



Development of Discovery Learning Based E-Modules on Animalia and Ecosystem Materials for Class X High School Students

Moralita Chatri^{1*}, Tita Yunia Zalni¹, Irdawati¹, Suci Fajrina¹

¹Master of Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang, Padang, Indonesia

Received: July 24, 2023

Revised: August 26, 2023

Accepted: November 25, 2023

Published: November 30, 2023

Corresponding Author:

Moralita Chatri

moralitachatri@gmail.com

DOI: [10.29303/jppipa.v9i11.4789](https://doi.org/10.29303/jppipa.v9i11.4789)

© 2023 The Authors. This open access article is distributed under a (CC-BY License)



Abstract: The initial investigation in the research conducted was an interview with a Biology teacher and gave a questionnaire to 21 students of class X MIPA SMAN 12 Bungo to find out the needs of students in e-module teaching materials. The use of teaching materials used by students is still in the form of printed books, LKS, handouts, videos and image media that do not contain concepts about Biology material that is easily understood by students. Therefore, e-modules are needed that can help students in the learning process. It is known that students have difficulty understanding the concepts in Animalia and Ecosystem material, resulting in low learning outcomes. Therefore, e-modules are needed that can help students in the learning process. The purpose of this research is to produce e-modules based on discovery learning on Animalia and Ecosystem materials for class X SMA / MA students who are valid, practical and affective. This type of research is development research using the Plomp model. The Plomp model consists of three phases, namely the preliminary research phase, the design and prototyping phase and the assessment phase. The subjects in this study were students of class X SMAN 12 Bungo. The research data consisted of validation sheets, practicality assessment sheets by teachers and students, observation sheets and learning outcomes in the cognitive, affective and psychomotor domains, as well as multiple choice questions to assess the cognitive domain of students. The results showed that the discovery learning-based e-module with an average value of 93.13% with very valid criteria. The results of the practicality assessment by teachers with very practical criteria with an average value of 83.33% and the practicality assessment by students with very practical criteria with an average value of 87.72%. The effectiveness test found an influence on the learning outcomes of the cognitive, affective and psychomotor domains of students. So in this study it can be concluded that the discovery learning-based e-module on Animalia and Ecosystem material that has been developed is very valid, very practical and very effective which can be used in the learning process.

Keywords: E-Module; Discovery Learning; Development Research.

Introduction

Teaching materials are used as support in learning process and can increase student effectiveness. According to Magdalena, (2020) teaching materials are an important part of organizing education. The application of teaching materials by teachers aims to make it easier to carry out learning and students will be helped more and easier to learn and teaching materials

can be made in accordance with the needs and characteristics of the teaching materials presented. In addition, according to Abidin (2018), teaching materials can be interpreted as a set of facts, concepts, procedures, or generalizations specifically designed to facilitate learning that can be poured in the form of innovative and interactive teaching materials. The development of technological advances encourages the birth of more innovative learning concepts and mechanisms and this

How to Cite:

Chatri, M., Zalni, T. Y., Zalni, I., & Fajrina, S. (2023). Development of Discovery Learning Based E-Modules on Animalia and Ecosystem Materials for Class X High School Students. *Jurnal Penelitian Pendidikan IPA*, 9(11), 9729–9737. <https://doi.org/10.29303/jppipa.v9i11.4789>

concept can change the way students learn. One of them uses electronic-based modules, namely e-modules.

According to Ritonga (2020), e-modules are one of the media that can help students in learning. E-modules are adaptations and developed from printed modules into digital form. The benefits of using e-modules as support in the learning process include: can increase knowledge and broaden students' horizons, can stimulate students to think, behave and develop further (Satriawati, 2015). E-modules as independent learning materials that are systematically organized into certain learning units, which are presented in electronic format which will later be linked (Kemendikbud, 2017).

In learning Biology, there are basic competencies (KD) for student learning achievement which are regulated in Permendikbud number 24 of 2016 2013 Curriculum in Primary Education and Secondary Education. KD 3.9 requires students' ability to apply classification principles to classify animals into phyla based on anatomical and morphological observations and relate their role in life. Meanwhile, KD 3.10 requires the ability of participants to analyze information/data from various sources about ecosystems and all interactions that occur in them.

Based on the results of interviews with Mrs. Friskha Christina N, S.Pd at SMAN 12 Bungo that the teaching materials used by students in the form of guidebooks used by students are both still in the form of printed books, LKS (Student Worksheets), handouts, videos and image media used still do not contain more complete concepts on Animalia and Ecosystem material. In addition, there are still some students who have difficulty in understanding the concepts in Biology learning materials, especially Animalia and Ecosystem materials. This causes low student learning outcomes. So that the learning objectives of Biology material have not been achieved optimally. In addition, students are less active in the learning process, because the process of receiving information comes more from the teacher.

Learning media used in schools greatly affects the learning process and student learning outcomes. Learning media as a means of transferring knowledge is used to facilitate teachers and students in the learning process, so the media used must be effective, interesting, easy to understand the material and easy to use by its users. For this reason, it is necessary to develop teaching materials that are attractive to students (Wahyuningtyas, 2020).

Based on the results of a questionnaire given to students in classes X MIPA 1, MIPA 2 and MIPA 3, 94% of students stated that they wanted teaching materials to contain a summary of the material, supporting images accompanied by image captions to help make it easier for them to understand the topics studied, and add

animated videos and animations to the material. Teaching materials can be developed in the form of e-modules.

In developing e-modules, there are various applications used including sigil, Flip Html 5, 3D Pageflip, Flipbook Maker, Adobe Flash CS6, AnyFlip, Flip PDF Professional and Flip PDF Corporation Edition. Among these applications that are interesting to develop is Flip PDF Corporate Edition. Flip PDF Corporate Edition is a PDF development application that can be accessed online or offline which contains text, audio, video, images and so on (Zinnurain, 2021).

One of the approaches that can be used in e-modules, namely discovery learning, is a learning method that focuses on utilizing available information, both those provided by the teacher and those sought by the students themselves, in building the learning process. Knowledge by learning on your own. With this method, the teacher should: (1) provide data or methods to explore the knowledge that students will learn, (2) check and review student learning outcomes (Amalia & Hidayat, 2021).

The discovery learning model was chosen because this model provides opportunities for students to think, find, argue, and work together through scientific learning activities, so that it will have an impact on improving learning outcomes. According to Arifah et al. (2022), if the e-module is included with the learning model it will be more effective. Furthermore, according to Tampubolon (2017), the discovery learning model creates an active learning process where the material is not given by the teacher at the beginning of learning directly. During the learning process, students are asked to find their own way to solve problems. Furthermore, this discovery learning model is how students understand concepts, meanings and relationships through an intuitive process to finally arrive at a conclusion. Based on the problems described above, researchers have conducted development research with Discovery Learning-based E-Module products on Animalia and Ecosystem Materials for Class X SMA / MA.

Method

The type of research to be carried out is development research (Research and Development). Research and Development (R&D) is a research method used to produce products. In this study, researchers developed a product to be used in the learning process, namely in the form of e-modules based on discovery learning on Animalia and Ecosystem materials that are valid, practical and effective in improving the learning outcomes of class X students from SMAN 12 Bungo.

This discovery learning-based e-module development uses the Plomp model. The research phases consist of preliminary research phase, development or prototyping phase and assessment phase. Formative evaluation is present in all phases and iterative cycles of the assessment design. Formative evaluation has several layers illustrated in Figure 1.

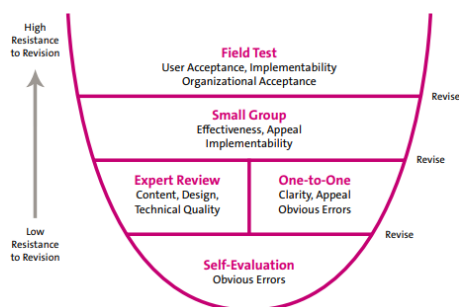


Figure 1. Formative Evaluation Layer (Plom, 2013)

A summary of the research procedure can be seen in Figure 2.

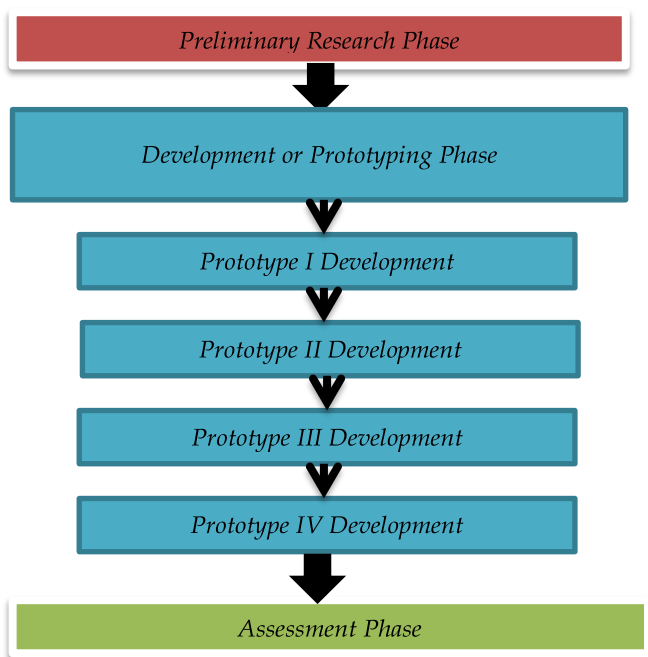


Figure 2. Schematic of Discovery Learning Based E-Module Development Procedure

Preliminary Research Phase I

The preliminary stage is carried out by focusing on data collection to get an overview of the product to be developed, so that it can be used in learning. The activities carried out at this stage are needs and context analysis. Needs analysis Needs analysis is carried out to find out the problems faced in learning from both teachers and students, especially regarding teaching materials that have been used previously in the learning process at school which will later develop teaching

materials in the form of e-modules. based on discovery to meet student learning needs. According to Akbar and Razak (2019), innovation is needed to improve the learning process. create teaching materials that can be used in the learning process. improve learning based on student characteristics and needs.

Analysis of the needs of teaching materials needed by students as learning support materials in the learning process activities. In analyzing the needs obtained based on the results of interviews with Biology teachers SMAN 12 Bungo, namely teaching materials in the form of e-modules based on discovery learning to support learning used by X MIPA class students with the aim of increasing the enthusiasm for learning. students in learning so that it will improve learning outcomes.

Context analysis was conducted by collecting data from three MIPA classes at SMAN 12 Bungo. This context analysis is carried out by analyzing the characteristics of the discovery learning-based e-modules developed, analyzing the characteristics of students who will be targeted in the use of the e-module products developed, analyzing the curriculum and analyzing the learning materials to be presented in the discovery learning-based e-modules.

Syllabus analysis aims to find out the indicators to be achieved in the learning process which is useful in compiling the e-modules that have been developed. Based on the analysis that has been done from several courses on Animalia and Ecosystem material, each of these materials requires an explanation of the material equipped with supporting images and videos, a structured and clear explanation of the material, especially on material that has an explanation of the process.

Phase II Development and Prototyping (Development or Prototyping Phase)

This phase involves prototype development, evaluation and revision to produce a final prototype of a valid, practical and effective e-module discovery learning product.

Prototype I Development

This stage begins with designing a discovery learning-based e-module storyboard based on the results obtained from preliminary research. Then the manufacture of e-module Prototype 1 is evaluated by means of self-evaluation by revising the e-module product that has been designed using a checklist to see the errors found in prototype I and then making revisions.

Prototype II Development

Prototype 2 was conducted with experts or experts (expert judgment) so as to obtain a valid product. The

validated aspects include construct aspects, content aspects, graphic aspects and language aspects. Furthermore, a one to one evaluation will be carried out by asking 3 students who have high, medium and low abilities to provide comments on the e-module Animalia and Ecosystem material designed. Based on the validation results and comments on the product given by students, the product can be revised.

Prototype III Development

This stage is the result and revision of prototype II. In prototype III a small group evaluation is carried out. At this stage the development of e-modules based on discovery learning has been validly used by 6 students of class X SMAN Negeri 12 Bungo with different levels of academic ability. This small group evaluation was conducted to determine the practicality of the e-module product to be designed.

Prototype IV Development

This stage is the result of the revision of prototype III. Prototype IV will be continued in the assessment phase by conducting a large group field test in the classroom.

Assessment Phase III

The assessment phase is the last stage of the Plomp development model and the final stage of design research, namely the large group trial practiced on class X students in one class to see the effectiveness and practicality of the prototype. The practicality test was carried out by filling out a practicality questionnaire by Biology teachers and students on the use of e-modules. According to Putri (2022), discovery learning-based teaching materials can be used as learning resources and learning support.

Result and Discussion

The results of the initial investigation were used as guidelines in the development of e-modules based on discovery learning. The following are the results of this development stage.

Prototype Development Stage I

Prototype development begins with creating a storyboard for discovery learning-based e-modules. Followed by product development based on e-modules based on discovery learning using Flip PDF Corporate Edition. The e-module components developed include cover, main menu, preface, table of contents, list of images, introduction, evaluation question material, and answer key glossary.

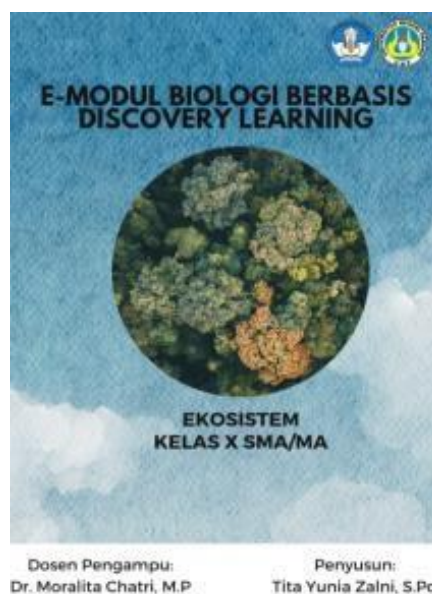


Figure 3. Cover View of Discovery Learning-Based E-Module

Prototype II Development Results

The next stage is expert review and assessment conducted by students, namely one to one evaluation. The expert review includes four requirements, namely construction aspects, content aspects, graphic aspects and language aspects. The expert review that has validated the discovery learning-based e-module developed consists of three lecturers. The results of the validity of discovery learning-based e-modules on Animalia and Ecosystem materials can be seen in Table 1.

Table 1. Results of discovery learning-based e-module validity test

Assessment Aspect	Average (%)	Category
Construction	93.33	Very practical
Content	93.75	Very practical
Graphics	93.75	Very practical
Language	91.67	Very practical
	372.5	
	93.13	Very practical

Based on Table 1, it can be concluded that the developed e-module is assessed based on four aspects of assessment consisting of construction aspects, content aspects, graphic aspects and language aspects. So that based on the analysis, an average value of 93.13% was obtained with a very valid category. According to Astuti & Baysa (2022), the validity test is used to obtain the level of validity and validity of an instrument to test the accuracy between the object data that actually occurs and the data that researchers collect.

Obtained very valid criteria for e-module products show the truth in the aspect of construct substance with

an average value of 93.99% including a very valid category. Very valid criteria were also obtained in the content aspect with an average value of 93.75%. The content aspect is said to be very valid because it meets the criteria of material tailored to the achievement of indicators and discovery learning syntax that can direct students to learn independently. According to Khasinah (2021), discovery learning is believed not to make teacher-centered learning that makes students passive learners.

Judging from the graphic aspect with the average value obtained is 93.75% with very valid criteria. The criteria are very valid because they meet criteria such as the presence of images, videos and animations that can explain related material. According to Mumpuni (2019), the combination of colors and backgrounds that are designed to be comfortable and easy to read in order to produce an attractive appearance so that it can affect reading interest. Furthermore, according to Razak (2022), e-modules are developed by having an attractive appearance where students can be directly active, creative in finding knowledge and understanding in the learning process. This is one of the driving factors in improving students' understanding and learning outcomes in learning.

The language aspect received an average score of 91.67% with very valid criteria. This is because the sentences and language rules used in the e-module are clear, good and in accordance with Indonesian Language Rules so that they do not cause multiple interpretations (ambiguous) and are easily understood by students. The use of communicative language, communicative language is a way of using language in accordance with the communication function of language so that it is easily understood by readers (Yastini et al., 2018). In addition, according to the Indonesian Ministry of Education and Culture (2017), a good e-module should use simple language, easy to understand and express. Based on the research of Najihah, et al (2018) that the e-module deserves to be very good to be used as a learning tool as learning materials for students.

Prototype III Development Results

Improvements from the expert review stage and one to one evaluation resulted in prototype III. Furthermore, a small group evaluation was conducted by six students of SMAN 12 Bungo class X with different ability levels (high, medium and low). The results of practicality in small groups can be seen in Table 2.

Table 2. Practicality test results of e-modules based on discovery learning in small groups (small group evaluation).

Assessment Aspect	Average (%)	Category
Ease of Use	95.24	Very practical
Efficiency of Learning Time	93.75	Very practical
Benefits	97.02	Very practical
	286.01	
	95.34	Very practical

Based on the results of the small group practicality test in Table 2, with an overall average of 95.34% with a very practical category. Based on the convenience aspect, the average value is 95.24% with a very practical category. This shows that the discovery learning-based e-module developed is practical and can be used for large group trials (field test).

Prototype IV Development Results

At the prototype III development stage, there were no revisions and the results of the practicality test showed that the discovery learning-based e-module was very practical so that it could be used for the assessment stage in the field test or large group evaluation.

Assessment Phase

In the assessment phase, the activity carried out is the assessment of e-modules based on discovery learning with a larger sample, in this case using one sample class. The purpose of large group research is to find out and see the extent of the practicality of e-modules based on discovery learning. This research was conducted in an experimental class consisting of 21 students. The aspects seen include ease of use, efficiency of learning time and benefits. The results of the practicality test in large groups (field test) can be seen in Table 3.

Table 3: Results of the Discovery Learning-Based E-Module Practicality Test in Large Groups (Field Test)

Assessment Aspect	Average (%)	Category
Ease of Use	92.10	Very practical
Efficiency of Learning Time	85.50	Very practical
Benefits	85.50	Very practical
	263.1	
	87.72	Very practical

Based on the ease of use aspect, there are no obstacles in using e-modules based on discovery learning. This shows that e-modules are easy to use, because students have been told to read the instructions for using e-modules before using discovery learning-based e-modules. The e-modules were used well and

there were no errors or sudden stops. The presence of e-modules is also supported by the presence of images where the purpose of the image will make students focus on the material and will affect students' understanding of the material. According to Utami (2018), images are very attractive to students, because then students' curiosity about the material is greater.

Based on the efficiency of learning time, this shows that by using e-modules based on discovery learning, students can save learning time, understand learning material faster and students can also take advantage of free time to be able to learn using e-modules. anytime and anywhere easily. According to Sapitri (2017), with the e-module, learning time becomes more efficient and students can learn according to their own learning pace.

In terms of benefits, the use of e-modules as support in the learning process. E-modules based on discovery learning can assist teachers in developing students' learning independence so that students increase their curiosity and support the teacher's role as a facilitator. In line with Rahma (2019), that e-modules can support the teacher's role as a facilitator, reducing the teacher's burden in explaining the material repeatedly, It helps students to learn independently, increases curiosity and makes the learning process more enjoyable. In addition, e-modules based on discovery learning are equipped with videos to help visualize the material so that learning is not boring. Thus it can be concluded that the benefits of discovery learning-based e-modules developed meet the criteria of being very practical.

Results of Practicality of Discovery Learning-Based E-Modules by Teachers

The practicality test was conducted by teachers to see the practicality of e-modules based on discovery learning. This assessment was conducted by a Biology teacher who teaches at SMAN 12 Bungo. The results of the practicality data analysis can be seen in Table 4.

Table 4. Results of Discovery Learning-Based E-Module Practicality Test by Teacher

Assessment Aspect	Average (%)	Category
Ease of Use	100.00	Very practical
Efficiency of Learning Time	75.00	Very practical
Benefits	75.00	Very practical
	250	
	83.33	Very practical

Based on the practicality test conducted by the teacher, the results obtained an average value of 83.33% with a very practical category. Aspects of practicality by Biology teachers consist of ease of use, efficiency of learning time and benefits.

Assessment of Cognitive Competence (Knowledge)

Cognitive learning outcomes in this development research were obtained from the final test in the form of a written test given to the experimental class and control class at the end of the meeting in the learning process. The results of data analysis of students' cognitive domain can be seen in Table 5.

Table 5. Average Results of Cognitive Domain Learning Outcomes of Experimental Class and Control Class Students

Class Number	Total	Average	Description
Experiment	2340	83.57	Completed
Control	1813	72.52	Not Completed

Based on Table 5, the results of product trials show that the average value of learning outcomes in the cognitive domain of experimental class students is higher than the control class. When viewed from the evaluation results of each experimental class and control class, it is known that the experimental class in the cognitive domain with an average of 83.57% and the average value of the cognitive domain of the control class is 72.22%. This shows that the use of e-modules based on discovery learning in the learning process provides positive aspects for improving students' cognitive learning outcomes. E-modules based on discovery learning emphasize students how to understand material concepts independently. According to Khoerunisa (2021), learning independence is one of the factors that will determine student success in learning. Furthermore, the model used is discovery learning, which is learning given to students so that they have scenarios to solve their own problems.

Cognitive knowledge competence is related to memory, thinking ability or intellect. In Bloom's Taxonomy, the revised cognitive domain according to Anderson and Krathwohl (2001), consists of remembering, understanding, applying, analyzing, evaluating and creating. Furthermore, based on research conducted by Ramli (2022), that the use of e-modules in learning effectively improves the ability to understand concepts in learning materials.

Furthermore, to analyze the data, the data was tested with the results of hypothesis testing (t-test). Based on the t-test results, it is known that the value of Asymp. Sig. (2-tailed) of students' knowledge domain competence, namely, $0.000 < 0.05$ which indicates that H0 is rejected and H1 is accepted. So it can be concluded that there are differences in learning outcomes in knowledge competencies between X MIPA 1 students (using e-modules based on discovery learning) and X MIPA 3 (not using e-modules based on discovery learning). So it can be said that there is an effect of using e-modules

based on discovery learning on the learning outcomes of knowledge competencies of X MIPA class students.

Assessment of Affective Competence (Attitude)

Affective domain competency assessment is carried out during the learning process by observer. The results of the analysis of the affective domain of students conducted in the experimental and control classes can be seen in Table 6.

Table 6. Average Affective Domain Learning Outcomes of Experimental and Control Classes.

Class Number	Total	Average	Description
Experiment	2784.09	89,80	Complete
Control	2356.82	87.28	Not completed

The results of the analysis of affective learning outcomes of experimental class students showed an average of 89.80 with an effective category and the learning outcomes of control class students showed an average of 86.28 with an effective category. Based on these categories, it shows that e-modules based on discovery learning have a positive effect on improving the affective learning outcomes (attitudes) of students. the use of e-modules based on discovery learning can familiarize students to behave such as having good spirituality, for example, greeting and praying before starting learning, being disciplined, cooperating and having self-confidence. Aspects of assessment in the affective domain include, spiritual, discipline, cooperation, self-confidence and responsibility. According to the opinion of Saftari and Fajriah (2019), affective abilities are closely related to interests and attitudes that can form responsibility, cooperation, discipline, commitment, confidence, honesty, respect for the opinions of others and the ability to control themselves.

Furthermore, hypothesis testing was carried out using the Mann Whitney test. Based on the results of the affective learning outcomes hypothesis test on students obtained Sig. (2-tailed) 0.03 then 0.094 <0.05 the hypothesis is accepted, meaning that there is a significant difference between the affective learning outcomes of experimental class students and control class students Dimiyati and Mudjiono (20130, divide the affective domain into five categories, namely acceptance, responding, assessment, managing and characteristics. Furthermore, according to the opinion of Saftari and Fajriah (2019), affective abilities are closely related to interests and attitudes that can form responsibility, cooperation, discipline, commitment, confidence, honesty, respect for the opinions of others and the ability to control themselves.

In the stages of learning contained in e-modules based on discovery learning can help students in fostering the scientific attitudes of students and can indirectly train students' attitudes in solving problems, increasing activeness in learning so as to increase interest in learning This is in accordance with the opinion of Margiastuti (2015), in doing scientific work can foster scientific attitudes in students. The variety of scientific attitudes that arise depends on the amount of student involvement in learning. Learner involvement playing an active role in scientific work such as observing, recording and asking questions can support the development of scientific attitudes in students.

Assessment of Psychomotor Competencies (Skills)

Assessment of psychomotor competence was carried out during the learning process by observers. The results of the analysis of students' psychomotor skills during the learning process in the experimental and control classes can be seen in Table 7.

Table 7. Average Assessment of Psychomotor Domain of Experimental and Control Classes

Class Number	Total	Average	Description
Experiment	2789.71	89.99	Very Good
Control	2363.24	87.53	Very Good

The hypothesis result of expertise competency assessment obtained Sig. (2-tailed) 0.072, then 0.072 <0.05. This shows that Ho is rejected and H1 is accepted. The use of e-modules based on discovery learning can be used both individually and in groups so that it can facilitate students in developing their competencies such as questioning activities, discussions to presentations. According to Marpaung (2018), discussion and presentation methods are used to transfer knowledge effectively and efficiently, motivate, foster cooperation, learn to be responsible for data discovery and can create a more enjoyable learning process. This is also in line with research conducted by Wulandari et al. (2021), that the psychomotor domain obtained an increase with good criteria. The discovery learning process is the concept of finding yourself and finding information from various literatures and then conducting observational investigations to collect accurate data.

Conclusion

The discovery learning-based e-module on Animalia and Ecosystem material developed obtained a validity value with a very valid category based on the validator's assessment. The discovery learning-based e-module on Animalia and Ecosystems material developed has a practicality value with a very practical

category based on the assessment of teachers and students of class X MIPA SMA 12 Bungo. The discovery learning-based e-module on Animalia and Ecosystems material developed has effectiveness with the category of very effective based on the assessment of learning outcomes in the cognitive, affective and psychomotor domains. Student learning outcomes in the cognitive, affective and psychomotor domains are significant differences between experimental and control class learning outcomes.

Acknowledgments

During the research the author received a lot of support, guidance, direction and input from various parties, so on this occasion the author would like to thank the lecturers of the Biology Education Postgraduate Program at Padang State University. Furthermore, to the Principal and Teachers of SMAN 12 Bungo who have given the opportunity and permission to carry out this research.

Author Contributions

This research involved contributions from various authors for several aspects, namely aspects of conceptualization, methodology, software, validation, investigation, resources, data curation, writing, and obtaining funds. The conceptualization, methodology, data curation, and supervision aspects involved all authors in this article, namely Moralita Chatri, Tita Yunia Zalni, Irdawati, Suci Fajrina. Meanwhile, the software and validation aspects involved contributions by Tita Yunia Zalni, Irdawati, Suci Fajrina, and Abdurahman; the investigation aspect, Tita Yunia Zalni; Resources: Class X students and teachers of SMAN 12 Bungo; initial script writing, Tita Yunia Zalni; supervision, Moralita Chatri; acquisition of funds.

Funding

This research received no external funding or was self-funded by the authors.

Conflict of Interest

The authors declare no conflict of interest. The authors confirm that no circumstances or personal interests of any kind have influenced the representation or interpretation of the reported research results.

References

- Abidin, Y. (2018). *Pembelajaran Multi Literasi*. Jakarta: Refika Aditama.
- Akbar, A., & Razak A. (2019). Pengembangan Modul Berbasis PBL (Problem Based Learning pada Materi perubahan Lingkungan dan Ekosistem Siswa Kelas X SMAN 1 Singkarak. *Jurnal Sains dan Tinggi Internasional*, 15(2), 46-52. <https://doi.org/10.53565/pssa.v6i1.129>
- Amalia, K., & Hidayat, S. (2021). Analisis Kemandirian Belajar Menggunakan Model Discovery Learning dalam Pembelajaran Jarak Jauh. *Jurnal Ilmiah Pendidikan Guru*, 8(3), 621-631. <https://doi.org/10.17509/pedadidaktika.v8i3.39231>
- Anderson, L., & Krathwohl, D. (2021). *A Taxonomy for Learning, Teaching, and Assesing: A Revision of Bloom's Taxonomy of Educatioanl Objectives*. New York: Addison Wesley Longman, Inc.
- Arafah, A., Moralita, C., Razak, A., & Violita. (2023). Development of Problem-Based Learning-Based E-Modules Using Adobe Flash Profesional CS6. *Jurnal Penelitian Pendidikan IPA*, 9(1), 525-532. <https://doi.org/10.29303/jppipa.v9i1.2332>
- Astuti, E., Baysa, M., & Resnandari, E. (2022). Validasi Media Pop-Up Book Materi Mengenal Anatomi Tubuh Manusia pada Pembelajaran IPA Kelas VII SMP. *Jurnal Lentera Pendidikan Indonesia*, Volume 3(3), 294-301. <https://doi.org/10.36312/lpi.v3i3.93>
- Culture, I. M. (2017). *Panduan Praktis Penyusunan E-Modul Pembelajaran*. Jakarta: Kemendikbud.
- Dimiyati, & Mudjiono. (2013). *Belajar dan Pembelajaran*. Jakarta: Rineka Cipta.
- Kasinah, S. (2021). Discovery Learning: Defenisi Sintaks, Keunggulan dan Kelemahan. *Jurnal MUDARRISUNA: Media Pendidikan Agama Islam*, 11(3), 2089-5127. <https://doi.org/10.22373/jm.v11i3.5821>
- Kemendikbud. (2017). *Panduan Praktis Penyusunan E-Modul*. Jakarta: Kemendikbud.
- Magdalena, I. (2020). Analisis Pengembangan Bahan Ajar. *Jurnal Pendidikand dan Ilmu Sosial*, 2(2), 170-187. Retrieved from <https://ejournal.stitpn.ac.id/index.php/nusantara/article/view/805>
- Maharani, F., & Yerimadesi. (2022). Pengembangan E-Modul Sistem Koloid Berbasis Guided Discovery Learning Untuk Siswa Kelas XI SMA. *Jurnal Edukimia*, 4(2), 048-053. <https://doi.org/10.24036/ekj.v4.i2.a351>
- Margiastuti, S. N., Parmin, & Pamelasari, S. D. (2015). Penerapan Model Guided Inquiry Terhadap Sikap Ilmiah dan Pemahaman Konsep Peserta Didik pada Tema Ekosistem. *Unnes Science Education Journal*, 4(3), 1041-1048. <https://doi.org/10.15294/usej.v4i3.8859>
- Marpaung, D. (2018). Penerapan Metode Diskusi dan Presentasi Untuk Meningkatkan Minat dan Hasil Belajar Siswa di Kelas XI IPS-1 SMA Negeri 1 Bagan Sinembah. *School Education Journal*, 8(4), 360-368. <https://doi.org/10.24114/sejpsgd.v8i4.11375>
- Najihah, A. R., Serevina, V., & Delina, M. (2018). Development of Heat and Temperature E-Module Based on Discovery Learning for Secondary Students. *Journal of Physics*, 11(70), 1742-6596.

- <https://doi.org/10.1088/1742-6596/1170/1/012029>
- Plomp, T., & Nieveen, T. (2013). *Educational Design Research*. Enschede the Netherlands: SLO: Universitas Twente.
- Putri, R. A., Fitri, R., Arsih, F., & Yogica, R. (2022). Pengembangan E-Module Interaktif Tentang Materi Sistem Sirkulasi untuk Peserta Didik Kelas XI SMA. *Journal on Teacher Education*, 3(3), 107-114. <https://doi.org/10.31004/jote.v3i3.4478>
- Ramli. (2022). Development of Discovery Learning Based E-Modules to Improve Concept Undersanding Ability in Flat Building Materials. *Indoensian Journal of Multidisciplinary Science*, 1(10), 1272-1287. <https://doi.org/10.55324/ijoms.v1i10.200>
- Razak, A., Solichin, M., Lufri, & Irdawati. (2022). Validitas dan Kepraktisan 3D Page Flip Professional Assisted Mobile Learning Berbasis E-Modul Pada Materi Ekologi dan Perubahan Lingkungan. *Jurnal Penelitian Pendidikan IPA*, 8(6), 3034-3043. <https://doi.org/10.29303/jppipa.v8i6.2467>
- Ritonga, M. (2020). *Learning From Home (LFH) dan Kerinduan yang Mendalam*. Yogyakarta: Cv: Markumi.
- Saftari, M., & Fajriah, N. (2019). Penilaian Ranah Afektif Dalam Bentuk Penilaian Skala Sikap Untuk Menilai Hasil Belajar. *Jurnal Ilmu Pendidikan dan Kependidikan*, 7(1), 71-81. <https://doi.org/10.35438/e.v7i1.164>
- Sapitri, D., Ardi, & Leilani, I. (2017). Pengembangan Modul Berbasis Pendekatan Saintifik Disertai Glosarium Tentang Materi Sistem Eksresi Pada Manusia Untuk Peserta Didik Kelas VIII. *Journal Biosains*, 1(2), 183-190. Retrieved from <https://ejournal.unp.ac.id/students/index.php/bio/issue/download/355/48>
- Satriawati, H., & Haryanto. (2016). Pengembangan E-Modul Interaktif Sebagai Sumber Belajar Elektronika Dasar Kelas X SMKN 3 Yogyakarta. *E-Journal Universitas Negeri Yogyakarta*, 6(3), 188-196. Retrived from <https://journal.student.uny.ac.id/ojs/index.php/mekatronika/article/download/2691/pdf>
- Tampubolon, D. (2017). Students Perception on the Discovery Learning Strategy on Learning Reading Comprehension at the English Teaching Study Program Christian University of Indonesia. *Journal of English Teaching*, 3(1), 43-54. <https://doi.org/10.33541/jet.v3i1.698>
- Utami, S. (2018). Penggunaan Media Gambar Untuk Meningkatkan Motivasi dan Hasil Belajar IPA Siswa Kelas III Sekolah Dasar. *Jurnal Primary Program Studi Pendidikan Guru Sekolah Dasar Fakultas Keguruan dan Ilmu Pendidikan Universitas Riau*, 7(1), 137-148. <https://doi.org/10.33578/jpfkip.v7i1.5346>
- Wahyuningtyas, R., & Sulasmono, B. S. (2020). Pentingnya Media Dalam Pembelajaran Gunna Meningkatkan Hasil Belajar di Sekolah Dasar. *Jurnal Basicedu*, 2(1), 23-27. <https://doi.org/10.31004/edukatif.v2i1.77>
- Wulandari, F., Yogica, R., & Darussyamsu, R. (2021). Analisis Manfaat Penggunaan E-Modul Interaktif Sebagai Media Pembelajaran Jarak Jauh di Masa Pandemi Covid-19. *Jurnal Ilmiah Kependidikan*, 15((2)), 139-144. <https://doi.org/10.30595/jkp.v15i2.10809>
- Yastini, Y. N., Nurdian, A. R., & Wikanengsih. (2018). Kemampuan Penggunaan Bahasa Baku Mahasiswa Program Studi Bahasa Indonesia IKIP Siliwangi di Media Sosial Instgram. *Jurnal Pendidikan Bahasa dan Sastra Indonesia*, 1(5), 659-644. Retrieved from <https://www.journal.ikipsiliwangi.ac.id/index.php/parole/article/view/818>
- Zinnurain. (2021). Pengembangan E-Modul Pembelajaran Interaktif Berbasis Flip PDF Corporate Editon Pada Mata Kuliah Manajemen Diklat. *Jurnal Inovasi Riset Akademik*, 1(1), 132-139. <https://doi.org/10.51878/academia.v1i1.546>