

Development of a Module Based on Problem Based Learning (PBL) Model And Local Potential As Supporting Biodiversity Materials In Senior High School of SMA Negeri 1 Natal

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Abstract

One of the learning resources for biology is biodiversity. Region-specific biodiversity differs. Thus, in light of biodiversity, many students still struggle to comprehend the material covered in biology lectures, particularly at SMA Negeri 1 Natal. The research uses the ADDIE model research and development (R&D) method. The instrument of this research is a questionnaire sheet for material experts, media experts, teachers and students to test practicality and pre-test and post-test to test effectiveness. Class X MIPA-1 SMA Negeri 1 Natal students as test subjects. Testing was carried out on 30 students and biology teachers to see the practicality of the module using student and biology teacher response questionnaires. Based on the validation results from material experts, a percentage of 96.25% was obtained with the criteria "Very Valid". The validation results from media experts obtained a result of 81.2% with the criteria "Very Valid". The results of the teacher's response to the module were 87.7% for the "Very Practical" criteria. The results of student responses to the module obtained a percentage of 93.5% with the criteria "Very Practical". And the effectiveness results were 77.4% with effective criteria. Thus, biology learning modules based on problem based learning and local potential modules on biodiversity material are very practical and effective for teachers and students to use in biology learning.

Keywords: Biodiversity; Local potential; Problem based learning (PBL)



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INTRODUCTION

The entirety of genes, species, and ecosystems within a region is referred to as biodiversity. Because biodiversity is a vital component of life and is intimately tied to human existence, it is a valuable lesson (Setiawan, 2022). Learning biology is fun and enjoyable, because it is connected to everyday life. Students must comprehend

the concepts of the information that the teacher provides during the learning process in biology in order for the learning process to go smoothly and meet all learning objectives (Mesak et al., 2019; Kurniawan & Rosyid, 2017). One of the learning resources for biology is biodiversity. Region-specific biodiversity differs. Thus, in light of biodiversity, many students still struggle to comprehend the material covered in biology lectures, particularly at SMA Negeri 1 Natal.

Mandailing Natal Regency has local potential for biodiversity in the Natal area, namely various types of plants that can be used in daily life such as traditional medicine, beauty treatments, cooking spices and food ingredients by the community in Panggautan Village, Natal District, Mandailing Regency Christmas. The community believes that the plants in Natal District can be utilized as optimally as possible, such as plants for traditional medicine which are used to prevent and cure various types of diseases. And various plants that can be used as ingredients for skin beauty and used for food consumption by the community. The knowledge that plants can be used in traditional medicine, beauty care and cooking has been passed down from generation to generation (Rachman & Yochanan, 2024). The use of plants in Natal District can support biodiversity material, but not only biodiversity material is also included in the classification of these plants.

The rapid advancement of modern times is evidenced by the globalization of politics, economics, technology, information, culture, and other spheres that affect society (Subijanto, 2015). Modern medications are typically preferred by younger generations over traditional ones. In the meanwhile, traditional medicine is more accessible and secure than contemporary healthcare. This is because, in comparison to current medications, traditional treatments have comparatively fewer negative effects (Sari, 2006). The results of interviews with the people of Panggautan Village, Natal District, Mandailing Natal Regency, found that medicinal plants are still considered to play an important role in daily life, the community uses certain plants to treat diseases, beauty treatments, and food ingredients, including the banuah nest plant (*Clerodendrum fragrans*), pagagan (*Centella asiatica*), babadotan (*Ageretum conyzoides*), ketepeng (*Cassia alata*), spliced Nyawa (*Gynura procumbens*), cold (*Kalanchoe laciniata*). There are many other plant varieties found in Natal District that can be used for daily needs (Fadul, 2019).

Based on preliminary observations conducted at SMA Negeri 1 Natal from January 14–23, 2024, it was discovered that student worksheets (LKS) were the primary learning resources and that traditional teaching methods particularly with regard to biodiversity were still employed by teachers who were still primarily focused on teaching. The primary learning resources used by teachers in their lessons are textbooks and student worksheets (LKS). This forces students to only pay attention to what their teachers are saying, lacks initiative on their part to learn independently about the biodiversity content being taught, and ultimately results in bored students (Indriani et al., 2022). Lack of enthusiasm in learning about biodiversity education is still not student-centered, especially in light of the fact that students should be able to do independent research that is amply supported by relevant instructional materials. Learning modules are an appropriate format for teaching materials that support biodiversity-related content (Ardianti et al., 2022).

Modules based on problem-based learning (PBL) and local potential as supporting material for biodiversity, which is based on learning models, must be developed in light of the issues at SMA Negeri 1 Natal and the ignorance of the younger generation regarding the use of plants in Natal District (Fatimah, 2016). Difficulties at the start of learning sessions to provide pupils a general understanding of their problem-solving skills (Aldo et al., 2021). It is anticipated that this problem-based learning module will be able to enhance student learning outcomes. Problem-based learning can be utilized as a technique of solving difficulties addressed scientifically so that accumulating information and skills in solving problems (Madjid, 2019; Farida & Indah, 2019). It is envisaged that this module on problem-based learning will be able to enhance student learning results.

Research on the development of local potential-based modules on biodiversity material has been carried out by (Rukmana et al., 2023; Ritonga 2022), Development of Biology Learning Modules Based on Local Potential for Making Patchouli Oil (*Pogostemon cablin benth*) in Aceh Tamiang Regency. The results showed that the development carried out produced independent teaching products in printed form. in the form of a module based on local potential that has been developed and meets valid criteria so that it can be implemented to support biology learning and (Saragih & Tanjung, 2023; Harahap et al., 2023) has writing about the development of modules based on the local potential of pineapple (*Ananas comosus*) and snakehead fish (*Tenualosa ilisha*) in central Panai. Meanwhile for this research in the Natal District area which has local potential that can be used as traditional medicine, beauty treatments, and pagan ingredients. Some of these include Sambung Nyawa (*Gynura procumbens*), Banuah nest (*Clerodendrum fragrans*), Pagagan (*Centella asiatica*), and Ketepeng (*Cassia alata*), sidingin (*Kalanchoe laciniata*), and many other types of plant.

Based on the background, results of observations and previous research that has been carried out, biology learning activities, especially biodiversity material, require learning support, namely teaching materials such as learning modules. Therefore, it is important to develop modules based on problem based learning and local potential as supporting biodiversity material at SMA Negeri 1 Natal which aims to be able to develop interesting and varied learning modules to improve student learning outcomes.

METHOD

The research and development approach using the ADDIE model was the methodology employed in this study. The five steps of the ADDIE paradigm are: (1) Analyze; (2) Design; (3) Develop; (4) Execute; and (5) Evaluate. Said because of the ADDIE model's systematic implementation steps, researchers selected it for their study.

Sample or Participant

This research was conducted at Senior Hiht School Negeri 1 Natal on class X MIPA students consisting of 30 students.

Instrument

The research tool utilized is one that has successfully completed the theoretical validation phase under the supervision of the research supervisor. The study instruments are tests (effectiveness), questionnaires (responses from teachers and students), and validation sheets (validation sheets made up of media experts and material experts). A Likert scale with a score of 1-4 is used as the measurement scale for each indicator on the validation sheet and the responses from the students.

Data collection

The author employed four methods to collect data from the field for the study: direct field observation to observe conditions there; questionnaire techniques to collect data by asking respondents who were students and teachers at Senior Hiht School Negeri 1 Natal and interviews to identify issues that needed to be resolved. paperwork is utilized as proof that research was conducted correctly when it comes to research.

Procedure

The development of Problem Based Learning (PBL) and Local Potential Modules was developed in five stages, namely Analyze, Design, Develop, Implement and Evaluate. The initial stage is carrying out a needs analysis and curriculum analysis. Needs analysis aims to find out the problems faced in the learning process which can determine what students need to improve the learning process. Next, the design stage was carried out by designing modules based on problem based learning (PBL) and local potential in biodiversity material.

Using instrument sheets, a validity test of the module is conducted on knowledgeable professional verifiers in the following development stage, namely learning media and learning material experts. Aside from that, the module should be improved using feedback and criticism from qualified verifiers before being tested on students. The next stage after development is to put the module into practice with students in order to gather data on its usefulness and efficacy. Based on the answers from both teachers and students, practicality data was gathered from practicality tests. In the meantime, the pretest and posttest are used to generate the efficacy test. The evaluation stage, which is the last in the ADDIE development paradigm, is the last stage. This phase involves evaluating the process from the start of developing biodiversity learning modules based on problem-based learning (PBL) and local potential to the implementation phase.

Data analysis

Research data was obtained in both qualitative and quantitative data. Qualitative data was obtained from interviews with teachers and criticism and suggestions from validators. Quantitative data was obtained through assessments using validation sheets, pretest and posttest assessments and student response questionnaires. The data obtained was then analyzed and processed descriptively qualitatively and descriptively quantitatively.

Equations

The validation sheet data will be analyzed for validity formula used by [Trisanti et al., \(2021\)](#):

$$\text{percentage (\%)} = \frac{\text{score obtained}}{\text{maximum skor}} \times 100 \%$$

Table 1. Validity Criteria, refers to [Riduwan \(2011\)](#)

No.	Intervals	Criteria
1.	81% - 100%	Very Valid
2.	61% - 80%	Valid
3.	41% - 60%	Fairly Valid
4.	21% - 40 %	Less Valid
5.	0% - 20%	Invalid

Table 2. Practicality Criteria, refers to [Riduwan \(2011\)](#)

No.	Intervals	Criteria
1.	81% - 100%	Very Practical
2.	61% - 80%	Practical
3.	41% - 60%	Fairly Practical
4.	21% - 40 %	Less Practical
5.	0% - 20%	not practical

A learning module is said to be valid if it has reached a validity level above 60%. Practicality analysis was carried out by analyzing data obtained from student response questionnaires. A learning module is said to be practical if it has reached a sufficiently practical level, namely above 61%. Formula Independent Sample N-gain by [Sugiyono \(2017\)](#),

$$N \text{ Gain} = \frac{\text{Skor Posttest} - \text{Skor Pretest}}{\text{Skor Ideal} - \text{Skor Pretest}}$$

Table 3. Categories of Interpretation of N-Gain Effectiveness, refers to [Hake \(1999\)](#)

No.	Percentage (%)	Interpretation
1.	< 40	Ineffective
2.	40-55	Less effective
3.	56-75	Effective enough
4.	> 76	Effective

Effectiveness analysis was obtained based on the results of the pretest and posttest. To see whether the media being developed is effective in improving student learning outcomes, N-gain calculations or normalized gain values are used.

RESULT AND DISCUSSION

Based on the results of research that has been carried out regarding the development of problem based learning (PBL) based modules and local potential as supporting biodiversity material at SMA Negeri 1 Natal through 5 stages of ADDIE.

Analysis Stages (Analyze)

Needs analysis

Based on findings from researchers' direct observations of learning media requirements and the utilization of interview forms completed by SMA Negeri 1 Natal biology subject coaches. Research employing questionnaires and interview sheets given to biology instructors reveal a deficiency in learning media resources that allow for the simultaneous use of printed books, specifically LKS books. Module-based learning resources are necessary to encourage students' commitment to and seriousness about their studies. The results of the student needs questionnaire also show that using modules makes learning more engaging and less monotonous.

Curriculum analysis

SMA Negeri 1 Natal uses curriculum 13. The material presented is also in accordance with Core Competencies (KI) and Basic Competencies (KD). KD 3.2 and KD 4.2. is Basic Competency (KD) in this research.

Design Stages

In order to foster biodiversity at SMA Negeri 1 Natal, researchers first created a biology learning module based on problem-based learning (PBL) and local potential. The goal of this step is to finish the storyboard, which is the first version of the product design. The title, learning instructions, fundamental skills, learning objectives I, supporting material, learning activities using PBL syntax, practice questions, evaluation, and assessment are all included in this module.

Development Stages (Development)

Material Expert Results Questionnaire

Table 4. Material Expert Validation Results




Aspect	Average Score	Criteria
Material Coverage	100%	Very Worth
Material accuracy	92,5%	Very Worth
Integrasi <i>Problem Based Learning</i>	100%	Very Worth
Integration of local potential	100%	Very Worth
Stimulates analytical thinking	100%	Very Worth
Suitability of material and evaluation	100%	Very Worth
Average Score		96,25%
Criteria		Very Worth

Table 5. Material Expert Revision Results


Before	After
<p data-bbox="383 392 837 470">1 GAMBARAN UMUM KEANEKARAGAMAN HAYATI</p> <p data-bbox="395 542 494 560">PENDAHULUAN</p> <p data-bbox="395 571 821 716">Keanekaragaman hayati adalah berbagai bentuk kehidupan yang ada di daratan, udara, dan perairan pada suatu ruang dan waktu, baik berupa tumbuhan, hewan, bahkan makhluk hidup terkecil seperti mikroorganisme. Negara Indonesia termasuk bagian dari salah satu negara tropis memiliki jenis keanekaragaman hayati yang berlimpah dibandingkan dengan negara non tropis. Keanekaragaman hayati bervariasi menurut masing-masing wilayah. Tiap wilayah menunjukkan kekhasan masing-masing baik flora maupun fauna. (Plos Biology, 2014).</p> <p data-bbox="383 721 558 743">Orientasi Masalah</p> <p data-bbox="422 757 598 772">Amatilah tumbuhan berikut!!!!!!!</p> <div data-bbox="427 784 845 985">  <p data-bbox="454 963 486 985">(A)</p> <p data-bbox="598 963 630 985">(B)</p> <p data-bbox="758 963 790 985">(C)</p> </div> <p data-bbox="375 1008 861 1030">Modul Pembelajaran Biologi 9 Materi 1</p>	<p data-bbox="893 392 1364 459">1 GAMBARAN UMUM KEANEKARAGAMAN HAYATI</p> <p data-bbox="909 470 1013 488">PENDAHULUAN</p> <p data-bbox="909 497 1348 851">Keanekaragaman hayati atau biodiversitas adalah keseluruhan gen, spesies, dan ekosistem di suatu kawasan. Keanekaragaman hayati merupakan kajian yang sangat penting karena akan berkaitan erat dengan kehidupan manusia sebagai salah satu bagian di dalam sistem kehidupan. Dalam kajian keanekaragaman hayati di dunia, Indonesia selalu termasuk ke dalam negara yang diperbincangkan karena merupakan negara yang sangat kaya akan sumberdaya hayatinya. Hal ini disebabkan Indonesia merupakan negara kepulauan terbesar di dunia, sehingga menjadi negara yang sangat diperhitungkan dalam hal biodiversitas di dunia. Indonesia merupakan salah satu dari 17 negara yang termasuk ke dalam negara megabiodiversitas, yaitu negara yang mempunyai tingkat keanekaragaman hayati yang sangat tinggi. National Geographic Indonesia (2019), peringkat keanekaragaman hayati daratan Indonesia adalah nomor dua setelah Brazil. Akan tetapi, jika keanekaragaman hayati daratan tersebut ditambahkan dengan keanekaragaman hayati lautan, maka Indonesia menjadi negara dengan keanekaragaman hayati tertinggi di dunia. Tahun 2017, Indonesia memiliki 31.750 jenis tumbuhan yang telah dipertemukan (Retnowati dan Rugayah, 2019) dan 25.000 diantaranya merupakan tumbuhan berbunga (LIP, 2021).</p> <p data-bbox="909 855 1348 996">Keanekaragaman (diversity) merupakan variasi dan juga variabilitas kehidupan di bumi. Menurut Baderan (2016) keanekaragaman merupakan perbedaan karakteristik antar komunitas. Keanekaragaman pada makhluk hidup dapat terjadi karena adanya perbedaan tekstur, warna, ukuran, jumlah, serta bentuk, yang merupakan karakteristik biologis untuk menyatakan struktur komunitasnya (Kristanto dkk, 2008). Keanekaragaman hayati (biodiversity) adalah keanekaragaman makhluk hidup yang meliputi keseluruhan atau totalitas variasi</p> <p data-bbox="885 1008 1372 1030">Modul Pembelajaran Biologi 10 Materi 1</p>
<p data-bbox="383 1108 662 1131">2 Organisasi dalam pembelajaran</p> <p data-bbox="414 1153 845 1198">Untuk menjawab pertanyaan sebagai solusi permasalahan di atas silahkan bentuk kelompok 5-6 siswa, lalu identifikasi jawaban dari pertanyaan di atas!</p> <div data-bbox="422 1209 837 1635">  <p data-bbox="462 1377 494 1400">(A)</p> <p data-bbox="614 1377 646 1400">(B)</p> <p data-bbox="782 1377 813 1400">(C)</p> <p data-bbox="422 1601 534 1624">(D)</p> <p data-bbox="614 1601 646 1624">(E)</p> <p data-bbox="782 1601 813 1624">(F)</p> </div> <p data-bbox="375 1736 861 1758">Modul Pembelajaran Biologi 11 Materi 1</p>	<p data-bbox="925 1108 1173 1131">2 Organisasi dalam pembelajaran</p> <p data-bbox="933 1153 1364 1198">Untuk menjawab pertanyaan sebagai solusi permasalahan di atas silahkan bentuk kelompok 5-6 siswa, lalu identifikasi jawaban dari pertanyaan di atas!</p> <p data-bbox="925 1205 1173 1227">3 Pembimbingan penyelidikan informasi</p> <p data-bbox="933 1232 1364 1276">Pahami dan cermati materi berikut untuk menunjang pemahaman kamu terkait konsep keanekaragaman hayati.</p> <p data-bbox="973 1281 1077 1299">URAIAN MATERI</p> <p data-bbox="933 1310 1364 1523">Keanekaragaman hayati adalah keanekaragaman organisme yang menunjukkan keseluruhan atau totalitas variasi gen, jenis, dan ekosistem pada suatu daerah. Keseluruhan gen, jenis, dan ekosistem merupakan dasar kehidupan di bumi. Keanekaragaman tersebut saling berhubungan satu sama lain sehingga tidak bisa dipisahkan satu sama lain. Keanekaragaman hayati tersebar di seluruh permukaan bumi mewarnai keberagaman makhluk hidup dan memberi manfaat terutama kepada kehidupan manusia. Namun demikian, kualitas dan kuantitas keanekaragaman hayati di suatu wilayah dapat menurun atau bahkan dapat menghilang. Keanekaragaman hayati dapat dijaga kelestariannya serta dapat dipulihkan kembali (Artanti, 2020).</p> <p data-bbox="933 1527 1364 1736">Materi pada modul membahas kajian pada bioekologi yang dimana terdapat beberapa tumbuhan lokal yaitu sirih cina, hanjuang, rambutan rimba, sembung, putri malu, kayu manis. Bioekologi mencakup morfologi habitat dan manfaatnya. Pada tumbuhan sirih cina (<i>Peperomia pellucida L. Kunth</i>), bahasa lokalnya sirih ketek memiliki klasifikasi kingdom: Plantae, divisi: Magnoliophyta, kelas: Magnoliopsida, ordo: Piperales, Famili: Piperaceae, genus: Peperomia, spesies: <i>Peperomia pellucida L. Kunth</i>. Tanaman sirih cina (<i>Peperomia pellucida L. Kunth</i>) memiliki Habitat berada pada daerah dataran rendah dan tinggi biasanya tumbuh di tempat yang teduh dan lembab tepi selokan atau halaman di bawah tanaman rindang.</p> <p data-bbox="885 1736 1372 1758">Modul Pembelajaran Biologi 12 Materi 1</p>

Before	After																								
<p style="text-align: center;">4 Penyajian informasi/ kesimpulan</p> <p>Pahami pokok-pokok informasi penting yang di peroleh dalam mekanisme pembelajaran</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Gambar</th> <th>Deskripsi</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"></td> <td>Tumbuhan hanjuang (<i>Cordyline fruticosa</i>) bahasa lokalnya linjuang putih merupakan salah satu tumbuhan yang terdapat di daerah kecamatan natal. Tumbuhan ini ialah salah satu jenis keanekaragaman tumbuhan yang tersebar di daerah Kecamatan Natal, keberadaan tumbuhan hanjuang putih mudah ditemukan di perkaranan sekitar rumah warga.</td> </tr> <tr> <td style="text-align: center;"></td> <td>Pada tumbuhan sirih cina (<i>Peperomia pellucida</i> L.Kunth), bahasa lokalnya sirih ketek. 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Jika dikaitan dengan hasil artikel jurnal Nurza (2019) bahwasanya tanaman Hanjuang (<i>Cordyline fruticosa</i>) secara morfologi memberikan informasi bahwa daun berbentuk bangun lanset, ujungnya runcing, pangkalnya runcing, tepinya berombak, susunan tulangnya menyirip, dagingnya seperti kertas, dan warnanya ungu. 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	Tumbuhan hanjuang (<i>Cordyline fruticosa</i>) bahasa lokalnya linjuang putih merupakan salah satu tumbuhan yang terdapat di daerah kecamatan natal. Tumbuhan ini ialah salah satu jenis keanekaragaman tumbuhan yang tersebar di daerah Kecamatan Natal, keberadaan tumbuhan hanjuang putih mudah ditemukan di perkaranan sekitar rumah warga.																								
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	Pada tumbuhan sembung (<i>Blumea balsamifera</i> D.C) nama lokal daun capo. Tumbuhan sembung merupakan tumbuhan yang ada di daerah kecamatan natal, tumbuhan ini banyak di jumpai di daerah rumah warga dia tumbuh di ladang - ladang warga atau tumbuh liar begitu dihutan yang ada di Kecamatan Natal.																								
Tumbuhan Hanjuang	Kolektor																								
	Amelisa Putri																								
	Nama ilmiah : <i>Cordyline fruticosa</i>																								
	Nama lokal : Linjuang																								
	Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal																								
	Pemanfaatan : sebagai obat tradid pereda batuk																								
Deskripsi	Cara Pengolahan																								
Tumbuhan hanjuang (<i>Cordyline fruticosa</i>) adalah salah satu tumbuhan yang tersebar di desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal, keberadaan tumbuhan hanjuang mudah di temukan di perkaranan sekitar rumah warga. Jika dikaitan dengan hasil artikel jurnal Nurza (2019) bahwasanya tanaman Hanjuang (<i>Cordyline fruticosa</i>) secara morfologi memberikan informasi bahwa daun berbentuk bangun lanset, ujungnya runcing, pangkalnya runcing, tepinya berombak, susunan tulangnya menyirip, dagingnya seperti kertas, dan warnanya ungu. Batang arah	Masyarakat desa Panggautan memanfaatkan tumbuhan hanjuang sebagi obat batuk, cara pengolahannya yait dengan mengambil daun tumbuha hanjuang yang berwarna hijau , kemudu dibilas dengan air bersih, setela tumbuhan tersebut bersih masuka dalam wadah dan tambahkan a secukupnya sesuai keinginan kemudu diremas daun hanjuang tersebut sehingg mengalami perubahan airnya agak sedikit tandanya sudah selesai dan bu untuk disaring, setelah disaring dan bu diminum sebagai obat pereda batuk.																								
Modul Pembelajaran Biologi 17	Modul Pembelajaran Biologi 15 Materi																								

BIJI

Jeruk nipis (<i>Citrus aurantifolia</i>)	Jeruk purut (<i>Citrus hystrix</i>)	Jeruk karantan (<i>Citrus sp</i>)
		
Biji sedikit dan berwarna hijau pucat	Biji sedikit berwarna putih	Biji berwarna hijau mudah dan lebih banyak

Sumber : Amelisa Putri, 2024

Jeruk Pagaran (<i>Citrus sp</i>)	Perbedaan ketiga terletak pada warna yaitu warna biji buah persamaan ciri -ciri antara lain yaitu habitat bentuk morfologi secara umum maupun cara perkembangbiakannya keempat jeruk tersebut tergolong dalam satu spesies yaitu <i>Citrus</i> yang berbeda varietas atau ras.
	
Biji lebih banyak dan berwarna merah.	

Modul Pembelajaran Biologi 32 Materi 2






PERBEDAAN BIJI

Jeruk nipis (<i>Citrus aurantifolia</i>)	Jeruk purut (<i>Citrus hystrix</i>)	Jeruk karantan (<i>Citrus sp</i>)
		
Biji sedikit dan berwarna hijau pucat	Biji sedikit berwarna putih	Biji berwarna hijau mudah dan lebih banyak

Sumber : Amelisa Putri, (2024)

Berdasarkan contoh spesies di atas maka terlihat bahwa perbedaan dalam spesies terbatas, pada beberapa hal yaitu warna, dan ukuran, tetapi dengan bentuk umum sama. persamaan tumbuhan dalam keanekaragaman gen lebih dominan dibandingkan perbedaan di antara tumbuh-tumbuhan tersebut. hal tersebut dipengaruhi oleh keragaman gen antara pemerintah satu dengan varietas lain dalam satu spesies, sehingga sifat yang nampak fenotip bervariasi. Misalnya variasi warna bentuk dan ukuran pada jeruk persamaan dan perbedaan tersebut hanya diamati melalui variasi morfologinya namun untuk pengamatan lebih dalam dapat dipelajari pada cabang ilmu genetik.

Modul Pembelajaran Biologi 32 Materi 2

Before	After		
<p style="text-align: center;">• Famili Crassulaceae</p> <p style="text-align: center;">Gambar 2.9. merupakan tumbuhan sidingin</p> <p style="text-align: center;">SIDINGIN</p>  <p>Sidingin memiliki batang yang lunak dan beruas, daunnya tebal berdaging dan mengandung banyak air, warna daun hijau muda</p> <p>Sidingin tumbuhan Semak semusim, batang segi empat, lunak, beruas, warna hijau. Daun tunggal, tebal, bentuk lonjong, tepi bergerigi, warna hijau. Perbungaan bentuk</p> <p style="text-align: center;">(sumber: Amelisa Putri, 2024)</p> <p style="text-align: center;">• Famili Lamiaceae</p> <p style="text-align: center;">Gambar 2.10 merupakan tumbuhan sarang banuah</p> <p>Tumbuhan sarang banuah memiliki Batang dan cabang yang bentuk persegi panjang. Daun berbentuk bulat telur, runcing ke ujung dan dan tumpul ke pangkalnya. Letak daun berseberangan. Bunga bertangkai pendek, memiliki bau yang harum dengan kelopak bunga berwarna ungu atau merah yang berukuran sekitar 10-15 mm, kadang-kadang terdapat bintik putih. Mahkota bunga berwarna putih hingga merah muda keputihan. Buahnya jarang terbentuk.</p>  <p style="text-align: center;">sumber: Amelisa Putri, 2024)</p> <p style="text-align: center;">Modul Pembelajaran Biologi 43 Materi 2</p>	<p style="text-align: center;">♦ KULIT ➤ ketepeng (<i>Cassia alata</i> L.)</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 60%;"> <p>Kolektor : Amelisa Putri Nama ilmiah : <i>Cassia alata</i> L. Nama lokal : galengang Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal</p> <p>Pemanfaatan : sebagai obat tradisional untuk gatal-gatal pada kulit</p> </td> <td style="width: 40%; text-align: center;"> <p>Tumbuhan Ketepeng</p>  </td> </tr> </table> <p>Deskripsi</p> <p>https://ojs.unud.ac.id/index.php/ifu/article/download/99991/51392/</p> <p>Metabolit sekunder pada daun ketepeng meliputi flavonoid, fenolik, alkaloid, saponin, antrakuinon, tanin, terpenoid, steroid, fitosterol dan glikosid. Selain bagian daun, terdapat pula laporan bagian bunga, akar dan biji, dengan hasil analisis fitokimia meliputi metabolit sekunder saponin, flavonoid, tanin, alkaloid, antrakuinon, glukosida, terpen dan fitosterol, fenol, glikosid, dan minyak folatil.</p> <p>Cara pengolahan</p> <p>Bagian yang digunakan adalah daunnya cara pengolahannya yaitu dengan mengambil daunnya kemudian rebus dengan air setelah matang campurkan dengan air mandi ini dapat mencegah-gatal pada kulit</p> <p style="text-align: center;">Modul Pembelajaran Biologi 62 Materi 3</p>	<p>Kolektor : Amelisa Putri Nama ilmiah : <i>Cassia alata</i> L. Nama lokal : galengang Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal</p> <p>Pemanfaatan : sebagai obat tradisional untuk gatal-gatal pada kulit</p>	<p>Tumbuhan Ketepeng</p> 
<p>Kolektor : Amelisa Putri Nama ilmiah : <i>Cassia alata</i> L. Nama lokal : galengang Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal</p> <p>Pemanfaatan : sebagai obat tradisional untuk gatal-gatal pada kulit</p>	<p>Tumbuhan Ketepeng</p> 		

Notes :

- *Add material.*
- *Improve the arrangement of paragraphs to avoid repetition on the next page.*
- *Do not repeat images twice in a module.*
- *More emphasis is placed on the utilization and management of local potential*
- *Follow all input given in the module.*
- *Arrange images by adding collectors, local names, Latin names, location names, descriptions, processing methods.*
- *Add clear reference sources.*
- *Don't just describe it, but clearly explain its use.*





Media Expert Results Questionnaire









Table 6. Media Expert Results

Aspect	Average Score	Criteria
Module Cover Design (Cover)	80%	Worthy
Module Content Design	86,6%	Very Worth
Average score		81,2 %
Criteria		Very Worth

Table 7. Media Expert Revision Results

Before	After
<p style="text-align: center;">PENDAHULUAN</p> <p>A. LATAR BELAKANG</p> <p>Keaneekaragaman hayati adalah berbagai bentuk kehidupan yang ada di daratan, udara dan perairan pada suatu ruang dan waktu, baik berupa tumbuhan, hewan, bahkan makhluk hidup terkecil seperti mikroorganisme. Negara Indonesia termasuk bagian dari salah satu negara tropis yang berada di garis khatulistiwa. Negara tropis memiliki jenis keaneekaragaman hayati yang berlimpah dibandingkan dengan negara non tropis. Keaneekaragaman hayati bervariasi menurut masing-masing wilayah. Tiap wilayah menunjukkan kekhasan masing - masing, baik flora maupun fauna. Secara alami keaneekaragaman hayati memiliki keterbatasan persebaran, sehingga tiap wilayah menunjukkan kekhasan dalam menampilkan keaneekaragaman hayatinya. Tingginya tingkat keaneekaragaman hayati suatu daerah memberikan peluang pemanfaatan yang lebih tinggi, karena semakin banyak pilihan dan cadangan yang dapat dimanfaatkan. Dengan demikian, daerah yang memiliki keaneekaragaman hayati tinggi mempunyai peluang besar untuk memperoleh keuntungan dari pemanfaatan keaneekaragaman hayati. Upaya yang dapat dilakukan untuk menjaga keaneekaragaman hayati adalah dengan mempelajari suatu potensi pada daerah masing-masing. Bekal pengetahuan tentang potensi lokal menjadi langkah awal untuk membantu masyarakat dalam memanfaatkan dan melestarikan sumber daya alam dengan bijaksana. Mengembangkan potensi lokal yang ada di daerah sekitar tempat tinggal kalian dapat mengubah hal biasa menjadi hal yang lebih bernilai. Ini dapat menjadi langkah awal menghadapi perkembangan zaman, serta dapat tetap menjaga kekayaan keaneekaragaman hayati di Indonesia agar tidak punah.</p> <p>Modul keaneekaragaman hayati berbasis problem based learning dan potensi lokal disusun berdasarkan kurikulum 2013, dapat terlihat dari sisi Kompetensi Inti dan Kompetensi Dasar serta pelaksanaan pembelajarannya dengan pendekatan saintifik.</p> <p style="text-align: center;">Modul Pembelajaran Biologi 1 Pendahuluan</p>	<p style="text-align: center;">PENDAHULUAN</p> <p>A. LATAR BELAKANG</p> <p>Keaneekaragaman hayati adalah berbagai bentuk kehidupan yang ada di daratan, udara dan perairan pada suatu ruang dan waktu, baik berupa tumbuhan, hewan, bahkan makhluk hidup terkecil seperti mikroorganisme. Negara Indonesia termasuk bagian dari salah satu negara tropis yang berada di garis khatulistiwa. Negara tropis memiliki jenis keaneekaragaman hayati yang berlimpah dibandingkan dengan negara non tropis. Keaneekaragaman hayati bervariasi menurut masing-masing wilayah. Tiap wilayah menunjukkan kekhasan masing-masing, baik flora maupun fauna. Secara alami keaneekaragaman hayati memiliki keterbatasan persebaran, sehingga tiap wilayah menunjukkan kekhasan dalam menampilkan keaneekaragaman hayatinya (Pur Biology, 2014). Tingginya tingkat keaneekaragaman hayati suatu daerah memberikan peluang pemanfaatan yang lebih tinggi, karena semakin banyak pilihan dan cadangan yang dapat dimanfaatkan. Dengan demikian, daerah yang memiliki keaneekaragaman hayati tinggi mempunyai peluang besar untuk memperoleh keuntungan dari pemanfaatan keaneekaragaman hayati. Upaya yang dapat dilakukan untuk menjaga keaneekaragaman hayati adalah dengan mempelajari suatu potensi pada daerah masing-masing. Bekal pengetahuan tentang potensi lokal menjadi langkah awal untuk membantu masyarakat Kecamatan Natal, Kabupaten Mandailing Natal, Provinsi Sumatera Utara dalam memanfaatkan dan melestarikan sumber daya alam dengan bijaksana. Mengembangkan potensi lokal yang ada di daerah sekitar tempat tinggal kalian dapat mengubah hal biasa menjadi hal yang lebih bernilai. Ini dapat menjadi langkah awal menghadapi perkembangan zaman, serta dapat tetap menjaga kekayaan keaneekaragaman hayati di Indonesia agar tidak punah.</p> <p>Modul keaneekaragaman hayati berbasis problem based learning (PBL) dan potensi lokal disusun berdasarkan kurikulum 2013. Dalam modul menggunakan model pembelajaran problem based learning (PBL). Problem Based Learning (PBL) merupakan model pembelajaran yang dapat membantu peserta didik untuk aktif dan</p> <p style="text-align: center;">Modul Pembelajaran Biologi 1 Pendahuluan</p>

Before	After								
<p>Keanekaragaman gen sangat berpengaruh terhadap kemampuan bertahan hidup dan beradaptasi dengan lingkungan. Gen dalam keanekaragaman hayati berperan penting untuk menghadapi perubahan Global seperti perubahan iklim dan serangan penyakit. Gen juga memberikan keuntungan secara langsung bagi manusia sebagai materi genetik yang dibutuhkan untuk mengembangkan pertanian dan kekebalan terhadap penyakit tumbuhan atau untuk pengembangan obat.</p> <p>Berikut merupakan contoh keanekaragaman gen di sekitar Kecamatan Natal Kabupaten Mandailing Natal Provinsi Sumatera Utara. Gambar 2.1 merupakan habitus jeruk (<i>Citrus sp</i>), Gambar 2.2 merupakan habitus gendarusa (<i>Justicia gendarussa</i>).</p> <p>Jeruk</p> <p>Jeruk yang ada di kecamatan natal memiliki tiga yaitu jeruk nipis, jeruk purut jeruk pajaran . ketiga jeruk tersebut memiliki persamaan dan perbedaan. Deskripsi bioekologi (Habitat, batang, daun, buah dan biji) jeruk meliputi persamaan dan perbedaan ketiga jeruk dipaparkan sebagai berikut</p>  <p>Gambar 2.1 Habitats jeruk : jeruk termasuk tumbuhan pohon jeruk dapat tumbuh diberbagai ketinggian (Sumber : Dokumentasi Amelisa Putri,2024)</p>	<p>Berikut merupakan contoh keanekaragaman gen di sekitar Kecamatan Natal Kabupaten Mandailing Natal Provinsi Sumatera Utara.</p> <p>❖ Jeruk</p> <p>Jeruk yang ada di desa Panggautan terdapat tiga yaitu jeruk nipis, jeruk purut jeruk sundas . ketiga jeruk tersebut memiliki persamaan habitat perkarangan dan cocok di dataran tinggi maupun dataran rendah, perkembangan generatif dengan biji, secara vegetatif dengan cara cangkok dan okulasi , sistem perakaran ketiga jenis jeruk ini adalah tunggang. Jenis batang pada ketiga jeruk tersebut adalah berkayu sama seperti jeruk pada umumnya. Bentuk penampungan melintang batangnya bulat. Percabangannya batang utama selalu tampak lebih jelas dibandingkan batang percabangannya. Terdapat duri pada permukaan batang, duri nantinya tumbuh menjadi cabang. Bentuk daunnya oval, tepi daun yang rata.</p> <p>Berikut adalah perbedaan buah dan biji serta pemanfaatan jeruk nipis, jeruk purut, dan jeruk sundas.</p> <p>➤ PERBEDAAN BUAH</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Jeruk Nipis</th> <th style="width: 50%;">Kolektor : Amelisa Putri</th> </tr> </thead> <tbody> <tr> <td rowspan="5" style="text-align: center;">  </td> <td>Nama ilmiah : <i>Citrus aurantifolia</i></td> </tr> <tr> <td>Nama lokal : Limo Kape</td> </tr> <tr> <td>Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal</td> </tr> <tr> <td>Pemanfaatan sebagai bumbu penambah rasa pada masakan</td> </tr> <tr> <td></td> </tr> </tbody> </table>	Jeruk Nipis	Kolektor : Amelisa Putri		Nama ilmiah : <i>Citrus aurantifolia</i>	Nama lokal : Limo Kape	Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal	Pemanfaatan sebagai bumbu penambah rasa pada masakan	
Jeruk Nipis	Kolektor : Amelisa Putri								
	Nama ilmiah : <i>Citrus aurantifolia</i>								
	Nama lokal : Limo Kape								
	Nama Lokasi : Desa Panggautan, Kecamatan Natal, Kabupaten Mandailing Natal								
	Pemanfaatan sebagai bumbu penambah rasa pada masakan								
Modul Pembelajaran Biologi 28 Materi 2	Modul Pembelajaran Biologi 29 Materi 2								

<p>Gambar 2.8. Keanekaragaman ekosistem. Ekosistem alami : a) hutan magrove dan b) pantai barat Mandailing Natal, dan ekosistem buatan : c) kebun seduduk dan kebun d) pandan di Kecamatan Natal, Kabupaten Mandailing Natal, Provinsi Sumatera Utara.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>(a)</p> </div> <div style="text-align: center;">  <p>(b)</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">  <p>(c)</p> </div> <div style="text-align: center;">  <p>(d)</p> </div> </div>	 <p>(a)</p> <p>Sumber: Dokumentasi/Prilaku, (2024)</p>  <p>(b)</p> <p>Sumber: Dokumentasi/Prilaku, (2024)</p>  <p>(c)</p> <p>Sumber: Dokumentasi/Prilaku, (2024)</p>  <p>(d)</p> <p>Sumber: Dokumentasi/Prilaku, (2024)</p> <p>Keterangan:</p> <p>A. Ekosistem Alami yaitu Hutan Mangrove Alam yang ada di Kecamatan Natal</p> <p>B. Ekosistem Alami Pantai Alam Kecamatan Mandailing Natal</p> <p>C. Ekosistem Buatan kebun Seduduk yang ada di Kecamatan Natal</p> <p>D. Ekosistem Buatan kebun Pandan yang ada di Kecamatan Natal</p>
Modul Pembelajaran Biologi 46 Materi	Modul Pembelajaran Biologi 50 Materi

Notes :

- Look again at the writing in the module.
 - The writing of PBL has been changed to use capital letters PBL.
 - Paragraph spacing needs to be paid attention to.
 - The use of conjunctions must be correct.
 - Pay attention to the selection of fonts,
- colors, size of animation/graphics used for subtitles.
 - Description of plant names in the image page 10. It is better to explain them one by one in the image captions.
 - Writing personal documentation is written below the image description.
 - Pay attention to writing regional names and try not to repeat them.

Implementation Stages (Implementation)

After the module is declared valid from the validator, implementation is carried out. In this phase, researchers used problem-based learning (PBL) and local potential-based modules as material to support biodiversity at SMA Negeri 1 Natal. After consulting with the biology teacher at SMA Negeri 1 Natal, the classes used as research samples were Class X MIPA 1, and Class X MIPA 1 module will be tested. At this stage, the module was tested on 30 students of SMA Negeri 1 Natal using the biodiversity material test subject, namely Class X MIPA 1. To assess the practicality of the module and the effectiveness of the module, we not only need student responses but also teacher responses.

Student Response Questionnaire

Module testing was carried out equally among 10th grade MIPA 1 students at SMA Negeri 1 Natal. From the module testing activities carried out evenly, researchers distributed biology modules based on problem based learning (PBL) and local potential to 30 students. Next, the researcher explained the local potential of the Natal District area and the activities in the module. Next, the researchers gave questionnaires to 30 students to measure the practicality of the module. Regarding the calculation results of the practicality response questionnaire by students at SMA Negeri 1 Natal are in table 8.

Table 8. Practicality Student Response Questionnaire

Statement	Average Score	Criteria
1-12	93,5%	Very Worth
Average score		93,5%
Criteria		Very Worth

To test the effectiveness of the module, it is carried out by distributing the first pretest questions before the researcher provides and explains the module. Then, after being given a pre-test sheet, the researcher then gave a module and explained the local potential written in the module. After that, the researcher gave a posttest sheet to the students to measure how effectively the students used this module. The results of the effectiveness test from the pretest and posttest results from 30 students at SMA Negeri 1 Natal are in table 9.

Table 9. Effectiveness Test Results

Statement	Average Score	Criteria
1-30	77,4%	Effective
Percentage		77,4%
Criteria		Effective

Biology Teacher Response Questionnaire

Testing the practicality of the module is also carried out by biology teachers by distributing biology teacher response questionnaires by assessing the use of the module in the learning process. The results of the biology teacher's response assessment can be seen from table 10.

Table 10. Biology teacher response questionnaire

Statement	Average Score	Criteria
1-14	85,7%	Very Worth
Percentage		85,7%
Criteria		Very Worth

Evaluation Stage (Evaluation)

At this point, the researcher examines and assesses the module's success using the prepared Natal District's local potential. As a result, the results and information displayed are based on efficacy and practicality studies pertaining to how instructors and students use the module. The goal of this research is to create a biology learning module at SMA Negeri 1 Natal that leverages local potential and problem-based learning (PBL) to support biodiversity. A biology learning module that may be used as an efficient and useful learning tool throughout the learning process is the result of this research.

From the explanation of the research data previously explained, the researcher's first step was to carry out a needs analysis and curriculum analysis. Distributing a needs questionnaire to biology teachers and 10th grade MIPA 1 students at SMA Negeri 1 Natal was carried out to see the needs analysis. Then direct observations were made at the school and interviews with biology teachers to see what learning activities were like in the classroom, the methods used, and the media used in the biology learning process. The results of observations and interviews carried out by the teacher only used the lecture method and the learning resources used worksheets and textbooks.

Subsequently, based on the findings of the requirements analysis of both instructors and students, it was discovered that teachers need new teaching resources in addition to the textbooks provided by the schools, which were utilized for engaging in autonomous and stimulating learning activities. In order to support the biodiversity content, new teaching resources in the form of learning modules based on local potential problem based learning (PBL) must be developed with the teacher's permission.

According to the findings of the study on students' needs for instructional materials, more than only the school-provided worksheets and textbooks are required to make learning engaging for kids. To address these issues, researchers must create learning modules based on problem-based learning (PBL) and local potential as supporting biodiversity material. This is based on the findings of the requirements analysis. [Budiono & Susanto \(2006\)](#) mention The creation of problem-based learning modules (PBL) and local potential is crucial because it can enhance student learning outcomes and connect them to potential in their immediate surroundings.

The first step in module design is to try designing a module in storyboard form. modules are developed based on the material. The module design consists of title, KI and KD, learning objectives, achievement indicators, foreword, instructions for using the module, introduction, learning activities with PBL syntax, evaluation, competency test answer key, glossary and bibliography. The initial storyboard design was developed using the Canva, PhotoRoom and Microsoft Word applications. Next, carry out validation of the modules developed for validation and practicality tests.

Validity Analysis

Professional verifiers evaluate learning materials, such as problem-based learning (PBL) modules and local potential, in order to validate their efficacy. Evaluation provides researchers with insightful recommendations and constructive criticism to help them refine their module (Artanti, 2020) Analyzing the module with the validator's evaluation tool is the first step toward obtaining validation data. Researchers will be able to assess the quality, presentation, and appropriateness of the module's material by analyzing it. Based on a preset Likert scale, response assessments are weighted.

A product must be assessed by an expert in order to be usable and suitable for testing in an educational context. Subject matter specialists and media experts verify products. Mrs. Dini Annisha, M.Pd., a lecturer at the National Islamic University of Indonesia, conducted the evaluation of the media expert. In the category appropriate for testing in learning, the average percentage is 81.2%, and the average result for each dimension is "very feasible". The criteria were deemed "very feasible" by Dr. Mhd Rafi'i Ma'arif Tarigan, M.Pd, a lecturer at the Islamic University of North Sumatra, who conducted the material expert evaluation. He explained the average of each aspect of the validation results and stated that 96.25% of the data fell into the appropriate category to be tested in learning with revision. Implementation is the next stage. The module was tested at SMA Negeri 1 Natal, in class X MIPA 1, on 30 students, as well as biology professors, after it was judged appropriate and improved. Within a week, the researcher met with the same class twice.

Stated differently, a survey was carried out by researchers among biology students and professors in order to assess the usefulness of the module. The biology professors and students in MIPA-1 class X were given a set of questions. The average validation score for the student questionnaire was 93.5%, which met the "very practical" criterion. Similarly, the average validation result for the biology instructor answer questionnaire was 93.5%. 'Very practical' is the criterion. 85.7%. At the second meeting, the researcher gave students a pre-test to answer before going over the module's local potential with them. In order to determine whether the constructed module could be used successfully in the learning process, questions were intended to be posed to students following the test, following the researcher's explanation of the module's contents. When the standards for successful learning are taken into consideration, the average score that students received on the pre- and post-tests was 77.4%.

This module was developed based on problem-based learning (PBL) and local potential, with the main characteristics contextualized by presenting real

examples of diversity in the area where students live. The benefits and activities in the module can help students understand the concept of biodiversity material (Miftachudin & Sari, 2018). In addition, this module is designed taking into account students' local context so that the learning material is relevant to their surrounding environment. This fosters students' desire and motivation to learn because they see a direct connection between what they learn and the surrounding environment.

Research on the development of local potential-based modules on biodiversity material has been carried out by (Ritonga, 2022), Development of Biology Learning Modules Based on Local Potential for Making Patchouli Oil (*Pogostemon cablin benth*) in Aceh Tamiang Regency. The results showed that the development carried out produced independent teaching products in printed form. in the form of a module based on local potential that has been developed and meets valid criteria so that it can be implemented to support biology learning. And writing about the development of modules based on the local potential of pineapple (*Ananas comosus*) and snakehead fish (*Tenualosa ilisha*) in Central Panai has been carried out by (Harahap et al., 2023).

Based on the overall results, SMA 1 Natal students gave a positive response to the biology learning module based on Problem Based Learning and local potential in the Natal area. Improvements will be made based on criticism and suggestions. Reading this module will help students embrace and sustain the potential of their area. This module is expected to be able to support biodiversity material and effective learning materials to support the learning process.

CONCLUSION

Based on the results of research and development data analysis carried out by researchers, it can be concluded that the product is a module based on problem based learning and local potential in Panggautan village, Natal District, Mandailing Natal Regency, North Sumatra Province by material experts is 93.5% with the criteria very relevant and the results from media experts were 81.2% with very relevant criteria. So this biology learning module based on problem based learning and local potential can be used in the learning process. The results of the assessment of the Biology Module Based on Problem Based Learning and Local Potential at SMA Negeri 1 Natal carried out by the biology teacher reached a score of 85.7% with very practical criteria. The results of the trial of the Biology module based on Problem Based Learning and Local Potential at SMA Negeri 1 were carried out on students achieving a score of 93.% with very practical criteria. The module effectiveness test results obtained a result of 77.4% with effective criteria. So the module developed is considered to be practically and effectively applied in the learning program process.

REFERENCES

- Aldo, N., Revita, R., & Nurdin, E. (2021). Pengembangan Modul Berbasis Problem Based Learning pada Materi Statistika SMP Kelas VIII. *JRPM (Jurnal Review Pembelajaran Matematika)*, 6(2), 115–129. <https://doi.org/10.15642/jrpm.2021.6.2.115-129>

- Ardianti, R., Sujarwanto, E., & Surahman, E. (2022). Problem-based Learning: Apa dan Bagaimana. *Diffraction*, 3(1), 27–35. <https://doi.org/10.37058/diffraction.v3i1.4416>
- Artanti. (2020). Modul Pembelajaran SMA Biologi Kelas X Keanekaragaman Hayati. *Kementrian Pendidikan Dan Kebudayaan*, 1–23. https://repositori.kemdikbud.go.id/22124/1/X_Biologi_KD-3.2_Final.pdf
- Budiono, E., & Susanto, H. (2006). Penyusunan Dan Penggunaan Modul Pembelajaran Berdasar Kurikulum Berbasis Kompetensi Sub Pokok Bahasan Analisa Kuantitatif Untuk Soal-Soal Dinamika Sederhana Pada Kelas X Semester I Sma. *Pend. Fisika Indonesia Vol.*, 4(2), 79–87.
- Branch, R. M. (2009). *Instructional Design-The ADDIE Approach*. New York: Springer. Bruning.
- Fadul, F. M. (2019). *Keanekaragaman Hayati Pembelajaran Biologi dengan Pendekatan Kearifan Lokal dan Budaya untuk SMA/MA*. Yogyakarta: Mirra Buana Media.40.
- Farida, A., & Indah, R. P. (2019). Pengembangan Modul Pembelajaran Kalkulus 1 Berbasis Problem Based Learning Di STMIK Duta Bangsa. *Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, 4(1), 26–36. <https://doi.org/10.31316/j.derivat.v4i1.162>
- Fatimah. (2016). Pengembangan Pendidikan Karakter dan Keunggulan Lokal dalam Kurikulum Kejuruan di SMK Negeri Kabupaten Tapin. *Jurnal Pendidikan Kewarganegaraan*, 6(11), 882–899.
- Harahap, I. J., Tanjung, I. F., & Jayanti, U. N. A. D. (2023). Pengembangan Modul Berbasis Potensi Lokal Nanas (Ananas Comosus) dan Ikan Terubuk (Tenualosa Ilisha) Panai Tengah. *JUPEIS : Jurnal Pendidikan Dan Ilmu Sosial*, 2(4), 25–36. <https://doi.org/10.57218/jupeis.vol2.iss4.834>
- Hake, R. R. (1999). Analyzing Change/ Gain Score. Dept. Of Physics Indiana University. Diunduh dari <http://www.physick.indiana.edu> tanggal 28-03- 2024
- Indriani, L., Haryanto, H., & Gularso, D. (2022). Dampak Model Pembelajaran Problem Based Learning Berbantuan Media Quizizz terhadap Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Penelitian Dan Pengembangan Pendidikan*, 6(2), 214–222. <https://doi.org/10.23887/jppp.v6i2.48139>
- Kurniawan, A., & Rosyid Ridlo, M. (2017). Perilaku Konsumtif Remaja Penikmat Warung Kopi. *Jurnal Sosiologi DILEMA*, 32(1), 9–22. <https://jurnal.uns.ac.id/dilema>,
- Madjid, R. A. (2019). Pengaruh Penggunaan Media Audio Si Juara Terhadap Hasil Belajar IPA Pada Siswa Tunanetra Di Mtslb/a Yaketunis Yogyakarta. *E-Jurnal Skripsi Program Studi Teknologi Pendidikan*, 8(4), 305–314.
- Mesak, M., Zebua, L. I., & Sujarta, P. (2019). Penerapan Model Problem Based Learning (PBL) Untuk Meningkatkan Penguasaan Konsep Materi Keanekaragaman Hayati. *Pendidikan Dan Pembelajaran Khatulistiwa*, 7(3), 126–137.
- Miftachudin, A. A., & Puspasari, D. (2018). Pengembangan modul berbasis problem

based learning pada kompetensi dasar menjelaskan teknik penyelenggaraan rapat di smkn 10 Surabaya. *Jurnal Pendidikan Administrasi Perkantoran*, 6(2), 174–179. <https://jurnalmahasiswa.unesa.ac.id/index.php/JPAPUNESA/article/view/32145>

Rachman, A., dan Yochanan, E. D. I. A. I. S. (2024). *Metode Penelitian Kuantitatif, Kualitatif dan R & D*. Karawang: CV Saba Jaya Publisher. 249p. Ridoan, S., Susilo, F., & Nasution, J. (2022). Inventarisasi Jenis Tumbuhan Obat dan Pemanfaatannya oleh Masyarakat di Desa Malintang Kecamatan Bukit Malintang Kabupaten Mandailing Natal Sumatera Utara. *Jurnal Ilmiah Biologi UMA (JIBIOMA)*, 4(1), 27–39. <https://doi.org/10.31289/jibioma.v1i1.1227>

Riduwan. (2011). *Dasar-dasar Statistika*. Bandung : Akfabeta. 256p

Ritonga, A. Z. (2022). Pengembangan Modul Pembelajaran Biologi Berbasis Potensi Lokal Pembuatan Minyak Nilam (*Pogostemon cablin* Benth.) Di Kabupaten Aceh Tamiang. *Braz Dent J.*, 33(1), 1–12. <http://repository.uinsu.ac.id/id/eprint/14656>

Rukmana, M., Putri Agustina, T., & Watung, F. A. (2023). Pengembangan Modul Biologi Berbasis Potensi Lokal Kabupaten Enrekang pada Materi Plantae untuk Siswa Kelas X SMA. *Biotek*, 11(1), 1–13.

Saragih, P. P., & Tanjung, I. F. (2023). Development of STEM-Based Environmental Change Module to Enhance Environmental Literacy. *Biosfer: Jurnal Tadris Biologi*, 14(1), 89–98. <https://doi.org/10.24042/biosfer.v14i1.17884>

Sari, L. O. R. K. (2006). Pemanfaatan Obat Tradisional Dengan Pertimbangan Manfaat Dan Keamanannya. *Pharmaceutical Sciences and Research*, 3(1), 1–7. <https://doi.org/10.7454/psr.v3i1.3394>

Setiawan, A. (2022). Keanekaragaman Hayati Indonesia: Masalah dan Upaya Konservasinya. *Indonesian Journal of Conservation*, 11(1), 13–21. <https://doi.org/10.15294/ijc.v11i1.34532>

Subijanto. (2015). Kebijakan Program Pendidikan Berbasis Keunggulan Lokal Di Sekolah Menengah Atas Negeri 2 Pekalongan. *Jurnal Pendidikan Dan Kebudayaan*, 21(2), 115–134.

Trisanti, L. Y., Ibrahim, M., Hidayat, T., & Akhwani, A. (2021). Pembelajaran Karakter Terintegrasi IPA di Sekolah Dasar. *Jurnal Basicedu*, 5(5), 3373–3377. <https://doi.org/10.31004/basicedu.v5i5.1351>

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