

DEVELOPING EXPERIENTIAL-BASED TEACHING MATERIALS EXPLORING THE SURROUNDING NATURE IN HIGHER PLANTS SYSTEMATICS

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ABSTRACT

Indonesia's biodiversity continues to decline annually. One of the causes is the increase in tourist areas that ignore ecological values, reduce green open spaces, and only focus on economic gain. Learning can utilize local potential with the Natural Exploration model in the surrounding area so that students not only learn about plant diversity from books but also have knowledge and sensitivity to the surrounding environment. In the higher plant systematics course, an outdoor learning model is applied so that learning objectives can be achieved. Based on observations made in the higher plant systematics course, data was obtained that learning has not utilized existing local potential and still refers to textbooks with general material about plants. Furthermore, in the Biology Education Study Program at Pasir Pengaraian University, there is no E-Module based on local plants using the Experiential Natural Exploration (EJAS) model. The purpose of this study is to develop teaching materials for the higher plant systematics course based on EJAS. The method used in this study is development research with the ADDIE model. The results of this study obtained that the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course was overall very suitable for use with an average value of 90.4%.

ARTICLE HISTORY

Received 25 January 2025
Revised 08 April 2025
Accepted 24 April 2025

KEYWORDS

Teaching Materials,
EJAS,
Higher Plant Systematics

INTRODUCTION

Indonesia is a country rich in biodiversity, with abundant local potential in each region. Yayang et al. (2022) argue that Indonesia possesses an abundance of biodiversity, yet this rich biodiversity remains underutilized. Indonesia's biodiversity continues to decline annually. One of the causes is the expansion of tourism areas that disregard ecological values, reduce green open spaces, and focus solely on economic gain. According to data from the Rokan Hulu Development Planning Agency, in 2022, Rokan Hulu Regency accounted for 11.8% of the total area of Rokan Hulu Regency. This data is still far from the 20% target for green open space. Therefore, it is crucial for educators to incorporate the environment surrounding students into their learning materials.

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The higher plant systematics course applies an outdoor learning model. Learning can utilize local potential with the Natural Exploration model that exists in the surrounding area so that students not only learn plant diversity from books but also have knowledge and sensitivity to the surrounding environment (Anisah et al, 2020). The purpose of integrating local potential into learning activities at school is to maintain environmental conservation, it is hoped that students can develop and empower the potential of their respective regions. Based on observations made in the higher plant systematics course, data obtained that learning has utilized existing local potential, but still refers to textbooks with general material about plants. Furthermore, in the Biology Education Study Program, Pasir Pengaraian University does not yet have an E-Module based on local plants using the Experiential Natural Exploration (EJAS) model.

In previous research, Basaroh et al. (2021) in their research related to e-modules with an experiential model of exploring the surrounding nature, the results were feasible and practical for plantae material and in another study by Damarsasi (2013) the application of the inquiry learning method with e-modules had an influence on improving student learning outcomes. According to Kurniawan and Dedi (2021) technological developments change the learning orientation from conventional learning to digital learning. This change is in line with the integration of learning strategies with Information and Communication Technologies (ICT). The challenges of the 21st century are often associated with the 4Cs (communication, collaboration, critical thinking, and creativity) so that development is needed related to (1) communication skills; (2) collaboration with various parties; (3) critical thinking skills; (4) creativity (Rose et al, 2024; Sahil, et al, 2022; Banjarnahor et al, 2023). E-modules are a suitable technology for student learning, combined with animation, images and interactive videos will make students more enthusiastic about learning.

In the process of learning the material of plant systematics is a very broad field of study which includes diversity (biodiversity), identification (discovering identity), naming, classification (grouping), and evolution of plants. The aim of studying plant taxonomy is: (1) To inventory the plants that exist in the world; (2) To explain the methods used for plant identification and for communication. To produce a unified and universal classification system; (3) To provide scientific names for various taxa or groups of plants in Latin. The plant groups that are given names are all plants that exist on the surface of the earth, both living and fossil; (4) To show the evolutionary implications of plant diversity.

Therefore, efforts to understand the systematics of higher plants require additional teaching materials that can complement existing ones. The presence of innovative teaching materials can certainly foster students' understanding of the systematics of higher plants, thereby achieving learning objectives. To present images that represent the material in the teaching materials, a herbarium can be included. This herbarium can serve as a learning medium. According to Aripin et al. (2022), the use of herbariums in biology learning not only facilitates the learning process but is also expected to increase students' awareness of plant conservation.

Textbook-based teaching materials are not as practical as electronic teaching materials. Electronic teaching materials are more practical because they are easy to carry anywhere. Students often forget printed teaching materials, which can disrupt the learning process in class. Therefore, the additional teaching materials to be developed will be made in electronic module form. This will make it easier for students to access them while studying. This is also supported by the two learning systems currently in use: online and offline. Furthermore, students in the biology education program at Pasir Pengaraian University generally own mobile

phones, and they have free access to the campus Wi-Fi. This allows them to utilize electronic learning materials and modules.

Experiential Exploration of the Environment (EJAS) is defined as a learning method characterized by a fun and engaging nature, synonymous with learning that utilizes the natural environment surrounding students' daily lives, including physical, social, cultural, and religious aspects, as an object or resource for biology learning. This is achieved by studying environmental problems scientifically. The JAS learning method utilizes the student's immediate environment as a biological learning object, a phenomenon that can be studied scientifically. It incorporates several learning elements, including exploration, to create a more enjoyable learning environment for students (Alimah, 2016).

Furthermore, the JAS model tends to emphasize learning activities related to real life, making it an appropriate learning model for biology instruction. EJAS encompasses several innovative elements in its application, including constructivism, the application of science, inquiry, and the exploitation of the natural environment. The use of the EJAS model allows students to develop their potential and enhance their understanding, both theoretically and through hands-on activities based on their daily lives. The learning process using the EJAS model in other words means inviting students to recognize objects, recognize symptoms and problems and how to overcome them regarding the material being studied.

This electronic module will contain a herbarium of local plants using the EJAS learning model. According to Alimah (2016), the EJAS learning model itself facilitates exploration, interaction, communication, reflection, and evaluation activities, with the aim of supporting students' learning experiences. One of the syntaxes of the EJAS model, exploration, provides opportunities for students to develop their ideas and experiences through investigative activities in their environment. Thus, learning carried out by exploring the surrounding nature provides opportunities for students to develop their ideas and experiences. In this case, the e-module with an experiential model of exploring the surrounding nature with exploration activities can provide opportunities for students to improve their thinking skills and learning outcomes. This is supported by another opinion from Yusnaeni et al., (2016) that creating a learning environment that provides opportunities for students to think openly and flexibly can improve students' thinking skills. According to Kostova (2018), learning is easier to remember and understand when students experience it directly in learning activities.

The results of the EJAS are made in the form of a herbarium. Herbarium is an important basic material in the study of plant systematics. In addition to storage, it is also used for the study of plants, especially for nomenclature and classification. Herbarium is closely related to botanical gardens, research institutions, or education (Murni, et al., 2015). Through herbarium observations, students can analyze the morphological variations of plants discussed in the lesson so that the description of a plant taxon can be determined easily (Mertha et al., 2018). Based on this background, it is necessary to develop teaching materials based on the Experiential Nature Exploration Model (EJAS) for the Higher Plant Systematics course. The purpose of this study is to determine the feasibility of teaching materials based on the experiential nature exploration model for the higher plant systematics course.

METHOD

This research is a Research and Development (R&D) study using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. It was conducted in the Biology Education study program at Pasir Pengaraian University. The subjects were students in the Biology Education study program. Data collection instruments included interviews, validation questionnaires from linguists, material experts, and media experts, and student response questionnaires created on a Likert scale. The data analysis techniques employed in this study were quantitative and qualitative descriptive analysis, which involved describing and interpreting both quantitative and qualitative data.

Product trials were used to collect data related to the product being developed, namely a local plant-based e-module using the Experiential Nature Exploration (EJAS) model. Individual trials involved four students, small group trials involved 10 students, and large group trials involved 35 students. The data collected consisted of qualitative data obtained from interviews, questionnaires, and documentation.

Table 1. Expert Validation Questionnaire Sheet

No	Aspect	Criteria
1	Material Contents	Accuracy of concepts and definitions in leaf morphology material
		The accuracy of images, videos, and quizzes in the e-module on leaf morphology material
		Completeness of materials according to basic competencies
		Breadth of material
		Depth of material
2	Presentation Aspects	Encourage students' curiosit
		The complexity of the concepts presented
		Consistency of systematic presentation of material
		Examples of questions in the e-modul
		Glossary
3	Language	Summary
		Correctness of sentence structure
		Conformity of the statements used with EYD
		The language used in the e-module is easy to understand
		Effectiveness of sentences
4	Appearance	Standardity of terms
		The layout and layout of the e-module display are consistent.
		The use of text, images, videos and quizzes in e-modules is proportional
		Use of spacing between lines appropriately
		E-module background display
		Front view (cover) of e-module
		Color selection on e-modules
		Consistency of e-module content with the table of contents
		Clarity of letter display on e-module
		Easy e-module operation
practical e-module to use		

RESULTS AND DISCUSSION

The results of this research are an e-module. The development procedure in this study adapts the five stages of the ADDIE model as follows:

1. Analysis

At this stage, a learning needs analysis is conducted, including: Analysis of student characteristics: academic background, initial abilities, and learning interests; Analysis of learning needs in the Higher Plant Systematics course; Identification of learning problems that lack direct experience and observation of local plants; Assessment of the potential of the campus environment as a learning resource in EJAS learning; Determination of general learning objectives to be achieved through the development of teaching materials

2. Design

This stage aims to design a prototype of EJAS-based teaching materials. Activities include: Formulating specific learning objectives based on the results of the needs analysis; Developing the structure and content of teaching materials, including activities such as observing local plants and reflecting on learning experiences; Designing an EJAS-based learning flow, such as field orientation, specimen observation, identification, and documentation; Designing supporting media (images, videos, worksheets) and evaluation instruments (quizzes, reflection journals, field activity observations); Determining the format and visualization of teaching materials, both printed and interactive digital.

3. Develop

At this stage, the teaching materials are developed according to the established design: Preparation of an initial draft of the EJAS-based teaching materials; Expert validation conducted by: material experts (biology/plant systematics) and learning media experts; Product revision based on validator input; Preparation of teaching materials in a trial-ready format (printed modules or interactive e-books).

4. Implement

This stage is a limited trial of the developed teaching materials. Activities include: Implementing learning using the EJAS teaching materials for students in the Higher Plant Systematics course; Observing student engagement in nature exploration, plant identification, and reflective discussions; Collecting data related to the implementation of learning, student responses, and changes in learning outcomes; Documenting and evaluating the implementation process as a basis for final revisions.

5. Evaluate

Evaluation is conducted in two forms: Formative evaluation: conducted at each stage of development through expert validation and product trials. Summative evaluation: conducted at the end of implementation to assess the effectiveness of teaching materials through: Improved learning outcomes (pretest-posttest); Analysis of the quality of field activities; Reflection on students' attitudes and understanding of plant diversity and the importance of the environment.

The result of this research is an e-module based on experiential exploration of the surrounding nature (EJAS) for the course of higher plant systematics. The developed teaching materials have advantages in terms of appearance and content, equipped with several examples of surrounding higher plants that can facilitate students during the learning process so they can learn independently. The resulting teaching materials include interactive teaching materials because students can use them without being limited by space and time. The development of an e-module based on experiential exploration of the surrounding nature (EJAS) for the course of

higher plant systematics was assessed for its feasibility by 2 validators who are material experts, 2 validators who are media and technology experts, and 2 language experts.

The assessment was conducted to obtain information that will be used to improve the quality of the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course in the learning process. The development of the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course is generally included in the "very feasible" category with an average percentage score of 92.7%. The validation results by material experts on the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course received a score of 89.5% with the "very feasible" criteria. This is because the I-Spring learning media material presents the relationship between science and technology. According to Rahmayanti (2015) stated that learning media with the help of technology makes it easier for students to understand the material.

The e-module material based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course is able to develop skills and creativity in student activities, but there are not many matching exercises so that the validator provides suggestions to add matching exercises to make learning activities more enjoyable. According to Fitriani, Adudarin and Karelius (2019) stated that practice questions are suitable for use in order to monitor, guide, and improve student understanding.

The assessment of the feasibility of the experiential nature exploration (EJAS)-based e-module for the higher plant systematics course by a team of media and technology experts received a score of 95.7%, with the criteria of "very feasible." This is because the experiential nature exploration (EJAS)-based e-module for the higher plant systematics course has an attractive appearance and learning media that can encourage students to carry out learning activities so that learning objectives are achieved. Rinaldi (2021) stated that e-modules have advantages including increasing student learning interest because the media used is in the form of an application that contains interesting and clear materials, videos, and images.

After going through the validation and revision stages, the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course has been tested by teachers, individual trials, small group trials, and field trials. The purpose of the individual trials, small group trials and field trials is to determine the feasibility of the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course. The teacher trial obtained an average percentage of 100% including the criteria of "very feasible, individual trials were conducted on students who received even multiples of absence numbers totaling 8 people, with an average score of 87.8% included in the category of "very feasible". Small group trials were conducted on students who received odd multiples of absence numbers totaling 18 people, with an average score of 87.3% included in the category of "very feasible". Field trials were conducted on all students in the sample class totaling 35 people, with an average score of 93.8% included in the category of "very feasible"

CONCLUSION

The conclusion obtained from this study is that the e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course is overall very feasible to use with an average value of 90.4%. The e-module based on experiential exploration of the surrounding nature (EJAS) for the higher plant systematics course was validated by 2 media and technology experts, 2 material experts and 2 language experts. The results of the validation of the material expert lecturers on the feasibility of content and feasibility of presentation showed a very good category. The results of the validation of the language expert lecturers on the feasibility of language showed a very good category. The results of the validation of the media expert lecturers, on the feasibility of graphics showed the module was categorized as good. The module is categorized as feasible because it has gone through several feasibility tests. Based on the results of the initial product trial, small-scale trials, large-scale trials, the overall assessment of the E-module based on experiential exploration of the surrounding nature (EJAS) is very good.

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