari et al., 2023). In addition, e-books are combined between several information media such as text, photos, videos and quizzes so that they can better assist students in understanding the material (Nsengimana et al., 2017). This is following the opinion that

Indonesian junior high school students are in the age range of 11-14 years, namely the transition period from the concrete operational stage to the formal stage, so they need media that can help students increase their interest in reading (Kurniawati et al., 2017). Likewise, other opinions state that the development of a good e-book must pay attention to the elements of appearance and good content according to the characteristics of students (Jones & Brown, 2011; Lieung et al., 2021).

Besides being validated by material experts and media experts, this conservation e-book was also assessed by 10 science teachers. The results of the science teacher validation stated that the total CVR value ( $\sum CVR$ ) was 18 out of 18 question items. Then the resulting CVI value is 1 and is said to be valid.

After the E-Book is validated, the next is the revision stage based on the suggestions and comments of the experts (expert judgment). The appearance of some parts of the e-book before and after revision is presented in Table 7.

Table 7 Validator Suggestions and Comments and Improvements

Revised Component	Before	After
Cover (Illustration)		
Instructions page (effective sentences and adding points)		
Introduction (Spelling and Stimulation Question)		

**Revised Component**

**Before**

**After**

Content (changing graph with statements)

**MENGAPA PERLU KONSERVASI?**

**Berpikir Kritis**

Sejak tahun 1980, terjadi penurunan luas hutan di Indonesia, mengapa itu terjadi?

**Pertanyaan:** grafik di bawah ini

Untuk memperbesar tentara, KUK lebih pada area grafik

Grafik penurunan luas hutan Sumatera  
 Sumber: <https://www.mongabay.com/>

Kemampuan apa yang dapat kalian ambil dari data grafik di atas?

**Tugas:** jawablah dalam 5 baris ya!

**Jika, mengapa konservasi itu penting dilakukan?**

**Keanekaragaman Hayati di Indonesia**

**Berpikir Kritis**

Sacalah kedua pernyataan di bawah ini!

**Pernyataan 1:**

Bumi merupakan rumah bagi banyak makhluk termasuk fauna yang tersebar di sana. Keberadaan berbagai spesies fauna ini memiliki peranan penting dalam keseimbangan ekosistem. Sayangnya, hampir separuh spesies hewan di Bumi mengalami penurunan populasi karena sebagian besar diabaikan oleh aktivitas manusia dimana sebagian besar diabaikan oleh aktivitas manusia saat ini. Terdapat 23 persen makhluk yang terancam punah. (Sumber: detik.com)

**Pernyataan 2:**

Kebakaran hutan dan lahan dari tahun ke tahun telah menjadi masalah di Indonesia. Kebakaran sering kali terjadi di kawasan yang telah dibersihkan dan pengalihan dan pemanfaatan hutan dan lahan. Pembukaan lahan tersebut tentunya dilakukan dengan tujuan untuk membuka pertanian, perkebunan bahkan pemukiman baru. (Sumber: Kompas.com)

Jawablah Pertanyaan berikut!

1. Buatlah pernyataan singkat mengenai hubungan antara kedua pernyataan di atas. Apa yang menjadi masalah yang menyebabkan dan dimana permasalahan yang terjadi?

2. Menurut kalian, apa yang telah dilakukan sebagai solusi permasalahan di atas?

Layout and Template (Minimize the size of font and fix the layout)

**MENGAPA PERLU KONSERVASI?**

Alam telah memberikan banyak manfaat kepada manusia sebagai sumber makanan, pakaian, dan tempat. Namun, manusia sering mengakibatkan kerusakan yang mengakibatkan kerusakan dan bahkan kepunahan.

Kerusakan alam seperti banjir, tanah longsor, dan kebakaran hutan menyebabkan bencana alam yang mengganggu habitat satwa liar.

Untuk melindungi kekayaan alam, konservasi diperlukan karena kelestarian dan kelangsungan berbagai spesies tumbuhan dan hewan sangat mempengaruhi kelangsungan hidup manusia.

**Keuntungan Konservasi:**

Konservasi, juga dikenal sebagai pelestarian yang memiliki pengertian tindakan menjaga dan melindungi sesuatu secara terarah untuk mencegah kerusakan.

**Manfaat Konservasi:**

Konservasi memiliki banyak manfaat secara ekologi dan ekonomi. Manfaatnya secara ekologi adalah menjaga keseimbangan ekosistem dan menjaga keanekaragaman hayati. Manfaat ekonominya adalah ketersediaan sumber sandang, pangan, dan papan yang berkelanjutan. Selain itu, jika dikelola dengan baik, alam menjadi sumber pendidikan, seperti ekowisata.

**KONSERVASI DAN MANFAATNYA**

**Pengertian Konservasi**

Kata "konservasi" berasal dari kata bahasa Inggris "conservation", yang berarti pelestarian atau perlindungan. Konservasi, juga dikenal sebagai pelestarian yang memiliki pengertian tindakan menjaga dan melindungi sesuatu secara terarah untuk mencegah kerusakan.

Alam telah memberikan banyak manfaat kepada manusia sebagai sumber makanan, pakaian, dan papan. Namun, manusia sering mengakibatkan kerusakan yang mengakibatkan kerusakan dan bahkan kepunahan. Untuk melindungi kekayaan alam, konservasi diperlukan karena kelestarian dan kelangsungan berbagai spesies tumbuhan dan hewan sangat mempengaruhi kelangsungan hidup manusia.

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Adding Video Content

**Menganal Konservasi Penyul Panti Pungumbehan**

**Tata Kelola**

Pada awalnya wilayah konservasi penyul dikelola oleh lembaga swasta, kemudian sejak tahun 2010 dikelola Pemerintah daerah kabupaten Subabun dan mulai tahun 2017 dibawah naungan Dinas Perikanan dan Kelautan Provinsi Jawa Barat.

Berikut adalah tata ruang yang dilakukan di satuan pelayanan konservasi penyul:

Foto jalan masuk pengalihan, pengalihan bank, tanggul mesir baru dan jalan perahu air.  
 Sumber: Dokumen pribadi

**Menganal Konservasi Penyul Panti Pungumbehan**

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Berikut adalah video pelayanan singkat mengenai tata kelola kawasan konservasi penyul dengan narasumber Kepala Satuan Pelayanan Taman Pesisir Pantai Penyul Pungumbehan Basir Arie Harahy, SP.  
 Sumber: Dokumen pribadi

**Jenis dan Sebaran Penyul**

**GALERI**

Penyul hijau dan penyul hitam yang ada di sungai karantina adalah indikator kesehatan air sungai Pantai Pungumbehan.  
 Sumber: Dokumen pribadi

**Jenis dan Sebaran Penyul**

**GALERI VIDEO**

**Jenis Penyul yang diteliti**

Video spesies penyul yang diteliti dan diteliti baik bentuk.  
 Sumber: <https://www.youtube.com/watch?v=10218281818>

**Penyul dalam Ruang Karantina**

Video spesies penyul yang diteliti dan diteliti dalam baik bentuk.  
 Sumber: <https://www.youtube.com/watch?v=10218281818>

Material (Simplify the critical questions to be understandable)

**ciri-ciri**

**Berbedaan ciri-ciri Penyul Hijau dan Penyul Hitam**

**Penyul Hijau (Cherrytomia malinche)** VS **Penyul Hitam (Cherrytomia malinche)**

**Habitat**

Jika di sepanjang pantai diteliti pohon (Scaevola taccada, Ipomoea pes-caprae, dan pohon pandan dengan jenis pasir putih) dan sekitarnya.

**Habitat**

Pantai dengan pasir koral hasil penghancuran limbah, warna pasir putih dan kelunguran.

**Makanan**

Devonora (lubur-ubur, kepiting kecil, spons) saat kecil, herbivora saat dewasa (jenis alga atau lamar).

**Makanan**

Devonora dengan makanan utama berupa spons laut.

**Pertanyaan Kritis**

Jenis penyul hitam yang hidup di mangrove karantina, bagaimana konservasi Penyul Pantai Pungumbehan sebelumnya jenis penyul yang diteliti dan diteliti di Pantai Pungumbehan, mengapa demikian? Berikan pernyataan yang jelas!

**ciri-ciri**

**Berbedaan ciri-ciri Penyul Hijau dan Penyul Hitam**

**Penyul Hijau (Cherrytomia malinche)** VS **Penyul Hitam (Cherrytomia malinche)**

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Pantai dengan pasir koral hasil penghancuran limbah, warna pasir putih dan kelunguran.

**Makanan**

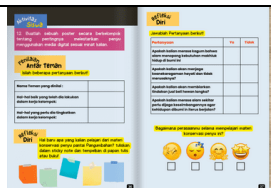
Devonora (lubur-ubur, kepiting kecil, spons) saat kecil, herbivora saat dewasa (jenis alga atau lamar).

**Makanan**

Devonora dengan makanan utama berupa spons laut.

**Pertanyaan Kritis**

Menurut pengelompokan konservasi penyul Pantai Pungumbehan jenis penyul hitam yang dapat berbiak, berdasarkan informasi perbedaan karakteristik penyul hijau dan penyul hitam berdasarkan habitat penemuan, mengapa demikian? Berikan pernyataan yang jelas!

Revised Component	Before	After
Adding Reflection	There is no reflection page	

## Implementation

This implementation stage uses experiments by comparing the situation before and after using conservation e-books in learning using One Group Pretest-posttest Design as shown in Figure 1. The use of conservation e-books is carried out in science learning for three meetings. Previously, students were given a pre-test instrument to determine the level of students' eco-literacy. Eco-literacy pre-test questions were given in the form of 14 multiple-choice questions for the knowledge domain and 30 questionnaire questions for attitudes, skills, and human relationships with nature. The first meeting of teachers and students carried out learning for 2 x 40 minutes. beginning with an introduction to the learning objectives, introducing the conservation e-book as the main learning resource for conservation material.

The e-book can be opened and accessed by students easily through Android. The teacher directs students to understand the instructions for using the e-book. Students are accompanied by the teacher to explore the initial material in the e-book and then in groups to do activities according to the instructions in it, namely making concept maps about conservation methods carried out in Indonesia. Students are very enthusiastic and active. On the second and third meetings, students learned material about turtle management and reproduction, the last meeting was about the role and how to conserve turtles, students in groups made posters about turtle conservation and ended with a post-test. Post-test is conducted to evaluate the impact before and after learning (Dimopoulos et al., 2009).

## Evaluation

The limited trial was evaluated and analyzed the improvement of students' eco-literacy before and after using the conservation e-book. The evaluation results of the learning implementation showed: (1) the learning was implemented very well; (2) students were enthusiastic and active during the learning process; (3) students found the e-book very easy to open and use; (4) students have a high interest in learning and care about biodiversity conservation.

### *Improving Eco-literacy Knowledge Competency*

Eco-literacy consists of four competencies, namely knowledge competencies, attitudes, skills, and human relationships with nature. Knowledge competency contains the ability of

aspects of understand the environment (Tyas et al., 2022). Eco-literacy knowledge competency consists of four indicators, namely the basic principles of ecology, thinking critically and deeply about a problem, analyzing the impact of human behavior, and designing solutions to problems in the long term (McBride et al., 2013). The N-Gain results of knowledge competency obtained a value of 0.65 (medium category) with details as presented in Table 8.

Table 8 N-Gain Value of Eco-literacy Knowledge Competency

No	Knowledge Indicator	N-Gain	Category
1	Understand the basic principles of ecology	0.64	Medium
2	Think critically and deeply about a problem	0.50	Medium
3	Analyze the causes and impacts of an environmental problem that exists in aspects of life	0.69	Medium
4	Design solutions to problems in the long term	0.78	High
Mean		<b>0.65</b>	<b>Medium</b>

The first indicator, understanding the basic ecological principles, based on the gain value in Table 8 shows 0.64 with a moderate category. This illustrates that there is a significant increase after using the conservation e-book. Based on these results, it can be concluded that students understand the conservation material presented. The e-book was prepared to cover conservation materials, basic biology, and ecology of sea turtles and their protection efforts. With the preparation of materials integrated with the local potential of Pangumbahan Beach Turtle Conservation Area, students understand more easily because the learning resources they get come from the surrounding environment. This is supported by research that learning is required to always be associated with the surrounding environment, culture, regional potential, and excellence (Sofyan et al., 2019). Another relevant study concluded that the black honey bee conservation e-module can improve ecological literacy skills so that they have a sense of care and curiosity about the environment (Sumberartha et al., 2021). The material is equipped with photos and videos to make it easier to understand the material (Asi et al., 2022).

The second indicator, namely critical and in-depth thinking about a problem, has a gain value (N-Gain) of 0.50. This shows that the gain value is categorized as moderate, meaning that there is a fairly effective increase in the indicator after using the conservation e-book. The ability to think critically about a problem increases because the e-book is equipped with triggering questions related to sea turtle conservation. This is supported by the opinion that the use of multimedia can improve students' critical thinking skills through problems that need to be solved (Djamas et al., 2018). According to another opinion, learning that integrates critical

thinking skills will help students build knowledge so that they are accustomed to finding solutions and problem-solving (Prafitasari et al., 2021). Having a critical sense of environmental problems has a positive impact on the development of environmental care attitudes and behaviors (Marques & Xavier, 2019).

The third indicator is analyzing the impact and human behavior with a gain value (N-Gain) of 0.69. This means that the gain value on the indicator falls into the medium category. There is a fairly effective increase after using conservation e-books. Students can understand the impact and behavior of humans on the survival of living things on this earth. By understanding the impact and behavior of humans on the sustainability of living things, students have an awareness of the importance of conservation.

The last indicator is designing solutions to environmental problems in the long term. This indicator has an N-Gain of 0.78 with a high category. This shows that students' understanding of efforts to solve environmental problems, especially about the survival of living things, is very good. Students can design positive activities to help reduce the threat of extinction in living things. Environmental problems cannot be separated from awareness values so that the government needs to encourage people to have respect for the environment (Lai, 2018).

From the explanation of all knowledge competency indicators above, it can be seen that the average N-Gain is 0.65 with a moderate category. Thus, the use of local potential-based conservation e-books in science learning is quite effective in improving students' eco-literacy knowledge competence. This is supported by other research that teaching materials based on local potential should be used in integrated science learning so that the study of material can be adapted to the learning environment and easily understood by students. Teaching materials need to be developed contextually to respond to the needs of educational units by looking at the characteristics of students and the region (Prihandono et al., 2017). Another study showed that students' interest in and understanding of conservation and biodiversity increased by using local wisdom-based modules (Mumpuni, Susilo, Rohman, & Ramli, 2022). The results of this study are relevant to other studies that local potential can be a source of inspiration in science learning and can support contextual learning in schools. In addition, education through contextual learning is one of the efforts to preserve the environment (F. Syah & Yustina, 2021).

#### *Improvement of Eco-literacy Competencies in Attitudes, Skills and Human Relationships with Nature.*

The next analysis conducted was on the pre-test and post-test scores of the competencies of attitudes, skills, and human relationships with nature which showed an N-Gain of 0.46 (medium category) with details presented in Table 9.

Table 9. N-Gain Score for Behaviour, Skills, and Interaction Between Human and Environment Competency

No	Knowledge Indicator	N-Gain	Category
1	Behaviour	0,48	Medium
2	Skills	0,57	Medium
3	Interaction Between Human and Environment	0,32	Medium
Mean		<b>0,46</b>	<b>Medium</b>

The competence of attitudes, skills, and human relationships with nature also needs to be improved in learning so that students not only know and understand the importance of the survival of living things. The N-Gain of eco-literacy attitude competence obtained a result of 0.48 and was categorized as moderate. From these results, it can be stated that there is a fairly effective increase. Attitude competence consists of indicators of empathy and care for the environment, instilling mutual respect for the environment and its contents and not taking other people's rights for personal gain. After using conservation e-books, students' conscious attitudes toward environmental awareness increased. Conservation education is held to foster positive attitudes and behaviors that have an impact on the environment so that in the future students can make decisions based on their surroundings (Afandi et al., 2022). An attitude of environmental care is a willingness that arises from oneself to express caring actions and maintain environmental quality (Suarlin & Ali, 2020).

The skill indicator has an N-Gain of 0.57 and is categorized as moderate, this means that conservation e-books can improve students' skills in designing a tool/media that can be used to socialize the importance of preventing extinction in endangered animals. Students who have good attitudes and skills towards the environment have a greater chance of participating in saving water and electricity energy, trying to get used to turning off devices that are not needed, utilizing waste, transportation energy, and others (Tagulao et al., 2022).

The next indicator, namely the interaction between humans and nature, has an N-Gain of 0.32. This indicator has a lower increase than the other two indicators because most students before using the conservation e-book already had feelings of gratitude and admiration for the diversity of living things. However, after using the conservation e-book, there was a moderate increase in the indicator. This means that students increasingly have a feeling of the importance of feeling wonder and awe for nature, respect for the earth and all living things and feel a strong and deep bond to nature.

It can be concluded that the increase in eco-literacy competencies in attitudes, skills, and human relations with nature is quite significant as shown by the average N-Gain value of 0.46 in the medium category. This proves that integrating the surrounding environment into learning

can increase students' knowledge, interest, and skills to protect and preserve biodiversity. This is in line with other research which states that to create a commitment of students' concern for the preservation of biodiversity needs to be done with various methods ranging from the applied educational structure, learning models, and the need for teaching and learning activities that lead to the cultivation of a culture of biodiversity conservation (Ramadoss, 2010). Other research states that eco-literacy needs to be introduced to students from an early age in various ways (Nurlaili, 2018). This research is relevant to other opinions that optimizing the use of technology in learning can be done in conservation education, for example, the Citizen Science application which contains content about sea turtles is said to be one of the collaborative projects to increase knowledge and influence behavior and attitudes towards nature, sea turtles and conservation (Santori et al., 2021).

This proves that the higher a person's knowledge about the environment, and animal and plant conservation, the better their behavior and attitude towards conservation. This is in line with the opinion that ecological intelligence and attitudes towards the environment are closely related (Ilela et al., 2021). The purpose of integrating learning with local potential is so that the environment remains sustainable and students are more familiar with local natural resources and facilitate learning because the teaching materials come from real sources (Aristyasari et al., 2023; Kurniarum et al., 2015). The development of conservation e-books based on local potential is one of the efforts to strengthen the importance of protecting sea turtles as one of the almost extinct animals (Harjiyatni et al., 2022; Tapilatu et al., 2020). This is supported by other research that someone who has extensive knowledge about mangroves and coral reefs will be able to better protect the marine and coastal environment. Without extensive knowledge, it will certainly be difficult to implement conservation (Sigit et al., 2023). With the breadth of knowledge, students are expected to have a responsible character for the environment, because character is a very important and main thing to be equipped at school (Amelia et al., 2018). In addition, providing early environmental awareness to students is very important for sustainable life on this earth (Keskin et al., 2020; Paradewari et al., 2018).

### **Students' Response to Local Potency-Based Conservation E-Books**

The last stage in this research is to analyze student responses to local potential-based conservation e-books after completing learning in the limited trial class. Questionnaires were made using a Likert scale of 1-5. The recapitulation of student responses to the conservation e-book is presented in Table 10.



Table 10. Recapitulation of Student Response to Conservation E-Books

No	Aspect	Percentage (%)	Category
1	Content and understanding	96	Very Good
2	Presentation	93	Very Good
3	Motivation	93	Very Good
Mean		<b>94</b>	<b>Very Good</b>

Based on Table 10, students' responses to the developed conservation e-book are very good. Aspects of material and understanding, display, and motivation showed very good scores. The material aspect is 96% and this is categorized as very good. Most students find it easy to understand the conservation material by using the local potential-based e-book. Students find it very easy to access and the language presented is developmentally appropriate. Conservation e-books make learning more interesting because the material is related to the surrounding environment. There are even some students who have visited the Pangumbahan Beach conservation area but do not understand the substance presented there. With this conservation e-book, students feel very familiar with turtle conservation.

From the display aspect, it shows a percentage value of 93%, this means that the e-book gets a very good response from the display aspect. Because the e-book has a very attractive appearance with a combination of bright colors and paragraph placement style, unlike the usual textbook. The text style used is not rigid and is equipped with photos, images, and videos that are very helpful in the process of understanding conservation material. Furthermore, from the aspect of motivation, the e-book also received a very good response with a percentage value of 93%. This is because the e-book is presented in a very interesting form and contains complete information so that students feel more motivated to want to learn seriously about conservation material. In certain sections, triggering questions and evaluations are presented that encourage students to practice critical thinking.

From the overall percentage of aspects, it is concluded that the e-book gets a very good response with a value of 94% and this illustrates that the e-book developed can be used further in science learning. This is in line with the results of research that teaching materials need to be developed contextually to respond to the needs of educational units by looking at the characteristics of students and the region (Prihandono et al., 2017). Another study showed that students' interest and understanding of conservation and biodiversity increased by using local wisdom-based modules (Mumpuni et al., 2022). In addition, Wahyuni et al. (2022) stated that digital technology can increase student attention and provide unlimited information and is more suitable for use in 21st-century learning. The transition of printed teaching materials into digital

form can reduce boredom when learning, teaching materials can be developed with multimedia applications that combine text, photo images, videos, animations, music, and graphics that can be used anywhere (Pursitasari et al., 2022). Contrary to that, educators need to be careful in designing technology-based media so that its utilization is optimal and has no negative impact (Troseth & Strouse, 2017).

## **CONCLUSION**

The development of conservation e-books based on the local potential to improve the eco-literacy and critical thinking skills of students is one of the innovations developed in learning science ecology sub-material conservation. From the results of the development, it is concluded that (1) E-Book of conservation based on local potential has characteristics that have met the aspects or criteria of linguistic feasibility, presentation feasibility, content/curriculum feasibility, and appearance. The material developed has met the needs of the curriculum, the characteristics of junior high school students, and the region and can improve eco-literacy. The E-Book can be accessed using a link and is equipped with embedded photos, images, and videos, student activities, and practice questions; (2) The results of the validation of material experts, media experts, and science teachers show valid values from the aspects of linguistic feasibility, presentation feasibility, content/curriculum feasibility, and appearance. The results of the validation of material experts and media experts show a valid category with a value of 93.20% and 93.29% and the results of the validation of science teachers show a CVI value of 1 with a very suitable category. This proves that conservation e-books are feasible to use in science learning; (3) Local potential-based conservation e-books are effective in improving eco-literacy knowledge competencies and attitude competencies, skills, and human relationships with nature, each of which has an average N-Gain value of 0.65 and 0.46 for moderate category eco-literacy. Students' response to the local potential-based conservation e-book shows a percentage of 94% with a very good category.

## **SUGGESTIONS**

The conservation E-Book based on local potency can be used as an example to develop other digital teaching materials. it is highly recommended to be used in the learning process so that students are more motivated and master the material. The limitation of this study is that it was implemented on a very small scale, so further research is needed for a wider population context. The eco-literacy assessment used is still very limited. Therefore, more studies on eco-literacy assessment are expected.

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