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Development of Biodiversity E-Module Based on Local Potentials in Labuhanbatu Utara Regency to Train Science Literacy of High School Students

Nurul Azmi✉, Sri Ngabekti, Margareta Rahayuningsih

Pascasarjana, Universitas Negeri Semarang, Indonesia

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Abstract

The local potential of North Labuhanbatu Regency is very diverse, which has the potential as a source of learning on biodiversity material to develop scientific literacy needed in 21st-century learning. Scientific literacy enables students to apply science in everyday life, not just understanding science in concepts. This study aims to produce local potential-based electronic modules in North Labuhanbatu Regency that are feasible based on validity, readability, and effectiveness to train students' scientific literacy. This research is a research and development (R&D) with a 4-D development model and a one-shot case study research design. Based on the results of the validation test, a percentage score of 94.22% was obtained, including the very valid category. The readability results obtained a score of 89.66 which indicates excellent legibility. Posttest results showed an average of 81.81 with an average classical completeness of 84.05%, including in the excellent and effective category. Based on these results the development of a biodiversity electronic module based on local potential in North Labuhanbatu Regency was declared feasible based on validity, readability, and effectiveness as teaching materials.

✉ correspondence :
Jalan Kelud Utara III No.37, Kota Semarang,
Jawa Tengah, Indonesia 50237
E-mail: nurulazmimarpaung96@students.unnes.ac.id

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INTRODUCTION

Each region must have its local potential, one of which is the North Labuhanbatu Regency. North Labuhanbatu Regency is located on the East Coast of North Sumatra which generally has a wet tropical climate, consisting of lowland and hilly areas. North Labuhanbatu Regency has superior resources in each of its sub-districts in the form of agricultural, plantation, fishery, and mining areas (Badan Pusat Statistik Kabupaten Labuhanbatu Utara, 2019). North Labuhanbatu Regency has two watersheds (DAS), namely the Kualuh River and the Bila River, which flow from South to North and empties into the Malacca Strait with relatively good river conditions. Furthermore, the Bukit Barisan area plays an important role as a source of water for all rivers in North Labuhanbatu Regency and is the habitat of various protected endemic flora and fauna (Tanjung, 2020).

The local potential of North Labuhanbatu Regency can be used as a local potential-based learning resource for teachers in biology subjects. Local potential can be interpreted as something that has been applied as a tradition in society that can be tested scientifically so that it can be used as a source of learning (Hastuti et al., 2020). Utilization of local potential as a learning resource can help students connect the material studied with real (contextual) situations (Ramdiah et al., 2020). Ilmiyah & Utomo, (2019) added that contextual local potential-based learning, which is part of introducing the values and norms of the surrounding community in real life, will be easily accepted by students, facilitating the learning process and making learning an interesting process.

Electronic modules based on local potential can be selected as learning resources that have an important role in achieving the expected learning objectives (Lestari et al., 2022; Asrial et al*.,* 2021). Electronic modules will facilitate student learning activities independently according to their abilities. Electronic modules can be an option because students can learn independently without depending on others, adjust to science and technology, and be used anywhere and anytime, regardless of time (Daryanto, 2013). Electronic modules are a solution that can present learning material thoroughly with a combination of various media such as audio, text, images, and video (Marlina et al., 2022) and can be accessed on a computer or mobile phone as a whole and systematically (Astalini et al., 2021; Herdiana et al., 2021).

Considering the various potentials in North Labuhanbatu Regency, biodiversity material was chosen as the suitable material to be developed into an e-module based on local potential. Through local potential-based learning, students can directly see the diversity around them, thus creating a deeper understanding of the concept of biodiversity material (Sukirno et al., 2020).

Biodiversity is material that has a close relationship with the variation of various types of living natural resources, both from plants and animals including diversity of species, between species and ecosystems and efforts to preserve them. Class X Biodiversity Material Has Basic Competence, 3.2 Analyzing observational data on various levels of biodiversity (genes, species, and ecosystems) in Indonesia. 4.2 Present the results of the identification of proposed efforts to conserve biodiversity in Indonesia based on the results of analysis of data on threats to the preservation of various Indonesian unique animal and plant diversity communicated in various forms of information media.

To solve various problems as Basic Competency demands on biodiversity material, it is necessary to develop scientific literacy. Learning in the Society 5.0 era requires students to have multiple 21st-century skills (Nastiti et al., 2022; Asrial et al., 2021), PISA 2018 results show that Indonesia is in the bottom 10 of 79 participating countries with consecutive scores of 371, 379, and 396 in reading, mathematics, and science (OECD, 2019).

Low scientific literacy is caused by the lack of support for students during the learning process to explore and develop all reading, math, and science skills (Setyowati et al., 2022) Another factor is the selection of learning resources by the teacher (Fuadi et al., 2020). Erman et al., (2020) argued that the development of scientific literacy is significant because it can contribute to social and economic life and improve decision-making skills at the community and personal levels.

Field studies have shown that current learning resources focus more on content dimensions rather than process and context dimensions, as required by PISA. Biology teachers still rely heavily on textbooks when teaching biodiversity, despite the

need to explain models that relate to their students' immediate surroundings. While textbooks do provide general concepts and examples, teachers are expected to incorporate local potential in their teaching process, as mandated by Law No. 20 of 2013.

The aim of this research was to assess the viability and efficacy of utilizing local potential-based electronic modules in North Labuhanbatu Regency as resources for teaching biology topics on biodiversity in SMA. The findings of this study will serve as a valuable guide for educators to leverage the natural resources of North Labuhanbatu Regency as an educational tool to enhance students' scientific literacy.

METHODS

This research is a research and development (R&D) using a 4-D development model including defining, designing, developing, and disseminating, with a one-shot case study research design. The research subjects comprised one material expert lecturer, one media expert lecturer, one practitioner (biology teacher), and 107 class X students of SMA Negeri 1 Marbau. The research instruments used were expert validation questionnaires, readability questionnaires, and 20 scientific literacy test questions.

The defining stage (define) is carried out by setting and defining the requirements for learning. This stage begins with analyzing the objectives of the material and material boundaries based on the 2013 revised 2017 curriculum. This stage includes: (a) the front-end analysis stage is carried out by interviewing the biology teacher; (b) the analysis was carried out by distributing questionnaires to students to understand student characteristics; (c) task analysis is carried out by analyzing basic competencies 3.2 and 4.2, which are then formulated according to the basic competencies indicators; (d) concept analysis is carried out by identifying the main concepts in the material on biodiversity; (e) analysis of learning objectives is carried out by changing the results of task analysis and concept analysis into learning objectives to be achieved by students. The design stage (design) aims to design bio charged electronic modules. The design consists of consisting of the front cover, preface, characteristics of electronic modules, instructions for indicators of scientific literacy, table of contents, instructions for use, material maps, introduction, content, evaluation, competency test, glossary summary, bibliography, personal data, and back cover. The development stage (develop) aims to produce a bio-rich electronic module based on the local potential of North Labuhanbatu Regency which is valid and practical to use for the learning process. This stage includes: (a) the validity test aims to reveal the validity level of the biodiversity electronic module based on the local potential of North Labuhanbatu Regency that has been developed; (b) revision to improve the part of the biodiversity electronic module based on local potential of North Labuhanbatu Regency which was deemed inappropriate by the validator before the product was tested; (c) the trial aims to determine the legibility of the biodiversity electronic module based on the local potential of North Labuhanbatu Regency which is being developed. Due to time constraints, this research was only carried out until the development stage.

RESULTS AND DISCUSSION

The research that has been developed produces a product in the form of a biodiversity electronic module based on the local potential of Labuhanbatu Utara district to train scientific literacy for class X high school students. Unlike other teaching materials, this module is based on the results of a needs analysis and an exploration of biodiversity in the North Labuhanbatu Regency. The design of the module is attractive to increase students' motivation and interest in learning. The module consists of an introduction, a material section, and a closing section. The introduction includes the front cover, preface, characteristics of the electronic module, instructions for indicators of scientific literacy, table of contents, instructions for use, material map, and introduction. The material section includes unit titles, apperceptions, learning activity sheets, bio quizzes, let's get to know and modeling, and learning activity sheets for discussion, questions for discussion, assessment, practice questions, and reflection. The closing section includes an evaluation, competency test, glossary summary, bibliography, personal data, and back cover.

The resulting electronic modules are local potential-based learning media in North Labuhanbatu Regency in the form of flip books, pdf which can be accessed using devices, and in printed form which can be accessed offline. In the electronic module developed, there are 3 main topics of discussion, namely the biodiversity of North Labuhanbatu, the benefits of North Labuhanbatu biodiversity, and the loss of biodiversity of North Labuhanbatu Regency and its conservation efforts. The modules also include links and barcodes that connect to videos and websites for additional information, as well as questions and activities that are integrated with Google Forms for easy answering by students.

Columns of learning activity sheets, bio quizzes, learning activity sheets, let's get to know, and did you know you can practice the ability to explain phenomena, design and evaluate investigations and interpret data and facts scientifically? Meanwhile, modeling columns and learning activity sheets will generate an attitude of concern and response to science issues, interest in science and technology, environmental awareness, and respect for the scientific approach. The purpose of the features presented in this local potential bio-based e-module is to train students' scientific literacy so that the electronic modules developed are on aspects of scientific literacy.

The following shows the layout and design of the electronic modules developed:

Figure 1. Display of the electronic module layout

This study used three assessments, namely validation, readability, and effectiveness to determine the feasibility of local potential-based biodiversity electronic modules in North Labuhanbatu Regency to train the scientific literacy of class X High School Students to be used in learning.

1. Validation of the local potential-based biodiversity electronic module in the Labuhanbatu Utara district

This learning media goes through a validation test process by several validators before being used as a learning resource in the learning process. The calculation of media results consists of 2 aspects: material and media.

Table 1. The results of the electronic module validation

Aspect	Validators	Percentage (%)	Category
Material	Materials expert	90.22	Very valid
	Practitioner	94.57	Very valid
	Average	92.40	Very valid
Media	Media expert	94.32	Very valid
	Practitioner	97.73	Very valid
	Average	96.03	Very valid

According to Table 1, the material aspect of the electronic module was evaluated by experts and practitioners who gave it an average percentage of 92.40% with a very valid category. This indicates that the module is complete, easy to understand, and relevant to Core Competencies and Basic Competencies. The material and activities in the electronic module are designed to encourage students' scientific literacy skills, and the language used in the teaching materials is coherent and consistent. The experts and practitioners also noted that the module is contextual and based on local potential-based learning.

In terms of the media aspect, Table 1 shows that the electronic module was evaluated by experts and practitioners who gave it an average percentage of 96.03% with a very valid category. The module follows the ISO standard for A4 book size and features orange and dark green colors for the cover. The font used is attractive, easy to read, and reflective of the content. The layout elements are consistent and harmonious in terms of color, size, and shape. The typography is simple, easy to read and understand, and the illustrations clarify the material and create an attractive appearance. The systematic presentation of the electronic module follows the principles of having an introduction, content, and closing.

2. Readability of the local potential-based biodiversity electronic module in the Labuhanbatu Utara district

The readability test aims to find out the responses of teachers and students which are used as a benchmark for the quality of the electronic modules that have been developed (Afdal et al., 2022). Teaching material products along with legibility assessment questionnaires were given to 16 students of class XI MIPA, to determine the level of readability.

Table 2. The results of the analysis of the readability of the electronic module

Practitioner	Percentage (%)	Category
Teacher	95.00	Very good
Student	83.33	Very good
Average	89.66	Very good

According to Table 2, the electronic module has a mean readability score of 95.00% with perfect criteria. Based on the teacher's assessment, the local potential-based biodiversity electronic module in Labuhanbatu Utara Regency is suitable for high school students as a learning resource. The material, pictures, and illustrations are captivating and presented in a consistent and harmonious layout. The design is visually appealing and encourages students to engage in learning. Overall, the electronic module is an excellent resource for students. In line with opinion, Klare in Yanti et al., (2022) It was reported that a good level of readability in a text can influence readers to improve memory, interest in learning, increase reading speed, and is useful for maintaining reading habits.

3. The effectiveness of the local potential-based biodiversity electronic module in the Labuhanbatu Utara district

After producing the electronic module based on the local potential of North Labuhanbatu Regency and validating it with expert validators and teachers, it was applied in learning to test its

effectiveness on students' scientific literacy. The effectiveness of the local potential-based electronic module on student literacy was measured by analyzing test data on student learning outcomes, specifically through the post-test scores. Finding out the effectiveness of using local potential-based electronic modules for developing student literacy, can be seen through test data on student learning outcomes as indicated by post-test scores (Kasim et al., 2022). The post-test results are presented in Table 3 below.

Table 3. Students' post-test scores by applying local potential-based electronic modules on biodiversity material

Indicator	Post-test		
	Class X4	Class X 5	Class X 6
Average value	78.43	82.14	83.57
Number of students who completed	27	31	33
Number of students who do not pass	8	5	3
Percentage of post-test scores (%)	77.14	86.11	88.89
Post-test average value	81.81		
Classical mastery (%)	84.05		

After analyzing the results in Table 3, the post-test scores show an average of 81.81. The average classical completeness is 84.05%, which is above the minimum criteria score of 75, and classical completeness is> 80%. This indicates that the electronic module developed for learning about biodiversity has been effectively utilized by implementing local potential-based electronic modules to enhance students' scientific literacy. The test results for scientific literacy ability were analyzed for three aspects: 1. Scientific competence, 2. Scientific knowledge, and 3. Scientific attitude. Data analysis of student tests based on scientific literacy abilities is presented in Figure 2.

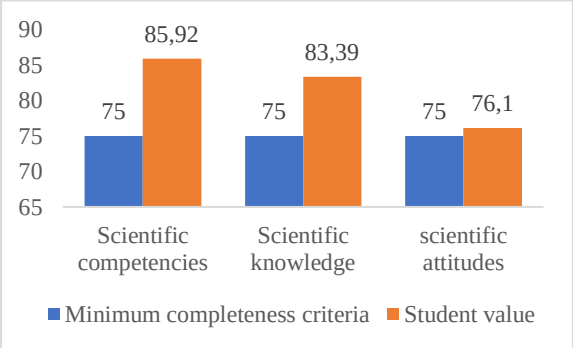

Figure 2. Bar chart of the average post-test scores of students

The results obtained based on Figure 2 scientific literacy skills in each aspect after learning activities using local potential-based biodiversity electronic modules in Labuhanbatu Utara Regency based on the results of the average post-test score of students as a whole are declared to meet the minimum completeness criteria because the average achievement score is above 75 at an advanced level. In line with the research of Herdiana et al., (2021) which stated that learning resources obtained from local potentials help teachers improve students' scientific literacy. Student achievement is obtained through the post-test because the local potential-based electronic modules used by students are real-life (contextual). Contextual learning by solving everyday problems is one of the elaborations of aspects of scientific literacy competence Herdiana et al., (2021). In addition, learning that utilizes local potential in the learning process can have a positive influence on the results of students' cognitive scores (Khaerani et al., 2020).

By designing local wisdom-based learning, students not only develop character but are also able to find knowledge related to competency aspects, and the application of knowledge in solving problems around them. Local potential-based learning will create meaningful learning and will be embedded as long-term memory, which will have an impact on increasing student knowledge (Dewi et al., 2021). (Kahar & Fadhilah, 2019) This is in line with the opinion (Kahar & Fadhilah, 2019) which states that by observing directly students will have the opportunity to make connections between theory and reality.

CONCLUSION

After conducting research, it has been concluded that a biodiversity electronic module can be developed based on the local potential of the North Labuhanbatu Regency. This module can be used to train scientific literacy among high school class X students and is highly suitable for use in Biology classes. The teaching materials have been assessed to have a high level of legibility and are easily understood by students. Furthermore, the post-test results show that the electronic module is effective in teaching biodiversity material and in improving students' scientific literacy by utilizing local potential-based electronic modules in North Labuhanbatu Regency.

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