



Development of E-Booklet on Ethnobotany-Based Diversity of Living Creatures in Colo Village, Gunung Muria

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Abstract

The ethnobotany of Colo Village is important local wisdom that should be preserved, including through an e-booklet on the Diversity of Living Organisms. This study analyzes biodiversity based on ethnobotany and evaluates the feasibility and readability of the e-booklet using the Research and Development (R&D) method with the 4D model. The results identify genetic, species, and ecosystem diversity. Genetic diversity is observed in the color variations of paper flowers (*Zinnia elegans* L.), roses (*Rosa hybrida*), and ixora flowers (*Ixora coccinea* L.). Species diversity includes 39 plant species from 28 families, while ecosystem diversity consists of forests, coffee plantations, and residential areas. Validation by material experts shows content feasibility at 77%, presentation 80%, and contextual assessment 77%. Media experts rate graphics at 99% and language at 100%. Teachers from SMAN 1 Mijen Demak assess usefulness at 73%, ease of use and appearance at 84%, and attractiveness at 79%, while SMAN 1 Kudus teachers rate these aspects at 95%, 100%, 100%, and 95%. Student response tests from SMAN 1 Mijen Demak show 83% for usefulness, 81% for ease of use, 83% for appearance, and 80% for attractiveness. SMAN 1 Kudus students rate these aspects at 83%, 86%, 81%, and 78%. Cloze test results show 88% for SMAN 1 Mijen Demak and 94% for SMAN 1 Kudus. The e-booklet is deemed feasible and highly readable.

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INTRODUCTION

Indonesia is a country rich in biodiversity, particularly in plant diversity, which has been utilized by communities for generations. Humans have used plants for thousands of years, adapting their usage according to local culture, making it a form of local wisdom. Local wisdom-based education is closely related to life skills, tailored to a region's traditions (Nadlir, 2014). According to Government Regulation No. 19 of 2005, the curriculum for senior high schools (SMA/MA/SMALB) or equivalent institutions may incorporate local excellence-based education, serving as a foundation for implementing local wisdom-based learning. Ethnobotany, the study of interactions between humans and plants concerning history, physical and social environmental factors, and plant uses (Hakim, 2014), is one form of local wisdom that can be a valuable learning resource for biodiversity studies.

Colo Village, located in the Muria Mountains, Dawe District, Kudus Regency, Central Java, sits approximately 700 meters above sea level and spans 584 hectares. Bordering the Muria Mountain Forest, it maintains a high level of biodiversity. According to Perum Perhutani KPH Pati, Colo Village is home to 80 species of trees, palms, and grasses. Planted trees include mahogany (*Swietenia mahagony*, 1942), pine (*Pinus merkusii*, 1944), sengon (*Albizia falcata*), eucalyptus (*Eucalyptus deglupta*), and coffee (1942). Fauna includes long-tailed macaques (*Macaca fascicularis*), Javan lutungs (*Trachypithecus auratus*), Javan leopards (*Panthera pardus*), barn owls (*Tyto alba*), and coucals (*Centropus*) (Widjanarko, 2016).

The residents of Colo Village, primarily farmers, rely on the surrounding natural resources and continue to use plants for traditional medicine, passed down through generations. They preserve local wisdom, including ethnobotany and herbal medicine. Local wisdom consists of knowledge, values, practices, and traditions that develop within a community through interaction with nature and society. This wisdom is inherited and serves as a guide for maintaining harmony and overcoming challenges. Rahayuningsih (2017) states that long-standing local wisdom effectively supports biodiversity conservation strategies. However, modern youth tend to favor instant solutions over traditional methods, leading to decreased interest in herbal medicine and a lack of understanding of the benefits of plants in their environment. To address this issue, this study introduces ethnobotany as a form of local wisdom to students as a supplementary learning resource. A booklet is an engaging, easy-to-read learning medium that includes images. With technological advancements, an e-booklet can serve as an electronic learning resource that is practical, portable, replicable, durable, and eco-friendly. Developing an e-booklet is essential to enable students to learn independently anytime and anywhere. The inclusion of images enhances biodiversity learning by providing clear visual representations of flora and fauna.

The "Merdeka Curriculum" promotes diverse intracurricular learning with optimized content, allowing students time to deepen concepts and strengthen competencies. Schools implementing this curriculum include SMA N 1 Kudus and SMA N 1 Mijen Demak. Interviews with biology teachers from these schools reveal that the Merdeka Curriculum differs from the 2013 Curriculum, offering teachers more freedom and flexibility to create meaningful, high-quality learning experiences tailored to students' needs. Learning about Biodiversity through an ethnobotany-based e-booklet is crucial for students to understand the benefits of plants around them and preserve them as part of local wisdom. The e-booklet presents biodiversity information in Colo Village, Muria Mountain, based on observation and documentation. Learning about Biodiversity is expected to be more meaningful for students by providing examples of biodiversity and the threats it faces in Colo Village, Muria Mountain. The results of this study can serve as supplementary learning material to achieve Phase E learning outcomes, where students develop the ability to create solutions to local or global issues based on their understanding of biodiversity.

The use of an ethnobotany-based e-booklet offers several benefits in learning about biodiversity. It helps students recognize and appreciate local plant species, understand their uses, and develop conservation awareness. By integrating local wisdom into the curriculum, students gain a deeper connection to their cultural heritage and environment. This approach also aligns with the goals of the Merdeka Curriculum, which emphasizes contextual and meaningful learning

experiences. The ethnobotany-based e-booklet not only provides accurate scientific information but also promotes local wisdom and environmental conservation. The validation results, teacher assessments, student response, and cloze tests all indicate that the e-booklet enhances learning experiences and supports independent study. By adopting this learning tool, schools can encourage students to appreciate and preserve their local biodiversity, fostering a sustainable and culturally aware generation.

RESEARCH METHODS

The research approach that will be used in this study is *Research and Development* (RnD) because it aims to validate and develop products in the form of *e-booklets*. The research and development model used is 4D proposed by Thiagarajan (1974) which stands for *Define, Design, Development, Dissemination*.. Field data collection in the form of diversity of living things in Colo Village, Dawe District, Kudus Regency. The preparation of *e-booklets* and expert validation was carried out at Semarang State University. The product trial in the form of an *e-booklet* was conducted at SMA N 1 Kudus and SMA N 1 Mijen Demak. Field data collection to product trials in schools will be carried out from June 2023 to July 2024.

RESULTS AND DISCUSSION

Diversity Of Living Creatures in Colo Village Gunung Muria

The diversity of living things in this study is based on the results of research conducted in Colo Village, Gunung Muria. The research on the diversity of living things in Colo Village uses an ethnobotanical approach. The level of diversity of living things, especially the flora referred to in this study, includes the gene, type, and ecosystem levels. The results of the research on the diversity of living things in Colo Gunung Muria Village which have been found to be used as a source of material in making *e-booklets* as a supplement to learning resources.

Genetic diversity in Colo Village, Mount Muria, is observed in the variation among flower species. Some flower species found in this area that fall under genetic diversity include paper flowers (*Zinnia elegans* L.), roses (*Rosa hybrida*), and Ixora flowers (*Ixora coccinea* L.). This genetic diversity is commonly found in residents' home gardens, which are part of the residential ecosystem. The residents of Colo Village, Mount Muria, utilize these flowers as ornamental plants due to their high aesthetic value, characterized by bright and attractive colors. These plants are considered part of genetic diversity because they exhibit variations in color within the same species.

The diversity of species found in Colo Village, Gunung Muria in this study was found as many as 39 species of plants from 28 families. The families that have the largest number are the Araceae, Arecaceae, and Zingiberaceae families. The Araceae family found is from the genus *Amorphophallus*. This plant is found in residential areas. The most widely found plant is porang (*Amorphophallus muelleri*), iles-iles (*Amorphophallus oncophyllus*) Dan enthik (*Colocasia esculenta*) which is a type of taro. The people of Colo Village use the tubers from the plant to be consumed directly or processed to produce higher economic value. This is supported by Sri *et al* (2023) which states that. The people of the Muria area often use family plants *Araceae* for food needs, and sold to pilgrims to the tomb of Sunan Muria Kudus. Plant *Araceae* It is a meal that many pilgrims are looking for when they come to the Muria area. The Muria area is synonymous with the existence of taro tubers (*Araceae*). In addition, tubers are used by the people of Colo Village as a basic ingredient for making

flour which can then be processed again into cakes.

Family *Arecaceae* includes palm plants such as palm (*Alexander pins*), Palm Seeds (*Pinanga coronata*), and rattan (*rattan calamus*). This plant grows in the forest area of Colo Village, Muria Village. Plants in this family can grow in humid tropical forest areas and some in lowlands with slightly dry conditions (Novianti *et al.*, 2023). Palm fruit is used by the people of Colo Village to take the seeds or known as kolang kaling for consumption. The sap from the flower bunches is also used for the manufacture of palm sugar. Rattan that grows in the forest is used by the Colo people as a handicraft material in the form of weaving. Meanwhile, seed palms are allowed to grow in the forest as a scenery.

Furthermore, there is also the *Zingiberaceae* family that grows in the Muria Mountain Forest. Some of the species that belong to the *Zingiberaceae* family that are found are turmeric, temulawak, ginger, and kana flowers. The plant is most commonly found in residential areas of Colo Village. The *Zingiberaceae* family is mostly found in residential areas because many people in Colo Village deliberately plant to benefit from these plants. The people of Colo Village use plants from the *Zingiberaceae* family to be made as traditional medicine as a seasoning for cooking.

The part of the plant that is most used by the people of Colo Village is the fruit part. A total of 11 species are used by the people of Colo Village. Fruit can also be consumed and sold directly without a long processing process so that the people of Colo Village choose more species that can be used for their fruit. Then, the leaf part is the second most common part of the plant after fruit. A total of 9 species of plants found in Colo Village are used by the community for their leaves. The many uses of these leaves are because the leaves can be used directly by the community as vegetables, one example is vegetable ferns as the main ingredient for making pecel which is very famous in the people of Colo Village. The third most used plant part is the stem part. There are as many as 5 species that are used by the community. The stem part is used by the people of Colo Village as a craft material such as rattan (*Calamus rotang*) and the wood can be used as a material for making cages such as kaliandra wood (*Calliandra tetragona*). Furthermore, there is a tuber part that is widely used by the community. There are 3 species that are used for the tubers. The use of tubers in the people of Colo Village is quite a lot because in addition to being consumed directly, the tubers are a dish that many pilgrims are looking for when they come to the Muria area, an example is taro (*Amorphophallus oncophyllus*). Furthermore, there is a part of the rhizome that is used by the people of Colo Village. Rhizomes in the species *Zingiber officinale* (ginger), *Curcuma longa* (turmeric), and *Curcuma zanthorhiza* (temulawak) are used as kitchen spices and traditional medicines such as herbal medicine. Plant parts such as roots, seeds, and flowers are rarely utilized because they are more difficult to process. For example, clove flowers (*Syzygium aromaticum*) must be processed by drying and extracting them first to be used as a tea mixture.

The diversity of ecosystems found in Colo Gunung Muria Village includes forest ecosystems, garden ecosystems, coffee, and residential ecosystems. Forest ecosystems are protected forest ecosystems and limited production forests found in Colo Gunung Muria Village in higher areas. In the protected forest ecosystem, many large trees are found. Large plants in protected forest ecosystems become the habitat of endangered animals such as leopards, panthers, porcupines, langurs, peacocks, Javanese eagles, bido eagles, pythons, and antelopes. Meanwhile, the small plants that grow around it become a source of food for the animals there. In limited production forests, plants that have economic value are found such as cloves, juwet, durian, avocado and various other types of plants. Plants that are in The forest area of Colo Gunung Muria Village thrives because it has higher humidity and lower temperatures. The species that is most commonly found in forest ecosystems is the type of fern. There are species *Rumhora adiantiformis*, *Diplazium esculentum*, dan

Asplenium nidus with a large number. This is in accordance with the opinion Majid *et al* (2022) which states that fern plants grow at high soil moisture. The tall trees are tight so that they create a forest roof (canopy). The density and size of the tree canopy of the tree cannot penetrate to the bottom of the forest so that ferns can thrive.

The garden ecosystem found on the slopes of Mount Muria is a coffee plantation. Coffee plants are suitable for growing in mountainous areas. This is in line with Murdaningsih & Hutubessy (2021) which states that coffee plants grow well at altitudes above 1000 meters above sea level such as highlands and mountainous areas. The most abundant species found in this coffee plantation ecosystem is robusta coffee (*Coffea canephora*). This species is also the species with the highest number of individuals at 1000 individuals. Based on the criteria for the number of individuals per species in table 3.3, the number is classified as very high. This is because the agroforestry system is applied to the coffee plantation ecosystem. Agroforestry is a system in the use or clearing of land as an agricultural business with a combination of woody plants and agricultural crops to increase economic and environmental benefits. Coffee plantation agroforestry in Colo Village is included in simple agroforestry indicated by the population of one type of tree planted in intercropping with annual plants. Crop land is planted randomly to form a plot fence so that the food crop land can be surrounded by trees planted around. Coffee plantations are surrounded by cloves, kaliandra, or other types of plants.

The residential ecosystem found on the slopes of Mount Muria is several types of plants that are deliberately planted by residents, such as avocados, ornamental ferns, orchids, pamelos oranges, and medicinal plants. The most abundant plant found in residential ecosystems is the vegetable fern (*Diplazium esculentum*). Vegetable ferns are widely grown in the yard of houses to be used as pecel ferns. The pecel fern food menu has been in great demand by the people of Colo Village since ancient times until now. This menu is served at food stalls at tourist sites on Mount Muria, especially at the Colo tourist location near Pesangrahan Colo.

Colo Village has an identity plant, namely parijoto (*Medinilla speciosa*). Parijoto plants are not found in residential areas, but can be found in garden and forest areas. In the past, parijoto was known as a wild plant, only after 1998 this plant was cultivated as an agricultural plant. Parijoto can be used for its fruit and sold directly by the people of Colo Village. This is proven in Table 4.4 which shows the number of these plants is only 37 individuals. Based on indicators, the number is less than 100 and is relatively low. Parijoto plants are increasingly difficult to find in Colo Village due to the low sales of parijoto plants. This is because many competitors from other regions sell parijoto plant products with various interesting preparations that are more in demand by the public. The efforts of the people of Colo Village to preserve parijoto plants are to increase the area of garden land for parijoto cultivation. In addition, the community collaborates with farmers from other villages for parijoto nurseries. Later, this plant will be processed into various processed syrup products and parijoto candies that have higher economic value and can compete with other products.

The plant that has the least number of individuals per species found in Colo Village is the moringa plant (*Moringa oleifera*). This plant is rarely found in residential areas but can be found in forests. The small number of individuals is because this plant is not so widely used by the people of Colo Village that no one cultivates it, only allows it to grow wild in the forest area.

The results of the next research were made in the form of an *e-booklet* on the Ethnobotany-based Diversity of Living Creatures in Colo Gunung Muria Village, which contains information on the diversity of living things in Colo Gunung Muria Village, especially the diversity of flora species along with photos of the research results equipped with descriptions.

Feasibility and Readability of Ethnobotany-Based Biodiversity E-Booklet as a Supplement to Biodiversity Materials

The feasibility of the ethnobotany-based *e-booklet learning media* for the diversity of living things in Colo Gunung Muria Village is seen from the results of the validity by material experts and the assessment of product practicality by teachers and students. Validation assessments are carried out by material experts and media experts. The standard used as a reference for the validation of *ethnobotany-based e-booklet media* for the diversity of living things in Colo Gunung Muria Village is adopted from the 2016 BSNP teaching material feasibility standard.

The validation assessment of media experts consists of two aspects, namely the feasibility of the graphic aspect and the linguistic aspect. The assessment of the validation of material experts consists of three aspects, namely the feasibility of the content, the feasibility of presentation, and the contextual aspect. Overall, *the ethnobotany-based biodiversity e-booklet media* in Colo Gunung Muria Village received a percentage of 78% by material experts and 99% by media experts, both of which were included in the very good criteria.

Validation of the learning media developed is an assessment by material expert lecturers. The lecturer who is an expert in the material to validate is a lecturer from the Department of Biology FMIPA, Semarang State University. Validation by lecturers who are experts in this material includes aspects of content eligibility, aspects of presentation feasibility, and aspects of contextual assessment. The following are the results of the assessment of material expert lecturers on *the ethnobotany-based biodiversity E-booklet* of Colo Gunung Muria Village.

Table 1. Product Validation Results by Material Experts

Assessment aspects	Percentage (%)	Category
Content eligibility aspects	77%	Good
Aspects of eligibility	80%	Good
Aspects of contextual assessment	77%	Good

Based on the results of validation by material experts, the feasibility aspect of the content received a score of 77% in the good category. Overall, this ethnobotany-based *biodiversity e-booklet* in Colo Gunung Muria Village presents materials that are in accordance with the learning objectives. The content of the material in the *e-booklet on the* ethnobotany-based diversity of living things in Colo Gunung Muria Village is designed in an interesting way to encourage students' curiosity and interest in learning.

The aspect of the feasibility of presentation according to the material expert lecturer received a score of 80% included in the good category. The presentation of material is based on the results of ethnobotany-based research on the diversity of living things in Colo Gunung Muria Village. The material is presented in the form of pictures accompanied by information based on the results of identification and interviews with researchers. The use of images can attract students' attention in learning. This is in line with the opinion Safitri & Kabiba (2020) which says that the function of images in learning media can arouse students' interest and attention, besides that images can clarify important parts of a media so that it is easier for students to understand the material in it.

Furthermore, the contextual assessment aspect received a score of 77% in the good category. The results are based on the presentation of e-booklets that contain contextual elements including

constructivism, inquiry, learning community, learning community, reflection and assessment. These elements are manifested in features in interesting *e-booklets* so as to foster interest, a sense of curiosity to learn, and an attitude of independence in student learning.

Product validation by media experts in this study was by lecturers from the Department of Biology FMIPA, Semarang State University. The assessment by the lecturer of media experts is the feasibility of the graphics and the language feasibility aspect. The following are the results of the assessment of media expert lecturers on *the ethnobotany-based biodiversity e-booklet* of Colo Gunung Muria Village.

Table 2. Product Validation Results by Media Experts

Assessment aspects	Percentage (%)	Category
Aspects of graphic eligibility	99%	Excellent
Linguistic eligibility aspects	100%	Excellent

Based on the results of validation by media experts, the feasibility aspect of graphics received a score of 99% in the very good category. This shows that overall, the display in the *e-booklet* on the ethnobotany-based diversity of living things in Colo Gunung Muria Village is good and worthy of being applied to students. The use of bright colors and the use of images, the proportional layout, the right selection of letters and sentences, and the size that conforms to ISO standards make this medium worthy of a high score.

The linguistic aspect of media experts received a score of 100% which was included in the very good category. The language presented in the website media is in accordance with the correct spelling standards. Languages spoken in *e-booklet* This is straightforward and communicative so that it meets the 2016 BSNP eligibility standards. The linguistic aspect is very important because it affects the level of media readability. The higher the level of media readability, the easier it is for students to understand so that it affects interest and is followed by an increase in student learning outcomes (Sari *et al.*, 2020).

The feasibility of the product is also based on an assessment by a biology teacher. The assessment results from the Biology teacher at SMA N 1 Mijen Demak showed a score of 73% for the usefulness aspect, 84% for the ease-of-use aspect, 84% for the appearance aspect, and 79% for the attractiveness aspect, each aspects categorized as good. Meanwhile, from the teacher at SMA N 1 Kudus showed a score of 95% for the usefulness aspect, 100% for the ease-of-use aspect, 100% for the appearance aspect, and 95% for the attractiveness aspect, each aspects categorized as excellent. The results of the validation by the teacher can be concluded that the ethnobotany-based *biodiversity e-booklet* of Colo Gunung Muria Village has been well prepared and has a useful aspect. The use of this *e-booklet* is also easy and flexible and can provide easy-to-understand material. The display in this *e-booklet* is also appropriate in the selection of letters, image layout, color proportions, and sentence selection. *This e-booklet* provides a different learning atmosphere because of its attractive appearance and makes learning not boring.

The readability of the product was assessed using a cloze test conducted on 30 students from Grade X MIPA at SMA Negeri 1 Mijen and 30 students from Grade X MIPA at SMA N 1 Kudus, with varying levels of ability within each class. The respondents' skill levels were determined based on the results of their Odd Semester Final Assessment.

Students were asked to complete the cloze test, a written test technique in which they fill in missing words within a given passage. This test serves as a measurement tool to evaluate the

readability of the developed e-booklet. Based on the results, students from SMA N 1 Mijen Demak achieved a score percentage of 88%, while students from SMA N 1 Kudus achieved 94%. The scores from both schools fall into the high category, indicating that the developed e-booklet has a high readability level and is suitable for use as a supplementary learning material on biodiversity. The recapitulation of the results of the cloze test can be seen in table 3.

Table 3. Results of the Student Cluster Test

Respond	Percentage	Category
Students of SMA N 1 Mijen	88%	High
Students of SMA N 1 Kudus	94%	High

Students are also asked to fill out a response questionnaire regarding the *e-booklet* developed. The filling out of this student response questionnaire aims to find out the suitability of the *e-booklet* developed and the practicality of the *e-booklet* based on the aspects of usefulness, convenience, appearance, and attractiveness. These student responses are used to assess the practicality of the product. The recapitulation of the results of student responses can be seen in table 4.

Table 4. Results of Student Response Questionnaire

Respond	Assessment aspects	Percentage (%)	Category
Students of SMA N 1 Mijen	Usefulness Aspect	83%	Excellent
	Convenience Aspect	81%	Good
	Display Aspects	83%	Excellent
	Attractive Aspects	80%	Good
Students of SMA N 1 Kudus	Usefulness Aspect	83%	Excellent
	Convenience Aspect	86%	Excellent
	Display Aspects	81%	Good
	Attractive Aspects	78%	Good

With this percentage value, this means that the product developed is practical because it is appropriate and meets all aspects of the practicality assessment. This is in line with the opinion Annisa *et al* (2020) which states that student learning media must be able to be used easily so that students do not experience difficulties during the learning process so that learning goals can be achieved. Easy-to-use learning media can also portray a positive response to the material taught. Thus, the product *e-booklet* The ethnobotany-based diversity of living things in Colo Gunung Muria Village has a high level of readability and is suitable for use as a supplement to students' learning resources on the diversity of living things.

CONCLUSION

Based on the research conducted, it can be concluded that:

1. The biodiversity in Colo Village includes genetic, species, and ecosystem diversity. The genetic diversity found in Colo Village, Mount Muria, is represented by color variations in paper flowers (*Zinnia elegans* L.). The species diversity in Colo Village, Mount Muria, consists of 39 plant species from 28 families. The ecosystem diversity in the area includes forest ecosystems, coffee plantation ecosystems, and residential ecosystems.
2. The ethnobotany-based biodiversity e-booklet in Colo Village, Mount Muria, is deemed suitable as a supplementary learning material on biodiversity, with a high readability score. Based on the results of the research that has been carried out, it can be concluded that:

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