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Development of Inquiry Based Modules in Biology Subjects

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Abstract

At this time teachers are expected to be able to design teaching materials that can help students achieve learning objectives and teaching materials that can be an independent learning resource that provides a series of lessons presented in a structured format. Modules are teaching materials that can be used to achieve learning objectives. The purpose of this study is to assess the feasibility and usefulness of products that have been developed, especially inquiry-based modules for the subject of Biology MAN 1 Langkat. This research refers to research and development (R&D) methods. The development model used in this study is the Borg and Gall model which is modified into 6 stages. Based on data analysis, the results of material expert validation in all aspects were obtained with a percentage of 93.93% with very feasible criteria, up from 91.51%. After improvements, the results of the validation of media experts reached 80% with feasible criteria, up from 70%. The results of linguist validation in all aspects with a percentage of 80%, after improvements were made increased to 87.69% with very feasible criteria. The average student response was 89.58% with convenient criteria, while the average teacher response was 100% with very practical criteria in both samples. Therefore, modules with material on the diversity of living things that have been made can be applied in schools in class X.

INTRODUCTION

Curriculum is very important in the education process. According to Angga et al. (2022) and Rahmat (2022), Curriculum is a very important component of education. The new curriculum, namely the Merdeka Curriculum, is currently being used to perfect the 2013 Curriculum. One of the proposals for improving Indonesian education that aims to create a better generation in the future is the Merdeka curriculum (Angga dkk., 2022). According to Saleh (2020), Merdeka Belajar is an initiative that encourages students and teachers to think creatively about how to improve classroom teaching. Several schools have chosen to use this Merdeka curriculum. The Merdeka curriculum is now ready to be implemented in all schools, taking into account the readiness and conditions of each school.

Quality education is supported by the effectiveness of various parties, namely teachers, students, curriculum, and supporting learning infrastructure and teachers are the most important elements. (Pringgar & Bambang, 2020). According to Ayuningtyas & Supardi (2015) To produce effective and efficient learning, teachers are required to prepare teaching materials that can help students understand the learning material.

Based on interviews with biology teachers from MAN 1 Langkat school. Due to changes in the new curriculum, the school adopted the independent curriculum. The teacher stated that during the learning process, they never used learning modules but relied on student textbooks, teacher textbooks, and LKPD because of the new curriculum. During the learning process, both student and teacher textbooks were only used as files passed down from teacher to student. According to the biology teacher, the independent curriculum does not contain physical books; instead, students must

rely on digital resources such as LKPD and files to complete their assignments. However, not all learning resources utilize LKPD.

Along with this, we need teaching resources that students can use to learn on their own. The goal of creating interesting and well-organized teaching materials is to encourage students to continue learning even after class is over so that they can truly understand the content. Modules are one of the viable options to use as educational resources. (Gulo & Toroziduhu, 2022). The purpose of creating a module is to make it easier for students to understand the material presented by the teacher. Zulhaini (2016) states that each module provides a context in which a particular concept can be understood and applied. As a complementary tool or substitute for classroom teaching, teachers can benefit from developing modules (Puspitasari, 2019).

Inquiry-based modules are the most suitable teaching materials to be developed considering the problems identified in schools. According to Prabowo et al. (2016), inquiry-based modules are designed to encourage students to consider what, why, and how events occur in nature. While conventional modules usually include a collection of information that students can learn, these questions are what differentiates them. According to Ramadhana et al (2017), students' curiosity will be aroused by inquiry-based modules. With inquiry-based modules, students will be motivated to find their answers to questions, inquiry-based modules have instructions to motivate students to find and solve problems, with this students can be more active and indirectly can improve learning outcomes and student independence levels (Sarah & Siti, 2016). The results of the study showed that there was an increase in student learning outcomes who studied using inquiry-based modules by 64% greater than learning using conventional modules by 56% (Sarah & Siti, 2016). Based on the problems above, the researcher is interested in conducting research with the aim of finding out whether inquiry-based modules are feasible and practical to use in the learning process.

RESEARCH METHODS

This research was conducted in January 2024 at MAN 1 Langkat. Validators were subject matter, media, language experts, 2 educators, and 18 students who were the subjects of this research. Meanwhile, the object used in this study was an inquiry-based module that had been developed. This type of research is Research and Development (R&D). In the process of developing an inquiry-based module, it follows the version of the Borg and Gall development model modified by Sugiyono (2015). Consists of six stages:

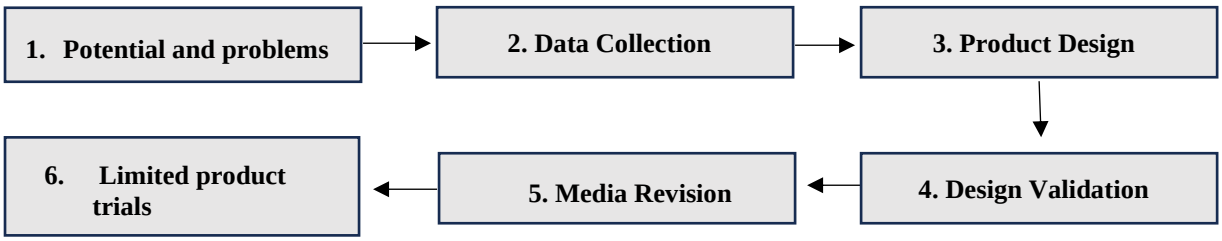


Figure 1. Development Research Steps

At the potential and problem stage, it is carried out to analyze the potential and problems that exist in the school starting from curriculum analysis, needs analysis and material analysis with field studies to MAN 1 Langkat. The data collection stage is carried out by collecting data or planning about the product to be developed. The product design stage is by creating a teaching material in the form of an inquiry-based module according to the steps in making the module and the inquiry steps. The next stage is design validation, design validation is carried out to find out whether the product that has been developed is feasible or not by providing a validation sheet to experts consisting of material, media and language experts. After validation, the shortcomings of the product that has been developed can be identified, then the next step is media revision which is carried out according

to comments and suggestions from experts or validators which will later produce a product that is feasible to use before the trial is carried out. After the revision is carried out, a limited product trial is carried out, a limited product trial is carried out to assess whether the product that has been developed is practical or not by providing a teacher response questionnaire consisting of 2 teachers and student responses consisting of 18 students.

Qualitative descriptive and quantitative descriptive methods are used to analyze the data in this study. The purpose of this technique is to ensure whether the creation of inquiry-based modules is feasible and practical to use in the learning process.

To determine the feasibility of a product is obtained from the validation results. In analyzing the validation test data, the following formula is used (Purwanto, 2013):

$$NP = \frac{R}{SM} \times 100\%$$

Information:

NP : Expected percentage value
R : Raw score obtained
SM : Ideal maximum score 100%

The following table is used to interpret the assessment results:

Table 1. Expert Validation Interpretation Criteria

Percentage of achievement (%)	Interpretation
0%-20%	Very inappropriate
21%-40%	Not Feasible
41%-60%	Decent Enough
61%-80%	Worth
81%-100%	Very Decent

(Riduwan, 2015)

After the feasibility study was completed, a questionnaire was distributed to teachers and students to measure the practicality of the product. The Guttman scale was used to evaluate the teacher and student response surveys. The following formula was used to calculate the questionnaire results:

$$P\ (\%) = \frac{Jumlah\ Skor\ Total}{Skor\ Kreterium} \times 100\%$$

The following table is used to interpret the assessment results:

Table 2. Criteria for the Practicality of Teacher and Student Questionnaires

Percentage of achievement (%)	Interpretation
21%-40%	Less practical
41%-60%	Practical enough
61%-80%	Practical
81%-100%	Very practical

(Bintiningtyas & achmad, 2016)

RESULTS AND DISCUSSION

Based on the research results, a product was produced in the form of an inquiry-based biology module on the material of the diversity of living things for class X which was validated by three validators, two teachers, and 18 students. The explanation of each stage of development is as follows:

1. Potential and problems

At this stage, the problems found in the school based on the results of interviews and observations conducted are that the teaching materials used in schools still use teacher books, student books, and LKPD but not all learning materials utilize LKPD due to changes in the new curriculum, namely the Merdeka curriculum. Where the teacher stated that the Merdeka curriculum does not yet contain physical books or printed books.

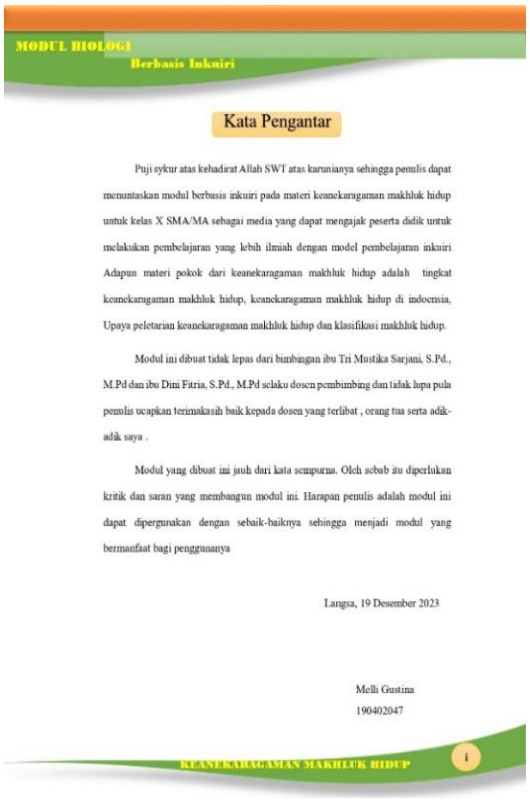
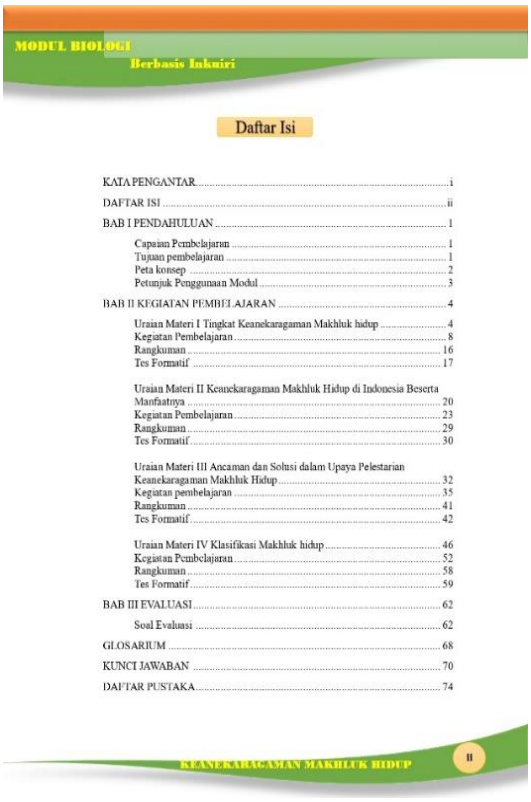
2. Data Collection

Data collection in this study was carried out from the results of interviews and observations carried out to plan the development of a product, where the product created can help teachers and students in the learning process.

3. Product Design

The activities carried out at this stage are to create a product in the form of an inquiry-based module. The developed module contains a foreword, table of contents, learning outcomes and learning objectives, a concept map of module usage instructions, material descriptions, learning activities, summaries, formative tests, evaluations, bibliographies, and answer keys. The results of the product design can be seen in the table below:

Table 3. Inquiry-Based Module Product Display

Foreword	Table of Contents
	
In this section, we express our gratitude for completing this inquiry-based module.	This section contains the contents and numbering of each page of the module content.

P-ISSN: 2503-4561
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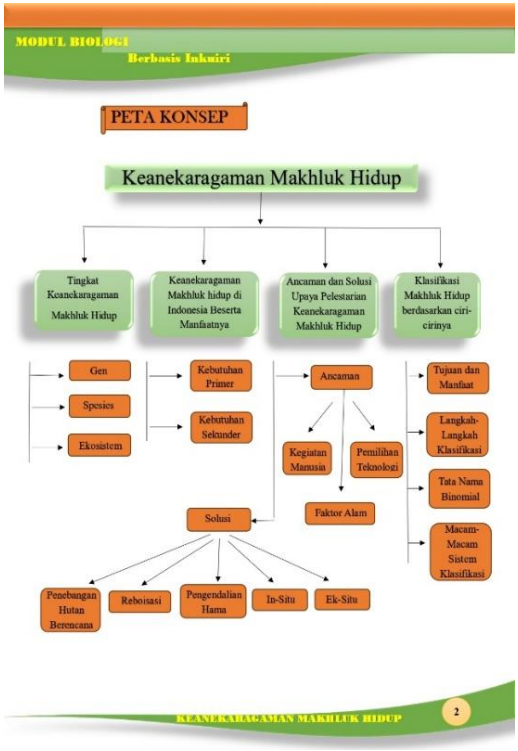
CP and TP

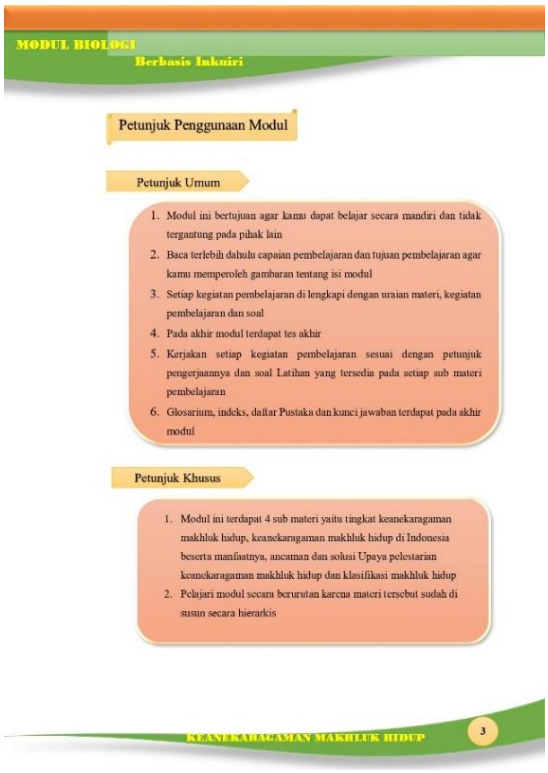
This section contains learning objectives and outcomes

Concept Map



This section contains what material is contained in the module.

Module Instructions for Use



This section contains general and specific instructions for using the module for teachers and students

Material Description

In this section contains a description of the material on the diversity of living things

P-ISSN: 2503-4561
E-ISSN: 2527-3760

Learning Activities


MODUL BIOLOGI
Berbasis Inkuiri

Orientasi

Apakah kalian pernah melihat tumbuhan maupun hewan ? Pasti pernah bukan? Ya karena tumbuhan dan hewan selalu kita jumpai di lingkungan sekitar kita. Tumbuhan maupun hewan juga merupakan makhluk hidup dan kita juga saling bergantungan dengan makhluk hidup lain. Makhluk hidup itu bernekaragam atau bermacam-macam, kalian pasti sering melihat tumbuhan maupun hewan yang terlihat serupa bukan? tetapi memiliki perbedaan misal nya pada tumbuhan bunga kertas, buah mangga dan kucing. Dapat dilihat pada gambar dibawah ini!

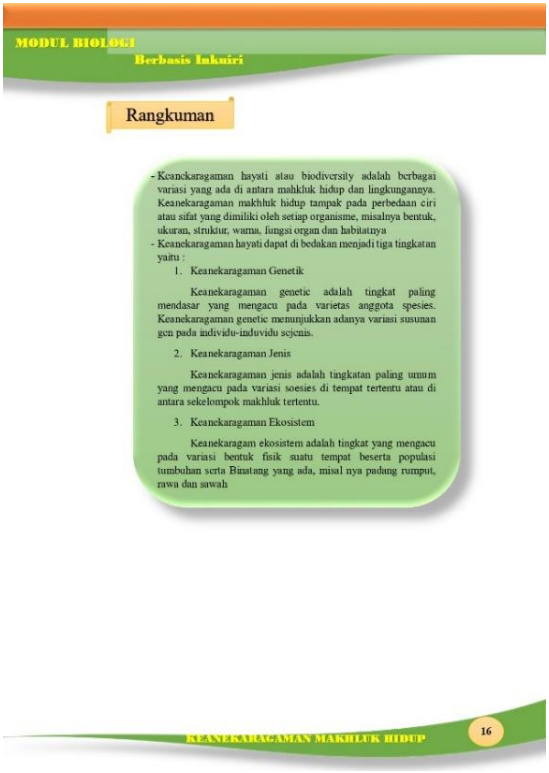
Gambar 6: Bunga Kertas berwarna merah *(Bougainvillea)* putih *(Bougainvillea)* dan ungu *(Bougainvillea)*

Gambar 7: Mangga Golek *(Mangifera Indica)*dan Mangga Madu *(Mangifera Indica)*

KEANEKARAGAMAN MAKHLUK HIDUP 10

This section contains learning activities that contain inquiry-based student learning steps.

Summary


MODUL BIOLOGI
Berbasis Inkuiri

Rangkuman

- Keanekaragaman hayati atau biodiversity adalah berbagai variasi yang ada di antara mahkluk hidup dan lingkungannya. Keanekaragaman makhluk hidup tampak pada perbedaan ciri atau sifat yang dimiliki oleh setiap organisme, misalnya bentuk, ukuran, struktur, warna, fungsi organ dan habitatnya
- Keanekaragaman hayati dapat di bedakan menjadi tiga tingkatan yaitu :
  1. Keanekaragaman Genetik

  Keanekaragaman genetic adalah tingkat paling mendasar yang mengacu pada varietas anggota spesies. Keanekaragaman genetic menunjukkan adanya variasi susunan gen pada individu-induvidu sejenis.

  2. Keanekaragaman Jenis

  Keanekaragaman jenis adalah tingkatan paling umum yang mengacu pada variasi soesies di tempat tertentu atau di antara sekelompok makhluk tertentu.

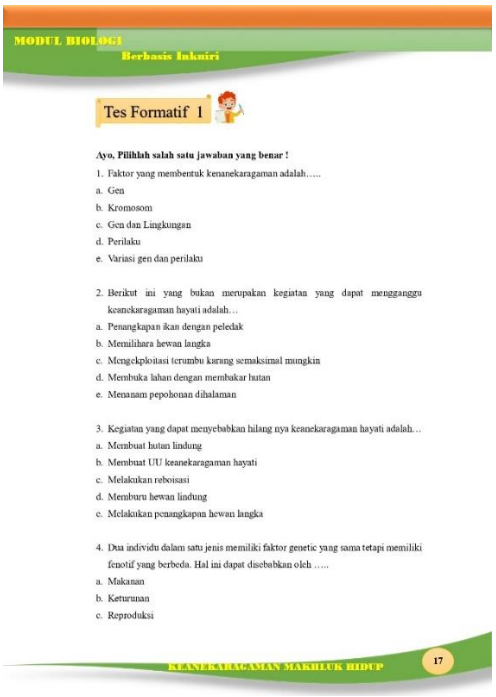
  3. Keanekaragaman Ekosistem

  Keanekaragam ekosistem adalah tingkat yang mengacu pada variasi bentuk fisik suatu tempat beserta populasi tumbuhan serta Binatang yang ada, misal nya padang rumput, rawa dan sawah

KEANEKARAGAMAN MAKHLUK HIDUP 16

This section summarises the learning material that has been learnt.

Formative Test


MODUL BIOLOGI
Berbasis Inkuiri

Tes Formatif 1

Ayo, Pilihlah salah satu jawaban yang benar !

1. Faktor yang membentuk kenanekaragaman adalah.....
a. Gen
b. Kromosom
c. Gen dan Lingkungan
d. Perilaku
e. Variasi gen dan perilaku

2. Berikut ini yang bukan merupakan kegiatan yang dapat mengganggu keanekaragaman hayati adalah…
a. Penangkapan ikan dengan peledak
b. Memilihara hewan langka
c. Mengekploitasi terumbu karang semaksimal mungkin
d. Membuka lahan dengan membakar hutan
e. Menanam pepohonan dihalaman

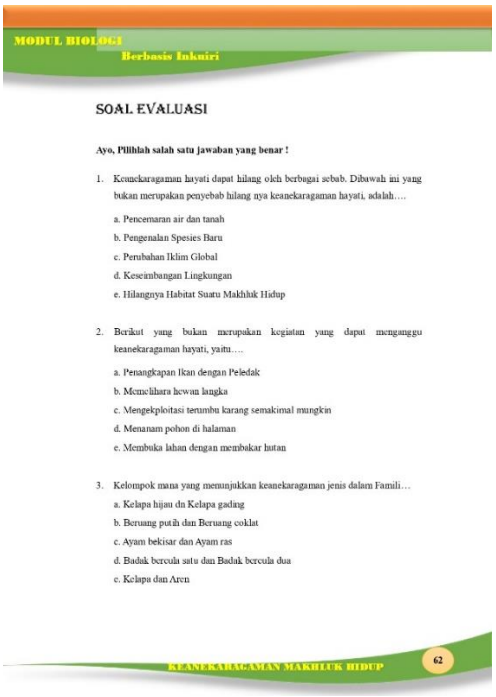
3. Kegiatan yang dapat menyebabkan hilang nya keanekaragaman hayati adalah…
a. Membuat hutan lindung
b. Membuat UU keanekaragaman hayati
c. Melakukan reboisasi
d. Memburu hewan lindung
e. Melakukan penangkapan hewan langka

4. Dua individu dalam satu jenis memiliki faktor genetic yang sama tetapi memiliki fenotif yang berbeda. Hal ini dapat disebabkan oleh .....
a. Makanan
b. Keturunan
c. Reproduksi

KEANEKARAGAMAN MAKHLUK HIDUP 17

This section contains formative tests or student activities to see their understanding of the material that has been learnt.

Evaluation


MODUL BIOLOGI
Berbasis Inkuiri

SOAL EVALUASI

Ayo, Pilihlah salah satu jawaban yang benar !

1. Keanekaragaman hayati dapat hilang oleh berbagai sebab. Dibawah ini yang bukan merupakan penyebab hilang nya keanekaragaman hayati, adalah….
a. Pencemaran air dan tanah
b. Pengenalan Spesies Baru
c. Perubahan Iklim Global
d. Keseimbangan Lingkungan
e. Hilangnya Habitat Suatu Makhluk Hidup

2. Berikut yang bukan merupakan kegiatan yang dapat menganggu keanekaragaman hayati, yaitu….
a. Penangkapan Ikan dengan Peledak
b. Memelihara hewan langka
c. Mengekploitasi terumbu karang semakimal mungkin
d. Menanam pohon di halaman
e. Membuka lahan dengan membakar hutan

3. Kelompok mana yang menunjukkan keanekaragaman jenis dalam Famili…
a. Kelapa hijau dn Kelapa gading
b. Beruang putih dan Beruang coklat
c. Ayam bekisar dan Ayam ras
d. Badak bercula satu dan Badak bercula dua
e. Kelapa dan Aren

KEANEKARAGAMAN MAKHLUK HIDUP 62

This evaluation section contains student activities to measure their understanding of the material learnt during 1 chapter.

P-ISSN: 2503-4561
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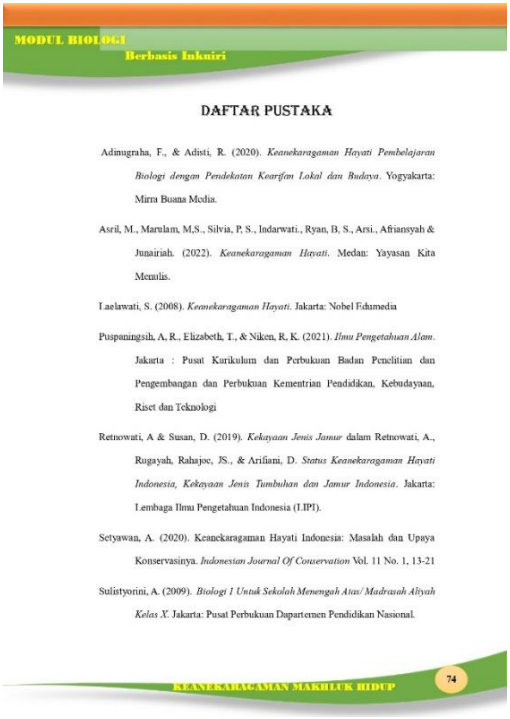
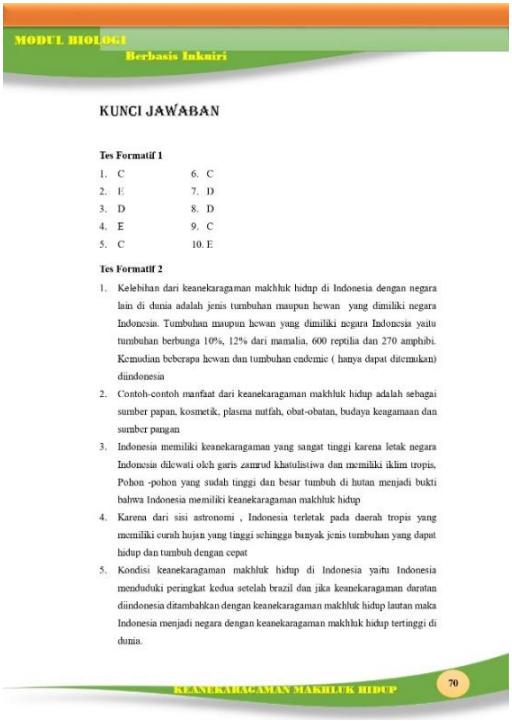
Bibliography	Answer Key
	
In this section contains a bibliography or reference that is a reference in making inquiry-based modules	This section contains the answer key for all tests contained in the inquiry-based module.

4. Design Validation

The developed product was evaluated through validation by three validators, namely material experts, media experts, and language experts. This validation was carried out to assess whether the developed product was feasible or not to be applied in the learning process. Validation of the inquiry-based module was carried out twice by material, media, and language experts. Figure 2 shows the results of the validation by material experts:

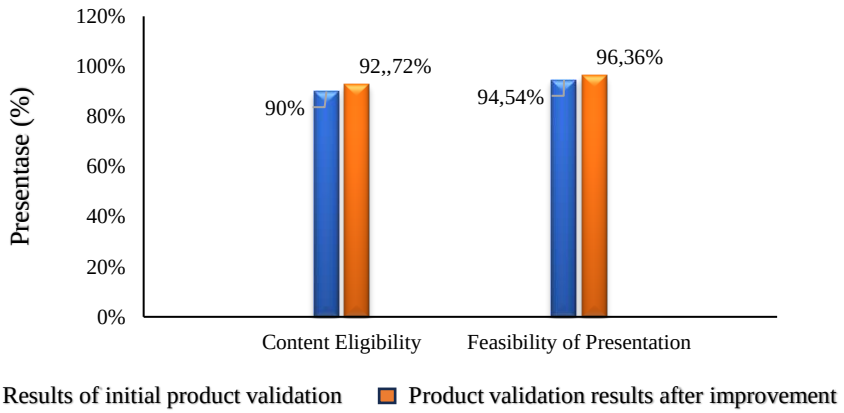


Figure 2. Results of Material Expert Validation

Figure 2. shows the results of expert validation of the material before and after the revision. There are two aspects of expert validation of the material, namely the feasibility of the content and the feasibility of the presentation. After implementing the suggested changes, the expert validation of the material obtained an average score of all aspects of 93.93% with the criteria of

very feasible, up from before the modification of 91.51%. This improvement is the result of several statements that have been revised or refined, especially in terms of the feasibility of the content and the feasibility of the presentation. These results indicate that the criteria obtained from expert validation of the material are very feasible for use in the learning process. The module that has been developed contains accurate images and questions that are in accordance with the material so that students can be actively involved in the learning process which can later improve student learning outcomes. This is in line with the opinion of Agustina & Adesti (2019) who stated that the feasibility of content that is in accordance with the material will be able to improve student learning outcomes and the optimized presentation aspect can support the learning process. According to Nuraini, et al. (2023) modules that have various images and questions that are relevant to the material, aim to encourage students to be active and can motivate students to improve their understanding.
The results of the media expert validation can be seen in Figure 3.

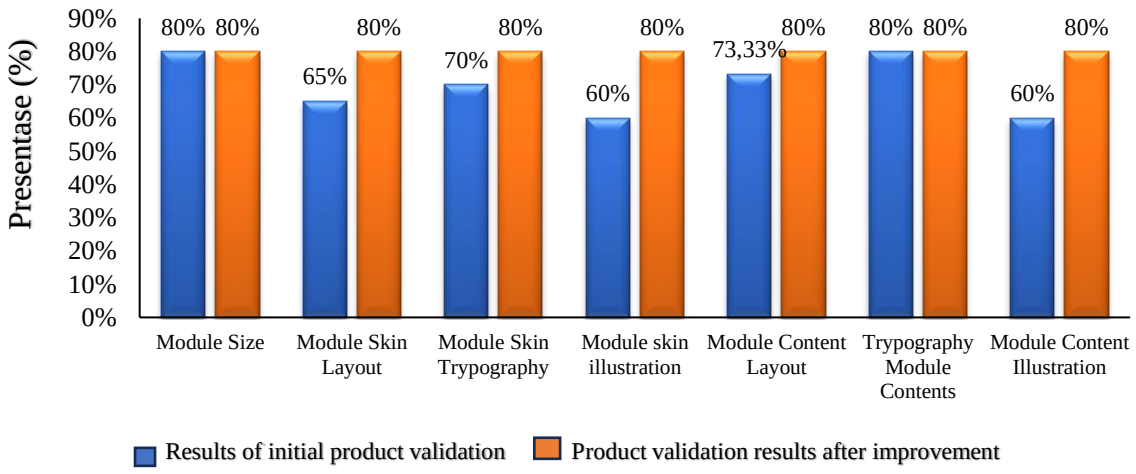


Figure 3. Results of Media Expert Validation

Figure 3. Showing the validation results Before and after the media expert validation improvements were made, there were seven aspects, namely module size, module skin layout, module skin tripography, module skin illustration, content layout, content tripography, and content illustration. After making the necessary improvements, the media expert validation obtained an average result in all aspects of 80% with feasible criteria, the value increased compared to the initial media expert validation results of 70% in all aspects. Improvements or revisions to various statements caused this increase. These results indicate that the criteria obtained from the media expert validation results are feasible for use in the learning process. This module contains attractive and easy-to-read letters, so that it can motivate and attract students' attention to read. This is in line with the opinion of Taufina & Chandra (2018) who stated that in developing a learning media there are important aspects that need to be considered, such as choosing the right color and writing that can motivate users to read a product that has been developed. This is clarified by the opinion of Rambe & Ristiono (2022) who stated that graphic components such as font type and size should be appropriate for age level so that they are easy to read. The appearance of the module must be attractive with the selection of appropriate images and colors such as bright and lasting colors to attract students' attention. and according to Rachmadtullah, et al. (2018) stated that a media is said to be good if it has ease of access without having to have special skills. The results of the linguist validation can be seen in Figure 4:

P-ISSN: 2503-4561
E-ISSN: 2527-3760

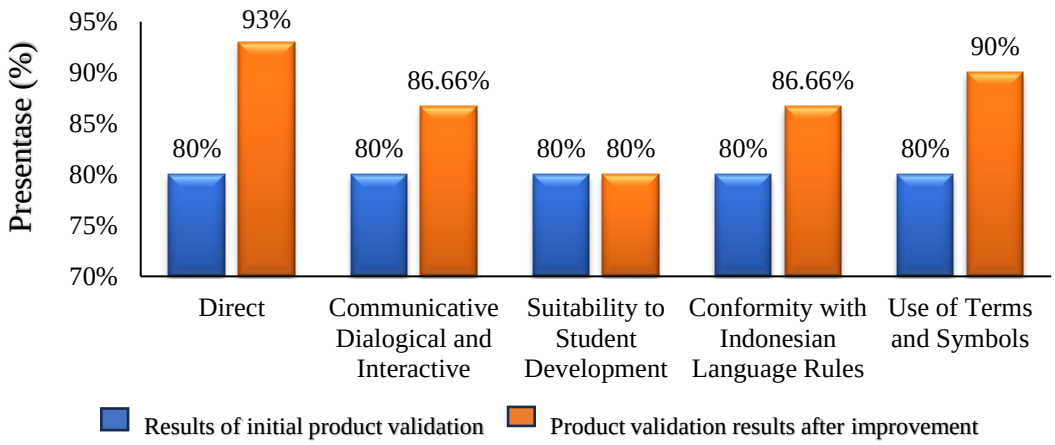


Figure 4. Linguist Expert Validation Results

Figure 4 shows the results of the linguist validation. There are five aspects of language validation, namely straightforward, communicative dialogical, and interactive, conformity with Indonesian language rules, suitability for learner development, and use of terms and symbols. After implementing the suggested changes, the average result of linguist validation on all aspects increased from 80% with decent criteria to 87.69% with very decent criteria. The increase was the result of various statements being refined or revised. These results indicate that the criteria obtained from the linguist validation results are very feasible for use in the learning process. This module uses effective sentences, sentence structure suitability, and grammatical accuracy so that students can more easily understand the material presented. This is in line with the opinion of Daryanto (2013) which states that in making modules, the grammar used must be simple and presented in a simple form while according to Fajarini, et al (2016), the preparation of sentences must also follow PUEBI which will make students comfortable when reading the module provided.

5. Media Revision

After validation, the next stage is media revision, at this stage revision or improvement of the media is carried out based on comments or suggestions from experts so that later the developed product is suitable for use before trial.

6. Limited Product Trial

After material, media, and language experts validate the product that has been developed, the product is then tested to find out whether the product that has been developed is practical or not to be used in the learning process. In the limited trial, eighteen students and two biology teachers participated in this study. Figure 5 displays the results of the survey given to the teacher.

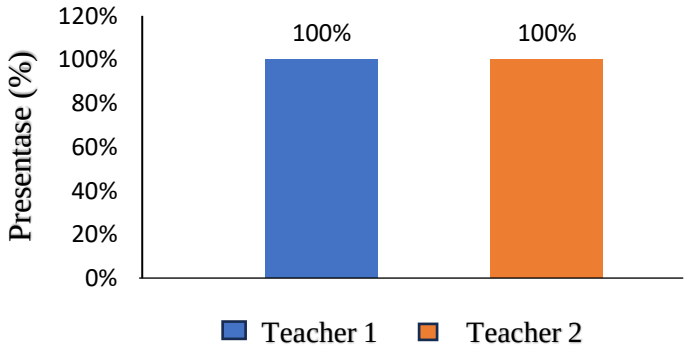


Figure 5. Teacher Response Results

Figure 5 shows the results of product evaluation involving two teachers. The perfect score was achieved by Teacher 1 and Teacher 2. With an average percentage of 100% and very practical criteria, the inquiry-based module received positive responses from the teachers. These results indicate that the criteria obtained from the results of teacher responses are very practical to be used in the learning process. The developed module contains material that is in accordance with the learning objectives, the appearance of the module is attractive and easy to understand so that students can be interested and easily use the module in the learning process. This is in line with the opinion of Alfiriani & Ellbert (2017) stating that the practicality of a learning module refers to the condition of the module developed, namely that the module is easy to use by students in learning so that it becomes meaningful, interesting, fun and useful for students, and can increase student creativity in learning and has effectiveness on student learning outcomes. The results of student responses can be seen in Figure 6:

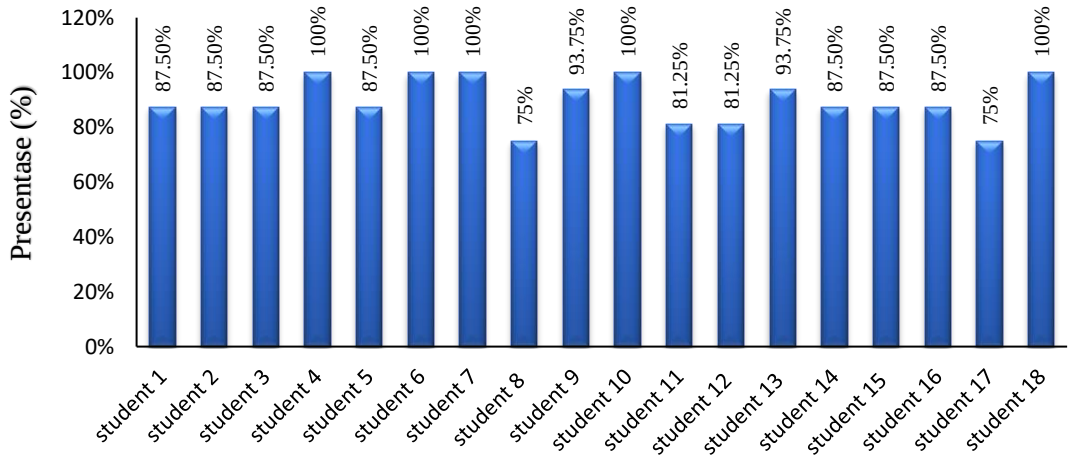


Figure 6. Student Response Results

Figure 6. displays the results of student responses conducted to 18 students regarding the developed product. The overall average result of student responses is 89.58% with very practical criteria. These results indicate that the criteria obtained from the results of student responses are very practical for use in the learning process. The module that has been developed makes it easier for students to learn, the images presented in the module are also interesting and the modules presented can encourage students to learn independently and in groups. This is in line with the opinion of Djamarah & Zain (2010), which states that practical values in a learning media can control and manage student learning time more efficiently.

CONCLUSION

Inquiry-based modules validated by material, media and language experts are determined based on research findings. The final percentage of material validation (93.93%), media validation (80%) and language validation (87.69%) of media expert validation obtained appropriate criteria and material and language validation used very appropriate criteria. The results of the practicality survey show that the learning process is based on reality, with an average response rate of 89.58% for students and 100% for teachers.

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