



# Mangrove Biodiversity Diversity E-Module-Based Teaching Material on Biodiversity Materials and Its Conservation Efforts at SMAN 3 Sungai Apit

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## ABSTRACT

The purpose of the study was to develop teaching materials based on e-modules. In addition, this study also aims to evaluate students' responses to e-module products created by using the ADDIE (Analysis, Design, Development, Implementation dan Evaluation). model for their development. The sample was selected using a purposive sampling technique on 31 students from the science department at SMAN 3 Sungai Apit. Data were collected through observation, interviews, FGDs, validation sheets and questionnaires. Following the collection of all the data, the researcher performed identification by comparing the data with many mangrove guidebooks, including the mangrove guide book. Following the collection of all the data, the researcher identified the data by cross-referencing it with many mangrove guidebooks, including the mangrove guidebook. Results show that the e-module product is very feasible to use, With the level of approval from material experts of 96.75% (very feasible), learning experts of 87.5% (very feasible), media experts of 92.77% (very feasible) , and teachers as users of 95.14% (very feasible). From the results of the questionnaire distributed to students, a positive response of 94.51% (very good) was obtained. Students also stated that the product was very easy to use, could increase learning motivation, and could increase students' knowledge about the diversity of mangroves in Sungai Apit. Therefore, it can be concluded that the product is very feasible and received positive responses from all parties, so that it can be distributed more widely.

**Keywords:** development of teaching materials, mangroves, e-modules

## INTRODUCTION

The advancement of all nations, developed and developing alike, including Indonesia, depends heavily on education. Education has a crucial part in the development of all nations, developed and developing alike, such as Indonesia. (Ainunnisa, et al 2023). The goal of education is to enable students to actively realize their potential via the intentional and planned creation of a learning environment and process. (Ayuardini, 2023) Teachers and students work together to accomplish learning objectives through education. (Ramanda, 2023). The learning process which involves instructors, students, and the learning environment and its impact on achieving learning objectives are inextricably linked to the field of education. (Ayuardini, 2023).

Education has a significant role in the exploration of information, moral principles, and understanding. Human resources may be created through education. In order to explore understanding, moral principles, and knowledge, education is crucial. Education is the key to developing human resources. (Ainurrahmi et al., 2024). technology, media, and information domains; learning and innovation skills; as well as life and career skills. This is the kind of 21st century education that prepares students for these challenges. (Ayuardini, 2023) Based on the Law of the Republic of Indonesia No.20 of 2003 it is explained that the development of education in Indonesia is to educate the life of the nation (Wijayanti, 2023). However, based on the facts, there are still many inhibiting factors in improving the quality of education in Indonesia. One of them is the lack of variety and innovation in the use of teaching materials applied to students. There is a change in the educational paradigm due to current industrial developments resulting in a change in approach from teacher center to student center (Zulvi, 2020). It is intended that teachers will be able to effectively communicate the subject they are teaching and give the necessary resources for students to grasp it, allowing the learning process to proceed as planned. Teachers can use various ways to help students in the process of remembering, including by means of repetition, carrying out meaningful learning, organization, elaboration, and visualization. (Hadi, 2020). Learning resources are educational tools that provide concepts and information that might help students learn. So we need teaching materials that can attract students' learning interest. One of the teaching materials that can be applied is using e-module-based mangrove biodiversity.

Learning biology is one of the disciplines that need the use of digital learning resources like electronic modules. The E-module is a module that is centered on information technology. E-modules are learning materials and media that support autonomous learning, much like modules in general. (Jayanti & Pertiwi, 2020). The newest innovation in printed modules is electronic modules, or e-modules. These electronic modules may be accessed using a computer that has been configured with the necessary software. (Suryani & Pima, 2023). It is envisaged that this electronic module would facilitate users in creating high-quality learning (Mahrawi, 2021). When compared to printed instructional materials, e-modules have the benefit of having interactive media, including audio, video, and animation, as well as other interactive elements that allow students to play and re-play lessons. (Nasution et al., 2024) E-modules also have the benefit of being robust, affordable to produce, easy to transport, and long-lasting. (Oktafiani et al., 2020). Learning using E-modules requires work in order for learning to occur successfully, efficiently, and with great appeal—particularly when learning biology. In particular while learning biology, employing E-modules to facilitate learning is an endeavor that makes learning effective, efficient, and very appealing. One alternate source for autonomous learning in learning activities is the present use of electronic modules. The self-instructional features of electronic modules allow pupils to study independently and without reliance on others. (Silalahi et al., 2022).

Numerous qualities define a high-quality electronic module (e-module), including self-instruction, self-sufficiency, independence, flexibility, and ease of use. Learning e-modules are presented through electronic media, therefore they have the same qualities as regular modules: they are self-instructive, self-contained, stand-alone, adaptable, and user-friendly. (Laraphaty et al., 2021) Students are supposed to be able to learn on their own through self-instruction. A self-contained e-module has all the necessary resources. Students are supposed to be able to learn on their own through self-instruction. A self-contained e-module has all the necessary resources. (Kholifah & Ngawi, 2024). In contrast, a stand-alone learning e-module is one that has to be used alone and doesn't rely on any additional instructional resources or equipment. One type of e-learning module called Adaptive is designed to change with advancements in technology and science. Science and technology advancements have to be compatible with an effective electronics module. An electronic module, or e-module, is considered adaptable if it is usable and compliant with advances in science and technology (Kurniawan et al., 2023).

In the meanwhile, the features of e-modules are intended. In order for an e-module to be considered user-friendly, it must be familiar or friendly to the user. The electronics module's (e-module) remaining descriptions and instructions are all practical and easy to use. (Laraphaty et al., 2021).

Development of contextual teaching materials by exploring the local potential of the region, namely germplasm (biodiversity) needs to be carried out as a learning resource for high school students in learning biology concepts. The development of good teaching materials is developed according to the needs of its users based on geographical, ethnographic and regional characteristics factors (Sukirno et al., 2020) especially Sungai Apit sub-district. Students are better able to draw links between theory and practical application in the real world when they use a contextual approach to integrate the subject they study with real-world situations. Lack of knowledge and in-depth understanding of the importance of the role of mangroves in coastal ecosystems from both children and the surrounding community encourages the development of this e-module as teaching material (Adriman et al., 2020).

When pupils get the lesson, they can interpret the significance of the material that the instructor has presented to them, whether orally, visually, or in writing. (Ayuardini, 2023). During the educational process, learners are anticipated to be self-sufficient in acquiring knowledge using technology-assisted instruction, including online lessons. With carefully prepared classroom materials from the instructor, it is believed that the learning process would be able to integrate conservation activities with classroom instruction. An essential starting point for raising environmental consciousness among students and fostering the growth of their cognitive capacities, proficiencies, and attitudes is conservation education. Education on conservation also emphasizes environmental protection and preservation. (Milasari & Nugraheni, 2024). The declining condition of the ecosystem makes nature protection crucial. Understanding the concept of conservation itself is necessary for the next step, which is to lessen the degradation of values, character, and the environment. Children in particular should be taught the importance of conservation as they represent the nation's future generation and are the first to understand the importance of natural resource conservation, conservation of values and culture, and the role of conservation agents in promoting environmental awareness. (Rahardyan & Nugraheni, 2024) It can also foster a respect for natural resources, strengthen bonds between people and the environment, and motivate practical environmental conservation efforts. (Al-idrus et al., 2024).

## **METHODOLOGY**

Data on the diversity of mangrove plants was collected in the mangrove ecosystem area of Sungai Rawa Village. The research method used is research and development (R&D). Research and development work is referred to as a bridge between basic research and applied research. These studies are generally divided into two main phases. The first stage is research related to the study of mangrove plant diversity, which is material that will be uploaded to the Young module. The second stage is the stage where the feasibility of developing teaching material products based on E-modules is tested on several experts, biology teachers and students as respondents according to statements on the research topic.

The methods employed for research and development make reference to the Borg and Gall-developed R&D (Research and Development) design. (Haka et al., 2021) The five phases that make up the ADDIE paradigm are Analysis, Design, Development, Implementation, and Assessment. (Munandar et al., 2021). Researchers used a variety of processes, including data collecting and data analysis approaches, in their investigation to gather data on the diversity of mangrove plants, which would be put into the e-module. Tools are required in order to facilitate and facilitate data collection.

Researchers require instruments to aid in the collection of data on the diversity of mangrove plants. Examples of these equipment are mangrove guidebooks and cameras for documenting individual species. Mangrove plants from Kayu Ara, Mengkapan, and Sungai Rawa villages served as the research materials.

Prior to the commencement of data collection. Mengkapan Village's mangrove region is one of the mangrove ecosystem sites that researchers noticed in Sungai Apit District. Kayu Ara mangrove ecosystem area, Rawa river mangrove ecosystem area, and Sungai Rawa village mangrove ecosystem area. The purpose of this exercise was to get a general understanding of the mangrove ecology.

The mangrove ecosystem region in Sungai Rawa Village, Mengkapan Village, and Kayu Ara Village was explored in order to gather data on the variety of mangrove plant species. Walking along the sea shore of Sungai Rawa Village, Mengkapan Village, and Kayu Ara Village utilizing the designated trail was the modified line transect method used for data collection. Through an exploration of the mangrove ecosystem region in Sungai Rawa Village, Mengkapan Village, and Kayu Ara Village, data on the variety of mangrove plant species were collected. A modified line transect approach was used to gather the data, which involved following the designated route along the sea shore of Sungai Rawa Village, Mengkapan Village, and Kayu Ara Village. Semi-structured in-person interviews with the sources were another method used to acquire data. Following data collection, the researcher identified each species by cross-referencing the data with many mangrove guidebooks, therefore verifying each species' local name so that the general population may learn it. The researcher categorized all of the species that were present in each mangrove region throughout data processing. Analysis was done in the interim to provide a paragraph-by-paragraph description of the interview and FGD data.

## RESULTS AND DISCUSSION

The results of the research can be translated into two, namely, the results of the diversity of mangrove plants in Sungai Apit District and the percentage of e-module eligibility, as well as responses from responses (teachers) and students. the results are presented as follows.

### Research Results of Mangrove plant diversity

Data gathered during exploration in two locations of the mangrove ecosystem in the Sungai Apit District, namely Sungai Rawa Village and Mekar Jaya Village, was analyzed to determine the mangrove plant diversity results in this study. Genuine and follow-up mangroves are the two varieties found in each of these settlements.

#### *Swamp River Village*

Several mangrove species with true and follow-up wood species categorization may be found sporadically along the beachfront that traverses Sungai Rawa Village. The following species are found in this kind of genuine mangrove:

*Aracanthus ilicifolius, Acrostichum aureum, Acrostichum speciosum, Avicennia alba, Avicennia marina, Bruguiera cylindrical, Bruguiera gymnorrhiza, Bruguiera parviflora, Bruguiera sexangula, Ceriop tagal, Ceriop decandra, Excoecaria agallocha, Heritiera littoralis, Hibiscus tiliaceus, Lummitzera littorea, Melastoma candidum, Nypa fruticans, Osbornia octodonta, Pandanus odoratissima, Rhizophora apiculata, Rhizophora mucronata, Rhizophora stylosa, Scyphophora hydrophyllscea, Sonneratia alba, Sonneratia caseolaris, Sonneratia ovate, Terminalia catappa, Xylocarpus granatum, Xylocarpus moluccensis.*

Mekarjaya village

Several mangrove species, which are categorized as true and related wood species, are dispersed over the shoreline that runs through Mekar Jaya Village. There are species in this kind of genuine mangrove. *Acrostichum aureum* Lin, *Acrostichum speciosum*, *Avicennia alba*, *Excoecaria agallocha*, *Lumnitzera littorea*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Rhizophora stylosa*, *Sonneratia alba*, *Sonneratia caseolaris*, *Sonneratia ovate*, *Cerbera manghas*, *Hibiscus tiliaceus*, *Pandanus odoratissimus*.

Community perceptions of the mangrove ecosystem were determined through interviews and FGDs. The research results were also confirmed through a literature review which contained relevant material that supported the completeness of the information obtained. Description:

**Table 1. The result of the FGD with the community**

No	Sources	Result of Discussion
1	S	Mangrove are known as mangroves, we often use them as firewood. On the beach where the mangrove trees are often used as a place to catch fish
2	J	I known mangrove trees, but I don't use them and I have never joined to take care of mangrove trees
3	JH	I often catch fish near the mangrove trees and I have never joined in taking care of the mangrove, because the trees grow by themselves
4	RHS	The nipah fruit can be used as food and the mangrove tree area is where I catch fish and look for Bongan (a type of snail that can be consumed)
5	SY	Mangroves are trees that can grow on the beach by themselves, but mangrove trees have been destroyed by many people, so it is necessary to replant them. However, I have never joined in planting them, so in the future I will participate
6	Ma	Mangroves has many benefits, so it is very necessary to preserve and to preserve mangroves the government must also take part, so that it becomes more effective
7	B	Mangroves have now been managed into tourist attraction, so that the community here has a place to travel within a short distance. To preserve it I have never participated
8	P	Mangrove trees have many benefits, nipah fruit can be eaten and there are some trees that are used as medicine such as postnatal treatment. It is necessary to preserve them, but I have never planted them

- S : Sayful, 30 years old, resident of Sungai Rawa Village
- J : Jefri, 36 Years Old, Resident of Sungai Rawa Village
- JH : Jhon Hendrie, 42 Years Old, Resident of Sungai Rawa Village
- RHS : Ramli Hanafi Sagala, 39 years old, a resident of Mekar Jaya Village
- sy : Supri Yadi, 40 years old, village resident Merry Jaya
- Mom : Maizura, 38 years old, a resident of Mekar Jaya Village
- B : Beiti, 35 years old, resident of Me Village Kar Jaya
- P : Para. 35 Year, a resident of Mekar Jaya Village

Students' best connection with their learning materials will be substantially supported by the usage of learning resources that depict real-world circumstances. These findings are consistent with studies carried out in the Sungai Apit District, Riau, in the villages of Sungai Rawa and Mekar Jaya. Researchers detected 30 different varieties of mangroves, according to their findings, including *Acanthus ilicifolius*, *Acrostichum aureum*, *Acrostichum speciosum*, *Aegiceras corniculatum*, *Avicennia marina*, *Bruguiera cylindrical*, *Bruguiera gymnorrhiza*, *Bruguiera parviflora*, *Bruguiera sexangula*, *Calophyllum inophyllum*, *Cerbera mangas*, *Ceriops decandra*, *Ceriops tagal*, *Derris trifolia*, *Heritiera littoralis*, *Hibiscus tiliaceus*, *Lumnitzera littorea*, *Malastoma candidum*, *Acrostichum aureum*, *Avicennia alba* Blume, *Excoecaria agallocha*, *Lumnitzera littorea* liar, *Rhizophora apiculata* e, *Rhizophora mucronata*, *Rhizophora stylosa* , *Sonneratia alba* , *Sonneratia caseolaris*, *Sonneratia ovate*. Meanwhile, the following types of mangroves include : *Cerbera mangga* , *Excoecaria agallocha*, *Hibiscus tiliaceus*, *Pandanus*

*odoratissima* Forssk possessing low species dominance and a modest species diversity index. The variety of mangrove forests is useful for traditional herbal medicine in addition to being a teaching resource. possessing low species dominance and a modest species diversity index. The variety of mangrove forests is useful for traditional herbal medicine in addition to being a teaching resource.

Several studies have demonstrated the health advantages of mangrove plants. Because plant extracts include bioactive substances that are beneficial to living creatures, they may have anticancer properties. Several studies have demonstrated the health advantages of mangrove plants. Because plant extracts include bioactive substances that are beneficial to living creatures, they may have anticancer properties. *Sonneratia alba* mangrove leaves make a useful tea, which is one of the advantages of using mangrove plants as medicine. (Sherina et al., 2021). People who live near mangrove forests frequently use mangroves as a source of herbal medicine and to prepare food and beverages from the fruit of these plants. Mangroves like *Sonneratia* sp. are good for processing into a variety of cuisines because of their unique scent, sour taste, and soft texture. (Diana et al., 2022) In addition to the mangrove flora, it has been discovered that the tiny fungus that inhabit mangrove forests may also be utilized to instruct students as educational resources for conservation initiatives. As the primary decomposers in ecosystems, fungus play a crucial role in speeding up cycles in forest environments, just way bacteria and protozoa do. (Fitria Rosa Damayanti et al., 2022) Bush vegetation in the mangrove forest area can also be used as teaching material for students (Salsabilla et al., 2023).

E-modules must undergo validity testing prior to being incorporated into the learning process. In order to acquire reliable findings and meet the learning objectives, validity testing is done. If a product satisfies the valid requirements as determined by an instrument of assessment, it is considered valid. (Fathul et al., 2024) If an e-module satisfies both internal and external validity requirements, it is deemed legitimate. Validity comes in two flavors: internal validity and external validity. Construct validity and content validity are two aspects of internal validity that attest to the accuracy of the study design and the reliability of the findings. Conversely, an outcome of study that has practical application in the actual world is known as external validity. (Basaroh et al., 2021)

## Research Results E-module

Creating an e-module at SMAN 3 Sungai Apit about biodiversity material and conservation efforts is an example of development research or research and development. To assess the degree of validity of the created learning e-modules, this study was conducted. The outcomes of the validation process for biology instructors, learners, media, and resources are as follows, depending on validators:

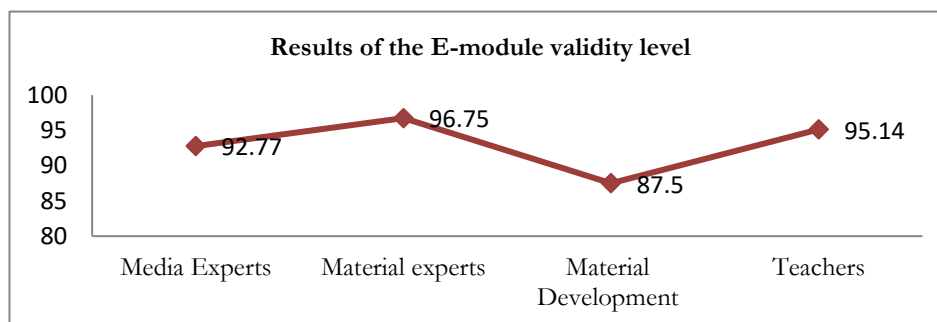


Figure 1. Result of the e-module validity level

The results of validation by media experts were obtained through validation questionnaire sheets and e-module soft files that were sent for assessment. The assessment carried out by the media expert validator on e-module-based teaching material development products includes 2

aspects, namely aspects of media design and aspects of the program. the results of the assessment by the media expert validator are presented

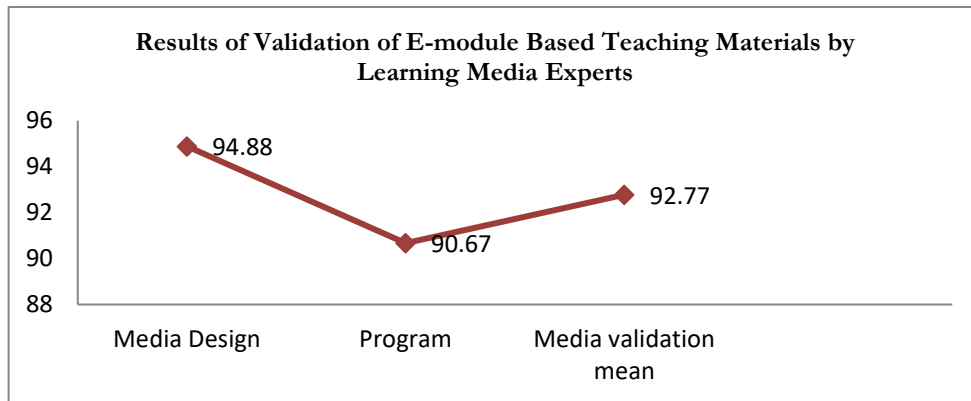


Figure 2. Results of Validation of E-module Based Teaching Materials by Learning Media Experts

The material expert validator in this study was carried out by providing a validation questionnaire sheet along with the e-module soft file which will be assessed to the material expert as the validator. The validator's assessment of e-module-based material development products on enrichment material is on the aspect of content quality.

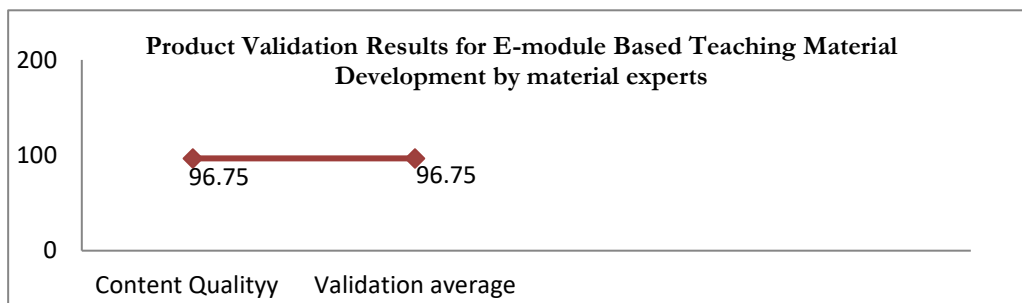


Figure 3. Product Validation Results for E-module Based Teaching Material Development by material experts

Product assessment of *e-module-based* teaching material development products on biodiversity enrichment consists of three aspects, namely media design aspects, program aspects and content quality aspects.

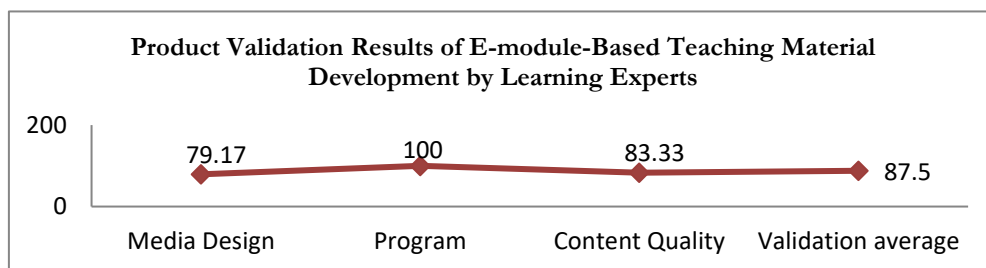


Figure 4. Product Validation Results of E-module-Based Teaching Material Development by Learning Experts

Product validation for the development of *e-module-based teaching* materials was carried out by 2 biology teachers who taught at SMAN 3 Sungai Apit. The teacher validation sheet consists of

three aspects, namely media design aspects, program aspects, and content quality aspects. the results of the biology teacher's assessment.

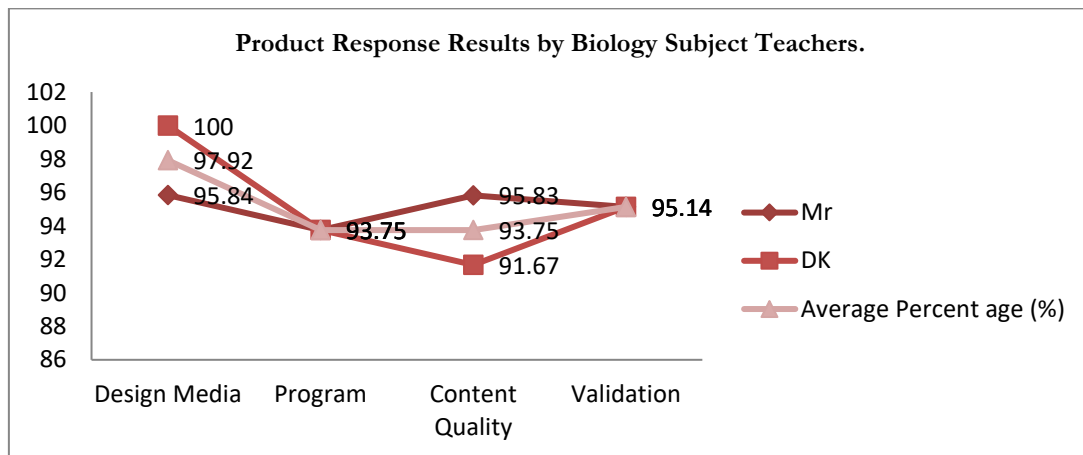


Figure 5. Product Validation Results of E-module-Based Teaching Material Development by Learning Experts

The results of the trials conducted on students were obtained from the results of the response sheets of class X students at SMAN 3 Sungai Apit. The results of the trial included the results of student responses regarding the e-module-based teaching materials that had been developed. The results of the analysis of student response sheets to the developed e-module-based teaching materials can be seen in.

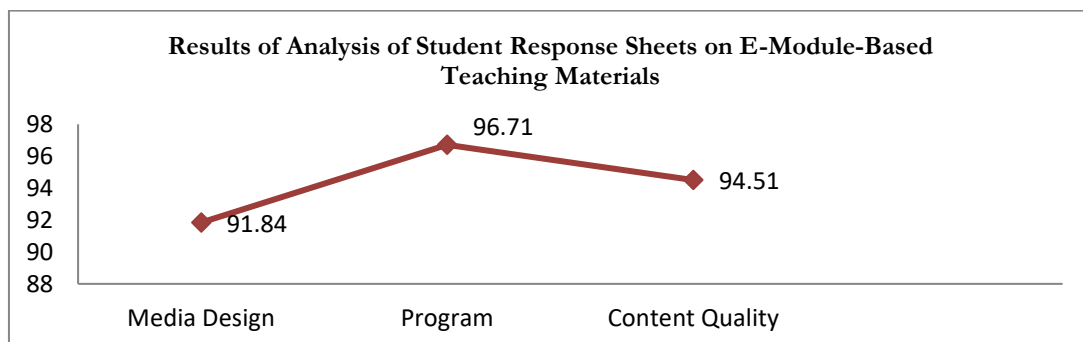


Figure 6. Results of Analysis of Student Response Sheets on E-Module-Based Teaching Materials

This development study was conducted in two locations, namely Sungai Rawa Village, Meng Kapan and Kayu Ara in Sungai Apit District to collect information on mangrove diversity. The experiment was conducted at SMAN 3 Sungai Apit for class X students studying biodiversity. This research produced a product in the form of developing an e-module teaching material on biodiversity. The contents of the teaching materials were adapted to the 2013 curriculum. The results of the FGDs and interviews indicated that the community still had little knowledge about the mangrove ecosystem and its role for the environment.

The Media Expert Validator awarded a very respectable average score of 94.88% for media planning. Cover art (text readability, screen rendering, and image quality) and content (screen rendering, font typology, picture quality, and video quality) are among the media design areas that are assessed. The average percentage for media planning reported by Learning Expert validators was 79.17%, which is considered fairly acceptable. They also offered some recommendations for



enhancing media strategy. Due to the fact that it is a component of media planning, two biology instructors, Muhammad Rasyidi (MR) and Mrs. Dewi Kartini (DK), filled in the responses; they provided response percentages of 95.64% and 100%, respectively. The validation result average is 97.92%, which is highly feasible.

Media expert validators awarded the program an average score of 90.67%, which is extremely good. Media interaction, usability, and media usage are the signs that media expert validators evaluate in terms of programs. Learning practitioners give programming an average score of 100%. Media contact is one program component that learning specialists evaluate. The e-module-based teaching material development product satisfies the acceptability standards to be evaluated and utilized by students, according to the findings of the learning expert validation. Teachers rated the program with an average score of 93.75%, which is considered very good. In the program assessment aspect, Muhammad Rasyidi (MR) and Dewi Kartini (DK), two teachers, completed the responses. They received scores of  $93.75 \pm 93.75\%$ . The development teaching material product has satiated the eligibility conditions, as indicated by this 93.75% of material experts are qualified, which indicates a high likelihood of content quality.

Aspects of the content's quality, such as the text's delivery style, depth, linguistic usage, and advantages for the variety of mangroves along Siak Regency's coast, are among the indications evaluated by subject matter experts. The content received an 83.33% (very excellent) rating from learning experts. The manner in which the content is presented, its completeness, and its depth are all considered indicators of content quality by learning specialists. Teachers ranked the content's quality as very excellent, with an average score of 93.75%. Muhammad Rasidi (MR) and Dewi Kartini (DK), two biology professors, completed the responses to the content elements with percentages of 91.67% and 95.8%, respectively. In terms of content quality, 93.75% (quite probable) of the material experts have the necessary credentials.

The indications evaluated by subject matter specialists include elements that pertain to content quality, such as the manner in which the knowledge is presented, its depth, language usage, and the advantages it offers for the diversity of mangroves near Siak Regency's shore. In terms of content quality, learning experts awarded 83.33% (very excellent). The manner in which the content is presented, its completeness, and its depth are all considered indicators of content quality by learning specialists. Teachers rated the content's quality as 93.75% on average (very excellent). Muhammad Rasidi (MR) and Dewi Kartini (DK), two biology professors, completed the responses to the content elements with percentages of 91.67% and 95.8%, respectively. In terms of content quality, 93.75% (quite probable) of the material experts have the necessary credentials. Among the metrics evaluated by subject matter experts are elements associated with content quality, such as the manner in which the content is presented, its depth, language usage, and the advantages of the content regarding the variety of mangroves along Siak Regency's shore. Learning specialists rated the material quality at 83.33%, which is considered very excellent. The manner the content is presented, its completeness, and its depth are all indicators of content quality that are evaluated by learning specialists. Teachers rated the material quality an average of 93.75% (very excellent). Two biology instructors, Muhammad Rasidi (MR) and Dewi Kartini (DK), filled up the responses to the content elements with percentages of 95.8% and 91.67%, respectively.

Aspects of content quality, such as delivery style, depth, language use, and the material's advantages for mangrove diversity on Siak Regency's coast, are among the parameters evaluated by material specialists. Learning specialists rated the material quality at 83.33%, which is considered outstanding. Learning experts evaluate the way the content is presented, its completeness, and its depth as indicators of content quality. Teachers rated the material quality an average of 93.75% (outstanding). The subject components were completed by Muhammad Rasidi (MR) and Dewi Kartini (DK), two biology professors, with percentages of 91.67% and 95.8%, respectively. Aspects of content quality, such as the methods of delivery, the content's depth, the language used, and the material's advantages for mangrove variety along Siak Regency's coast, are among the indications

evaluated by material specialists. Experts in learning awarded it an 83.33% (outstanding) rating for content quality. Content delivery methods, content completeness, and content depth are three indicators of content quality that learning professionals evaluate. Teachers scored 93.75% on a scale of very good to very good for content quality. The subject components were completed by Muhammad Rasidi (MR) and Dewi Kartini (DK), two biology professors, with percentages of 91.67% and 95.8%, respectively. as well as the tangible advantages of Siak Regency's mangrove variety. The content received an 83.33% (very excellent) rating from learning experts.

A mean percentage of 94.51 points fell into the "very good" category based on the E-module appropriateness test findings derived from the students' responses to the questionnaire. When mangrove ecosystems are used for their biological purposes, they may offer environmental services to a variety of users, including students who need a direct learning resource to help them comprehend biology principles. (Syukur et al., 2024). In addition, utilizing educational materials that originate from natural resources particularly mangroves can offer several immediate advantages, such as fostering a sense of community among students and enhancing their motivation in studying. (Ayu et al., 2024). Aside from that, a number of studies have demonstrated that learning via the use of media and resources is more successful, as it sparks students' curiosity, encourages their creativity, and has a positive impact on them. and if the content is connected to the students' immediate surroundings, they will comprehend it more readily. (Santoso & Merta, 2023).

## CONCLUSION

Based on the description of the research results above, it can be concluded that the diversity of mangroves consisting of 30 types of mangroves in three areas including Sungai Rawa Village, Kapan Village and Kayu Ara Village will be discussed in product development. E-module-based biodiversity teaching materials have been declared valid and suitable for use as secondary school teaching materials after going through several trials based on the evaluation results of media experts, material experts, learning experts and biology teachers. The validity and product development of teaching materials based on E-module biodiversity enrichment materials which received positive responses from students. The community's continued ignorance about mangrove ecosystems and their significance to the environment is evident from the results of focus groups and interviews. The Media Expert Validator awarded a very respectable average score of 94.88% for media planning. Media expert validators awarded the program an average score of 90.67%, which is extremely good. A mean percentage of 94.51 points fell into the "very good" category based on the E-module appropriateness test findings derived from the students' responses to the questionnaire.

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