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Development of An Integrated Biodiversity Biology Module With Local Potential of Andaliman Plants (*Zanthoxylum acanthopodium*) at Senior High School

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ABSTRACT

Biology teachers have not made regional potential a source of learning. The natural environment around the school is used to support teacher explanations that do not create exploratory. This study aims to determine the validity, practicality, and effectiveness of the integrated module of the local potential of South Tapanuli for the biodiversity of the Andaliman (Zanthoxylum acanthopodium DC) plant. The research uses the Research and Development (R&D) method referring to the 4-D development model developed by Thiagarajan. The small group trial subjects consisted of 14 students of class X MIA-1. The results of the development module research show validity values of 87% and 95% by teaching module and material experts, 87% and 83% practicality values by biology teachers and students, while effectiveness based on individual mastery of student learning outcomes achieves classical mastery of 85% . The overall results meet the valid, practical and effective categories, so that the development module deserves to be a teaching material in learning activities about andaliman plants.

Pengembangan Modul Biologi Keanekaragaman Hayati Terintegrasi Potensi Lokal Tumbuhan Andaliman (Zanthoxylum acanthopodium) di Sekolah Menengah Atas

ABSTRAK: *Guru biologi belum menjadikan potensi daerah sebagai sumber belajar. Lingkungan alam sekitar sekolah dimanfaatkan sebatas mendukung penjelasan guru yang tidak menciptakan eksploratif. Penelitian bertujuan mengetahui kevalidan, kepraktisan, dan keefektifan modul terintegrasi potensi lokal Tapanuli Selatan keanekaragaman hayati tumbuhan andaliman (Zanthoxylum acanthopodium DC). Penelitian menggunakan metode Research and Development (R&D) mengacu model pengembangan 4-D dikembangkan Thiagarajan. Subjek uji coba kelompok kecil terdiri 14 peserta didik kelas X MIA-1. Hasil penelitian modul pengembangan menunjukkan nilai kevalidan 87% dan 95% oleh ahli modul ajar dan materi, nilai kepraktisan 87% dan 83% oleh guru biologi dan peserta didik, sementara keefektifan berdasarkan ketuntasan individual dari hasil belajar peserta didik mencapai ketuntasan secara klasikal sebesar 85%. Keseluruhan hasil memenuhi kategori valid, praktis dan efektif, sehingga modul pengembangan layak menjadi bahan ajar didalam kegiatan pembelajaran mengenai keragaman tumbuhan andaliman.*

INTRODUCTION

The term learning has the essence of planning or designing in an effort to learn students. Learning puts attention from "how to learn students" rather than "what students learn" (Widodo et al., 2023);(Kehrer, 2022). Although this is very important in terms of how to structure learning, deliver learning content, and interact with organized learning resources so that they function optimally (Burov, 2021);. Learning aims to help students gain experience (Saragih & Tanjung, 2023). Through the experience, knowledge and skills of students as well as the values or norms that control attitudes have increased in quantity and quality, the essence of effective learning (Alenezi, 2020);(Handoko et al., 2024).

The facts in the field that were found through interviews with the biology teacher of class X MIA Senior High School and three students of class X MIA-1, namely based on the textbooks provided by the school, learning activities are still completely dominant delivered by teachers using lecture methods without being supported by approaches, strategies or learning models in creating exploratory. The use of environmental learning resources is only fixated on the natural environment around the school, which is limited to examples of subject matter that is delivered verbally when teachers explain (Septiyanto et al., 2024);(Mason et al., 2022). The explanation of the material by teachers is still often poorly understood by students, especially on biodiversity material in the concept of diversity at the gene level, species or types and ecosystems are evidenced by their confusion in mentioning examples of the level of diversity. The learning activities that students like by making observations that do not make students only listen and take notes (Pratama et al., 2020).

Students' space to expand knowledge and insight is limited so that learning aims to help students gain experience as the essence of learning is not achieved (Tawfik et al., 2022). The teacher also emphasized that there has been no use of teaching materials that contain local potential content in learning or introduce local potential content to students who are related to the study of material theory (Fahmi et al., 2021). According to Wulandari & Djukri (2022) local potential is essentially a resource in an area by developing from the tradition of community wisdom as part of culture.

In Indonesia, the curriculum is developed based on the principles and objectives of utilization as well as in preserving the richness of regional and environmental potential (Suprapto et al., 2021);(Annisha et al., 2020). Every change in the educational curriculum in Indonesia, it is expected that learning contains ethnopedagogical content. Ethnopedagogy is a description of local content that is inserted into learning or often known as learning based on local wisdom (Setiawan, 2021). Learning activities by emphasizing the local wisdom of students (Oktavianti & Ratnasari, 2018). Local wisdom that has the potential to be a source of biology learning, including rare plants and animals, norms and values, customs, traditional houses, traditional clothing, regional songs, regional foods and others by considering the suitability of Basic Competencies contained in Permendikbud No. 24 of 2016, as well as in the rules governing the implementation of the 2013 curriculum (Ramdiah et al., 2020). The andaliman plant (Zanthoxylum acanthopodium*)* is included in the typical plant section of North Sumatra, growing wild in the areas of Angkola, Mandailing, Humbang, Silindung, Dairi, and Toba Holbung (Anggraeni, 2020). According to Abduh et al. (2023) the plant is used as a spice for traditional Batak Angkola and Batak Mandailing cuisine.

Combining information that is close to the student's living environment is an effort to enrich the content of the subject matter through the creativity of teachers to develop

teaching materials. Teaching materials as part of the media, become a teacher facility for students by being able to understand the material more deeply (Destiara, 2020). Various types of teaching materials provide teachers with options to produce teaching materials that can teach students in eroding the doctrine that they are forced to learn because they are in school (Smart et al., 2021).

The module can be integrated with a variety of learning models as well as the potential and local wisdom that is able to accommodate the demands of the 2013 curriculum related to learning by doing as well as 21st century skills (Haka et al., 2020). The module is integrated into local potential and wisdom to influence in improving character, learning outcomes as well as critical thinking of students. The main objective of the module is to increase the efficiency and effectiveness of learning, optimally in achievement (Vitrianto, 2023).

Based on the description of the information above, research was carried out on the development of an integrated biology learning module with the local potential of South Tapanuli andaliman plants (Zanthoxylum acanthopodium) on the subject of biodiversity. This research aims to develop and test the quality of development results for validity, practicality and effectiveness. The existence of this module as a teaching material in the hope of facilitating students also makes it easier for teachers to deliver material.

METHOD

This type of research method is in the form of development research which is better known as Research and Development (R&D) abbreviated related research in the production of new and updated products (Gogahu & Prasetyo, 2020). The subjects of the small group trial in this study consisted of 14 students in class X MIA-1 for the 2021/2022 school year. The development was carried out in stages referring to the 4-D development model developed by Thiagarajan, Semmel, & Semmel (1974). The 4-D development model is an acronym for Define, Design, Develop, Dissiminate as the main stages of activities in development.

The data in this study through interviews, questionnaires, and tests with each instrument used consists of interview guidelines, material expert validation questionnaires and teaching modules, teacher and student response questionnaires, and multiple-choice objective tests with tested questions adopted from the national biology exam questions adjusted to the subject matter of the material. The weighting of the questionnaire is in the form of a likert scale with 4 alternative answers as an assessment score and then accumulated into an assessment percentage.

The data analysis technique uses descriptive statistics, the quantitative data obtained is processed into percentage data with results that refer to the table of criteria categories in the interpretation of the assessment which is a reference for improvement materials. Data analysis was carried out on validity data, practicality data and effectiveness data of the development product.

The acquisition of validity and practicality data based on the assessment score on the expert validation questionnaire and response questionnaire was processed with a formula to calculate the percentage of assessment on the aspect of the development product according to (Aithal & Aithal, 2020) :

$$P = \frac{\sum Skor\ perolehan}{N \times Bt \times \sum responden} \times 100\%$$

Information:
P : Response Rating Percentage
N : Number of Assessment Indicator Items
Bt : Highest Weight Rating Item Indicator
$\sum$: Total number of responses

And calculate the percentage of assessment of the development product according to (Sugiyono, 2015):

$$P = \frac{\sum xi}{\sum x} \times 100\%$$

Information:
P : Rating percentage
$\sum xi$: Number of answer scores from validation
$\sum x$: Highest number of answers

Acquisition of product effectiveness data based on the completeness of students' learning in the cognitive aspect of learning outcomes after using the module. Learning completeness is measured by the formula:

$$KB = \frac{T}{Tt} \times 100\%$$

Information:
KB : Learning Completeness
T : Number of scores obtained by students
Tt : Total score

RESULTS AND DISCUSSION

This research conducted as research and development has resulted in the development of the Integrated Module of Local Potential of South Tapanuli Regency Andaliman Plant Biodiversity (Zanthoxylum acanthopodium) into teaching materials that are suitable for facilitating students in learning.

The results of the stage define that there is a lack of creativity of teachers to provide teaching materials that adapt to the needs of students. According to Tamsah et al. (2021), creativity is the main factor for teachers in the development of teaching materials. The need for integrated teaching materials with local materials is an exploratory learning support in learning that is expected by students of class X MIA-1 SMAN 1 Sipirok, presentation with communicative language and introduction of local potential content that contains the latest information on andaliman plants for students to recognize the local potential of South Tapanuli Regency.

The results of the design stage include the assessment instrument of the development module on the learning outcome test sheet and questionnaire sheet that have passed the assessment of criteria based on the content and framework, and prototype 1 development product refers to the results of the define stage selected visual media in print form, namely the A4 size learning module.

The results of the develop stage, namely the final prototype, are based on testing including product validation by teaching module experts and material experts, and product trials are divided into practicality tests by biology teachers and students and effectiveness tests through related learning outcome tests to measure the level of student learning completeness.

Product validation as a result of validity tests through data acquisition from filling out the validation questionnaire for teaching module experts and material experts with lecturers in the Department of Biology of UINSU, summarized in the form of graphs in figure 1 and figure 2 as follows:

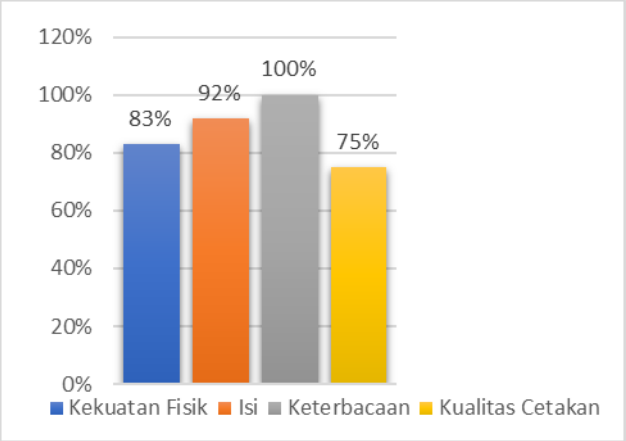

Figure 1. Graph of the percentage of grades for each aspect of the teaching module

The data from the validation results of the teaching module experts presented in figure 1, the interpretation of the percentage of the score on these four aspects is valid with a good predicate on the physical strength aspect of 83% and the quality of the teaching material print of 75%, and valid with a very good predicate for the aspect of readability of teaching materials of 100% and content of 92%. Furthermore, the data from the validation of material experts obtained a percentage of values on the three aspects, namely 93% of the content / material component aspects as well as the

presentation component aspects, and 100% of the material suitability aspects with local potential. The interpretation of each of the percentage of values from these three aspects is valid with a very good predicate. The acquisition of material expert data is summarized in figure 2.

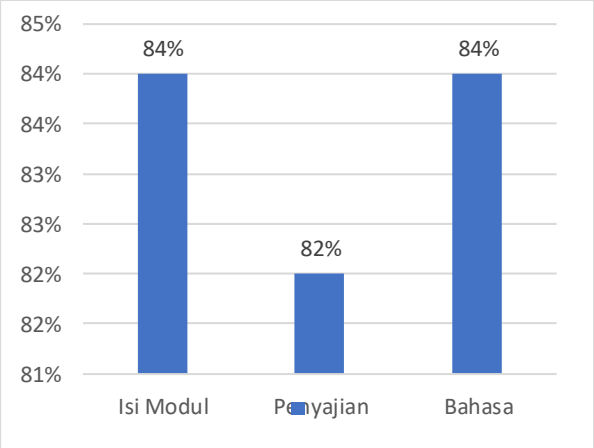

Figure 2. Graph of the percentage of grades of each aspect of the material module

Referring to the validity of the components of each aspect of the development module presented in the graph in figures 1 and 2, the percentage of the validity value of the development module is obtained as 87% of the results of the validation of the teaching module experts and 95% of the results of the validation of the subject matter experts in the interpretation, which is valid with a very good predicate. Based on the results of the assessment, the development module can be used in the trial process by actual users with previously revised so that it becomes prototype 2.

The development module that has become prototype 2 is retested which is carried out by practitioners, namely biology teachers and students as a practical test. This test is related to the response of teachers and students to the development module with assessment through filling out a questionnaire (Khan et al., 2021). The results of the biology teacher assessment were obtained from the results of the practicality data of the development module presented in the graph can be seen in figure 3.

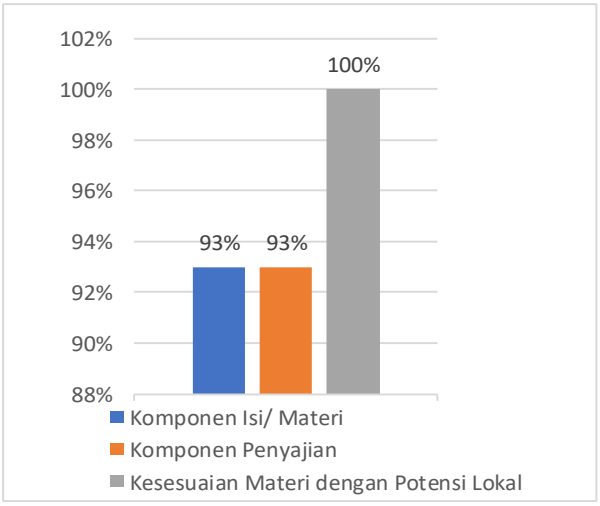

Figure 3. Graph of Percentage Practicality Values for Each Aspect of Biology Teacher Response Results

The data obtained from the teacher response questionnaire in the graph in figure 3 shows that the percentage of practicality values in these five aspects is included in the very practical criteria, so that the percentage of practical values of the development module of 87% is included in the very practical criteria. Based on the results of the assessment, prototype 2 testing was carried out by students of class X-MIA 1 at SMA Negeri 1 Sipirok. Data on the practicality of the development module from student assessments presented in the form of graphs can be seen in figure 4. At the time of the practicality test along with operationalizing the learning plan, in this case, the learning process has been carried out and the filling out of the student response questionnaire is carried out after the learning activity is completed.

Based on the graph data in figure 4, the percentage of practicality values for each aspect of the criteria is very practical, so that the percentage of practicality values for the development module of 83% is included in the very practical criteria. Based on the cumulative value of the percentage of practicality of the development module, in this case there are no difficulties for students and teachers related to its use so that it can facilitate learning activities

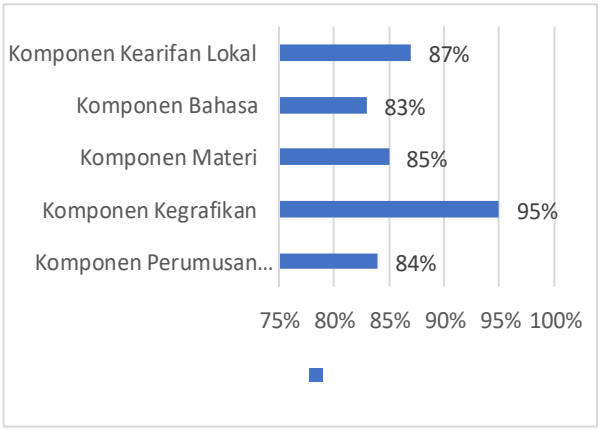

Figure 4. Graph of Percentage Practicality Values for Each Aspect of Student Response Results

The effectiveness test of the module developed based on *the post-test* carried out showed that almost of the total number of students completed individually with the average class score had reached the KKM score with a score of 80 with the acquisition of a classical completion percentage of 85%. The following is a table of grades obtained by 14 high school X students as seen in table 1.

Table 1. Learning Outcomes of Students in Small Group Trials

No	Respond	Skor *Post-Test*	Value	KKM	Inf. Complete / Not
1	Resp 1	6	60	70	Not
2	Resp 2	6	60	70	Not
3	Resp 3	7	70	70	Complete
4	Resp 4	8	80	70	Complete
5	Resp 5	8	80	70	Complete
6	Resp 6	8	80	70	Complete
7	Resp 7	7	70	70	Complete
8	Resp 8	8	80	70	Complete
9	Resp 9	8	80	70	Complete
10	Resp 10	9	90	70	Complete
11	Resp 11	9	90	70	Complete
12	Resp 12	9	90	70	Complete
13	Resp 13	9	90	70	Complete
14	Resp 14	9	90	70	Complete
	Sum		**1110**		**Complete**
	Average		**80**		

Referring to the table above, the learning outcomes of cognitive aspects are needed to measure the level of student learning completeness based on individual completeness. If individual completeness is greater than or equal to the Minimum Completeness Criteria, then the student is declared complete (Supena et al., 2021);(Wei et al., 2021). The effectiveness criterion is that a teaching material is called effective if ≥ 80% of the number of improvements that use such teaching materials are able to achieve Minimum Completeness Criteria, in this case the effectiveness of the development module is measured based on how many percent of students are able to achieve Minimum Completeness Criteria (Yani et al., 2020);(Fiolentin et al., 2021). In this case, the student's learning outcome test reaches the standard of classical completeness. Based on the acquisition of a percentage of completeness classically, the effectiveness test of the development module with an effective interpretation for those used in learning.

The feasibility of a development is determined by the assessment of an expert or expert in his field. In line with Khasna & Nuriyah (2023) and Harahap et al. (2024) stated that the determination of the level of validity of teaching materials is through validity tests with competent validators in the development of teaching materials. Feasibility tests have a very important position in development activities such as Pearson et al. (2020) and Baldassarre et al. (2020) said that the expert assessment of the feasibility test is the process of the success of the product developed before it is tested and used. Teaching materials that implement local materials in them have been carried out by some researchers with the results showing that the implementation of local materials into teaching materials is tested to be practical and suitable for use, which can improve learning outcomes (Kamil et al., 2020). The feasibility of the teaching materials is based on the results of expert tests and field tests (Hikmawati et al., 2020);(Jamilah et al., 2023).

Before its application in learning activities that are learning media from the

teaching materials developed in advance, a practical test is carried out to determine the level of ease of used (Putri et al., 2019);(Hasairin et al., 2023). The practicality criteria are met if 50% of the students contribute positive responses from at least a number of aspects asked.

Learning using learning tools based on local potential has an effect on student learning outcomes. This happens because students contribute a positive response to learning activities which can experience firsthand in the learning process (Sung et al., 2021);(Haka et al., 2022).

Consisting of local wisdom, local potential, and the local environment as part of local materials can be implemented in learning components to achieve learning goals (Jumriani et al., 2021);(Mashami et al., 2023). The implementation of local materials through the learning component is applied with an integrated model (Hikmawati et al., 2021);(Hidayati et al., 2020). Tested based on empirical evidence, the application of local materials to learning components such as models, media, learning resources, and teaching materials has a positive effect on improving students' character, competencies, and skills (Yurtseven Avci et al., 2020);(Yanti et al., 2022).

CONCLUSIONS AND SUGGESTIONS

This research conducted as research and development has resulted in the development of a valid, practical and effective Integrated Module for Local Potential of South Tapanuli Regency Andaliman Plant Biodiversity (Zanthoxylum acanthopodium dc) which is valid, practical and effective in teaching materials with local material content. The validity level is 87% of media experts and 95% of material experts. The effectiveness of the module obtained an average class score of 80 with a classical completion percentage of 85%. The suggestions in the research are further developed in producing teaching materials with other materials that are more innovative, and effective in using in the learning process.

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