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# Development of E-Modules Based on Discovery Learning to Improve Science Process Skills on The Material of Interactions Between Living Things

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**Abstract:** The type of research used is R&D (Research and Development). Research and Development. The development model used is the ADDIE model (Analysis, Design, Development, Implementation and Evaluations). The research sample involved 132 students consisting of 66 students each at MTSN Filiah and MTS N Sukoharjo. The characteristics of E-Modules are simple, interactive, and communicative. In addition, Emodul has been integrated with the discovery learning model that can encourage students' science process skills. The discovery-based E-Module developed is considered feasible to be used as learning media to improve students' science process skills. This can be seen from the average value of the percentage of eligibility acquisition on Discovery learning-based E-Modules ranging from 0.71% with a moderate category. Discovery-based E-Modules have a high level of effectiveness where the results of the analysis show that the significance value of Sig.2-tailed (0.00) <0.05, indicating a significant difference between pretests and postsets. This shows that there is a significant difference in effect with E-modules based on discovery learning between pretest and posttest.

**Keywords:** Discovery Learning; E-Module; Science Process Skills

## Introduction

In essence, science consists of four main elements, namely attitudes, processes, products, and applications which are the characteristics of science that are intact and cannot be separated from one another (Puskur, 2006). The nature of Natural Science (IPA) is also the meaning of nature and various phenomena, behaviors and characteristics that are packaged into a theory or concept through a series of scientific processes carried out by humans. Through these theories and concepts can make an inspiration for the creation of technology that can be utilized in human life, (Mariana, 2009). In essence, science is built on the basis of scientific products, scientific processes, and scientific attitudes (Trianto, 2010). The same thing was stated by Patta Bundu (2006) that science broadly has 3 dimensions, namely; (1) science as a process; (2) science as a product; (3) science as a scientific attitude.

The scientific process is a scientific activity carried out in order to find scientific products. The scientific process includes observing, classifying, predicting, designing, and conducting experiments. This scientific process is called Science Process Skills (KPS). Scientific products include principles, concepts, laws, and theories. Scientific products are natural knowledge that has been discovered. In the context of science learning at school, this scientific product is in the form of science learning outcomes achieved by students. Scientific attitude is a belief in the value that must be maintained when seeking new knowledge. The dimensions and indicators of scientific attitudes include: an inquisitive

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attitude, respect for data and facts, critical thinking, creativity, open-mindedness and cooperation, diligence and sensitivity to the surrounding environment.

Science learning is closely related to the achievement of students' science process skills. (Ibrahim, 2010) states that if someone has mastered process skills then that person has mastered the skills needed in higher-level learning, namely conducting research and solving problems. Science process skills are an important component that students must master in learning science.

Science process skills involve intellectual, manual, and social skills that are used to build understanding of a concept or knowledge and convince or perfect the understanding that has been formed (Moedjiono, 2002). Furthermore, Rustaman (2017) states that science process skills are an approach that involves cognitive or intellectual, manual and social skills. The indicators of science process skills according to Rustam (2005) are; (1) Observation, (2) Classification, (3) Interpretation or interpreting, (4) Prediction, (5) Asking questions, (6) Hypothesis

Based on preliminary observations made to teachers and students in the Ex-Karesidenan Surakarta area, several schools were sampled: SMPN 1 Surakarta, SMP Muhammadiyah 04 Sambi, SMP Islam Bakti Surakarta, SMP Muhammadiyah 2 Kartasura, MTSn 1 Sukoharjo, and SMPN 10 Surakarta found that the students' science process skills are still low while science process skills are very important for students. This is explained in research (Mamad & Pratomo, 2012) mentioning several reasons that underlie the need for process skills to be applied in learning, namely: (1) The development of science is increasingly rapid, whose impact can affect the teaching process of teachers and learning students; (2) Learning starts from easy things to complex things, learning materials delivered by teachers in the form of concepts, facts, principles, rules and problems; (3) Scientific knowledge is not absolute truth; (4) The learning process is inseparable from the development of attitudes and values in students. This is because science process skills are skills that individuals have in obtaining and developing discoveries, developing facts and concepts and fostering their values. Science process skills are important for each learner in the learning process.

However, the problem for the world of education today is related to the quality of education, especially the quality of science process skills which is very low. This is because learning emphasizes mastery of material concepts only, but is not directed at developing students' scientific skills and attitudes so that the overall goal of education can be achieved. This causes students to find it difficult if they want to learn more about science, and teachers will also take the easiest way, namely informing facts and concepts through the lecture method because they have to pursue curriculum requirements. As a result, students only have a lot of knowledge at their disposal. The education system positions teachers as an important component in efforts to improve the quality of education, especially in the learning process.

At the end of 2019, the world was shocked by an incident that made many people nervous about the corona virus (covid-19). The policy taken by the government in the education sector to reduce the rampant spread of this virus is to close all learning activities in schools (Rizqon, 2020). The closure of schools in various countries including Indonesia and the transition of the learning model from face-to-face to online in an effort to prevent the spread of the covid-19 virus is certainly a major task for the world of education. The implementation of online learning raises various problems, both faced by teachers and students themselves. Technological limitations are the main obstacle for the online learning process.

When conducting online learning, the use of technology is very important for the learning process, especially the media used. The use of learning media encourages learners' involvement in the learning process. The involvement of learners in the learning process will encourage a positive attitude towards learning content or material (Pribadi, 2017). The media platform used by teachers tends to be less attractive to students, this can be seen through the scores produced by students. The media platform alone is not enough to be used by teachers. The combination of using interesting media and interesting e-modules is considered appropriate to be used by teachers during learning so that students remain active in learning.

Learning using Google Sites provides benefits for teachers and students, for example, making learning more interesting because it can utilize features in google sites such as google docs, sheets, forms and others. Then it makes it easier to get subject matter because students and teachers do not need to use a flashdisk that can cause viruses on the computer because they only access the material through the available links (Azis, 2019). In addition, subject matter that has been uploaded to Google Sites will remain on Google Sites and will not be affected by virus interference because it is already under Google's responsibility. Google sites can be used as an alternative to media

The discovery learning model is the discovery learning model. The discovery learning model provides more opportunities for students to become a researcher/ scientist through systematic stages of scientific inquiry. Discovery occurs when individuals engage primarily in the use of their mental processes to discover some concepts and principles. Discovery is done through observation, classification, measurement, prediction,

determination, and inference. This is in line with (Hosman, 2014) stating that the discovery learning model makes students more active in learning, because the knowledge and skills acquired by students are not the result of remembering facts, but the result of finding themselves. The increase was also conveyed by (Ayuhans, 2018) in his research the value of students' initial process skills based on the pre-test results obtained an average of 21 with an incompleteness rate of 100%, while after applying the discovery learning model of students' science process skills from the post-test values obtained an average science process skills value of 70 with a completeness of 87%.

The observation results can be said that 88.9% of learning is carried out online. Some of the platforms used by teachers in carrying out learning include using whattsapp groups, google meet, zoom meetings, youtube, classroom, quizizz, iam teacher. From the data, it is found that the platforms that are usually used have limitations. These limitations include; Technology limitations by students and teachers by 33.3%, Requires a large signal so that students can join the platform (in order to participate in learning) 66.7%, then there are also features provided in the platform limited to 44.4%, so that in exploring students' abilities or student skills, especially in the science process, are limited 66.7%, because students cannot explore, it has an impact on communication or students are not interested in the learning process (inactive students) by 66.7%.

Observations were also made not only on teachers but also on students. Based on student data, 85.7% of students stated that they felt online learning on the material of interactions between living things, and 71.4% of students stated that while using learning media had several obstacles or limitations, the obstacles or limitations felt by students included: 28.6% of students found it difficult to communicate with friends about learning, 57.1% of students answered that the material delivered by the teacher was more difficult to understand, so 71.4% of students stated that the teacher's explanation could not be received optimally, which resulted in 14.3% of students' scores decreasing.

Interviews were also conducted with several teachers, in dealing with these obstacles, several breakthroughs or several ways are needed, including: the provision of emodules, the use of emodules and lks in each material that can be easily accessed by students. Providing adequate facilities such as networks or the internet to students or teachers who are in remote places, using various platforms according to the learning objectives to be achieved and not limited to just one platform, interactive learning media is needed which is supported by learning media that is easily accessible and applied online. 87.5% of teachers agreed to create e-modules as learning media to improve science process skills. 85.7% of students agreed to create discovery learning-based e-modules as their learning media. The development of this e-module is expected to improve students' science process skills.

The results of the observation were added by observing some conditions and obstacles in the field and strengthened by the existence of previous studies regarding e-module learning that can improve students' science process skills, this aspect made the basis for researchers to develop e-modules with discovery learning to improve students' science process skills. This research is expected to minimize the obstacles encountered in the field regarding online learning, so that with the creation of e-modules educators can still improve students' science process skills.

## Method

The type of research used is R&D (Research and Development). Research and Development. The development model used is the ADDIE model (Analysis, Design, Development, Implementation and Evaluations) the choice of this model is based on the consideration that this model was developed systematically and rests on the theoretical basis of learning design. This model is structured programmatically with a systematic sequence of activities in an effort to solve learning problems related to learning resources that are in accordance with the needs and characteristics of students.

Expert validation is used to determine the content validity of the instrument. In this study, content validity was determined using the Aiken formula shown in the equation:

$$V = S/[n*(c-1)] \text{ dimana } S = \Sigma\, n_i\, (r-l_o) \quad (1)$$

The following module assessment criteria are disclosed.

**Table 1.** Assessment Categories

| Assessment Result Score Interval | Category |
|---|---|
| Mi + 1.5 Sbi < X | Very good |
| Mi + 0.5 Sbi < X < Mi + 1.5 Sbi | Good |
| Mi – 0.5 Sbi < X < Mi + 0.5 Sbi | Simply |
| Mi – 1.5 Sbi < X < Mi – 0.5 Sbi | Less |
| X < Mi – 1.5 Sbi | Very Less |

Description:
X = Respondent score
Mi = Ideal mean
Sbi = Ideal standard deviation
Mi =1/2 (ideal maximum score + ideal minimum score)
Sbi = 1/6 (ideal maximum score - ideal minimum score)

Analysis of the effectiveness of the module is calculated by obtaining the NGain score. The following are the Ngain Score criteria, which are as follows: N-Gain score assessment criteria can be seen in Table 2.

**Table 2.** Score Acquisition Category Criteria

| Limitations | Category |
|---|---|
| g>0.7 | High |
| 0.3≤ $g$ ≤ 0.7 | Medium |
| g < 0.3 | Low |

## Result and Discussion

*Analysis*

Literature study was conducted at MTSN Filiah Surakarta and MTSN 1 Sukoharjo. At the literature study stage, researchers reviewed and studied literature reviews and theories that could support research on the development of Discovery Learning-Based E-Modules to obtain a plan for developing learning media that functioned properly. Analysis of teaching materials at school shows that teachers only use teaching media in the form of modules from the Ministry of Education and Culture which are loaned to each student as a handbook. Preliminary studies were conducted at MTS Negeri Filliah Kartosuro and MTS N 1 Sukoharjo to determine science process skills (KPS). In the preliminary study, several stages were carried out, including; 1) initial results test of students' critical thinking skills, 2) observation, 3) interviews with science teachers.

The results of interviews with science teachers and students of SMP Negeri 26 Surakarta show that teachers and students want problem-based learning, learning with interactive media such as E-Modules that allow students to improve their science process skills (KPS). Based on the results of the needs analysis, it can be concluded that teachers want a digital-based learning transformation that can improve students' science process skills or active learning-based learning.

*Design*

At this stage the researcher determines the format selection. Determining the font, font size, and animation and images that will be used in providing stimulus to students that can encourage the improvement of students' science process skills.

*Develop*

The activities carried out at the product design stage include; a) Analysis stage which focuses on the target to be addressed. b) Preparation of material on interactions between living things that will be presented in the e-module. c) Collecting or preparing teaching materials such as images, videos, animations related to material on interactions between living things that will be included in the e-module. d) Developing an initial design in the form of a draft e-module framework on the material of interactions between living things. d) Developing an initial design in the form of a draft e-module framework on the material of interactions between living things. e) Developing an e-module validation instrument which includes determining the theory used, grids, and compiling a list of questions for expert validation and student assessment. f) Developing an observation sheet instrument to observe the implementation of using the applied e-module, observation includes activities to determine the theory used, preparing a grid, and a list of learning criteria.

Initial product development was carried out based on the characteristics of e-modules and paying attention to the discovery learning syntax grids through activities in the e-modules that allow students to use science process skills. The front view of the discovery learning-based E-Module consists of the title of the E-Module, the objective material, and the next symbol to continue on the next page. The front view of the discoveruy-based E-Module can be seen in Figure 1.

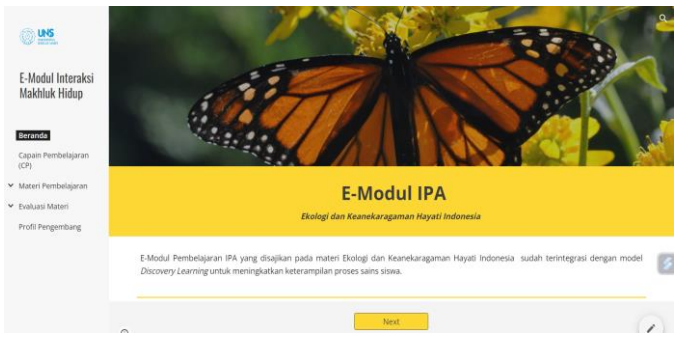


**Figure 1.** Front View

The learning outcomes display consists of a menu of learning outcomes (CP), learning objectives (TP), and Flow of Learning Objectives (ATP) and several buttons (Next, Home, Back). Seen in Figure 2.

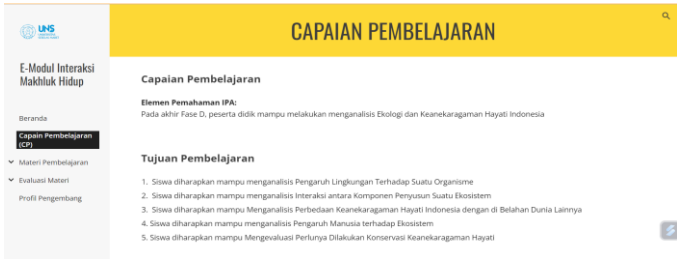


**Figure 2.** Learning Outcomes

The learning material menu consists of several menus which include the following: (1) material 1: the influence of the environment on an organism; (2) material 2: interactions between the components that make up the ecosystem; (3) differences in Indonesian

biodiversity; (4) human influence on the ecosystem; (5) glossary. Seen in Figure 3.

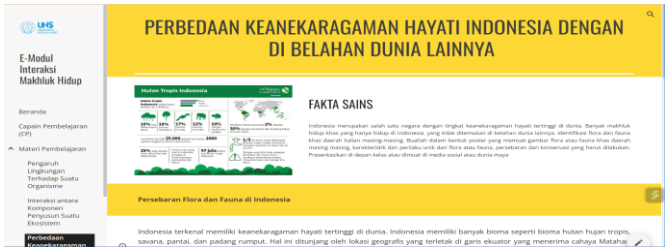


**Figure 3.** Learning Materials

On the display of the material evaluation menu consists of some information related to the profile of the discovery learning-based E-Module developer to improve students' science process skills. Seen in Figure 4.

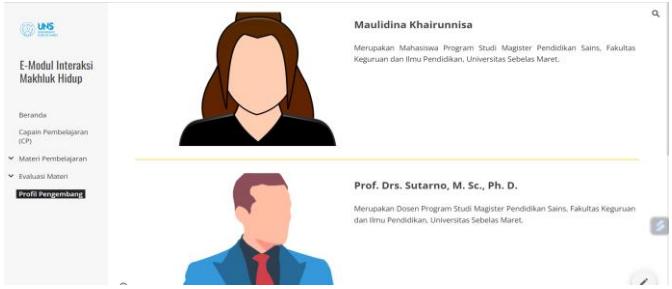


**Figure 4**. Developer Profile

*Implementation*

Expert validation is used to determine the validity of the instrument content involving 5 validators consisting of media experts, material experts, language experts, and learning experts. The results of the validation of the Discovery learning-based E-Module are as follows (Table 4).

**Table 4.4.** Average Value of E-Module Validity

| Aspects assessed | Percentage | Description |
|---|---|---|
| Media | 0.73 | Medium |
| Material | 0.69 | Medium |
| Language | 0.78 | Medium |
| Learning | 0.62 | Medium |
| Total | 0.71 | Medium |

The results of product design validation show that the average percentage value of feasibility acquisition on Discovery learning-based E-Modules is around 0.71% with a moderate category. This shows that the discovery learning-based E-Module developed is feasible to use in learning to improve students' science process skills. The following are the results of the recapitulation of the expert assessment analysis based on all items which are then analyzed with the Aikens' validity index. The validation results for all items can be seen in the table, which is as follows:

**Table 5.** Item Validity of Dicovery Learning-based E-Module

| Item | Media | | Material | | Learning | | Language | |
|---|---|---|---|---|---|---|---|---|
| | V | Description | V | Description | V | Description | V | Description |
| 1. | 0.80 | Mediuam | 0.80 | Mediuam | 0.80 | High | 0.95 | High |
| 2. | 0.80 | Mediuam | 0.80 | Mediuam | 0.45 | High | 0.95 | High |
| 3. | 0.45 | Mediuam | 0.70 | Mediuam | 0.60 | Mediuam | 0.80 | Mediuamlo |
| 4. | 0.40 | Low | 0.75 | Mediuam | 0.50 | Mediuam | 0.85 | High |
| 5. | 0.75 | Mediuam | 0.70 | Mediuam | 0.70 | Mediuam | 0.65 | Mediuam |
| 6. | 0.85 | High | 0.75 | Mediuam | 0.50 | Mediuam | 0.75 | Mediuam |
| 7. | 0.70 | Mediuam | 0.60 | Mediuam | 0.70 | Mediuam | 0.75 | Mediuam |
| 8. | 0.90 | High | 0.70 | Mediuam | 0.70 | Mediuam | 0.70 | Mediuam |
| 9. | 0.85 | High | 0.55 | Mediuam | 0.50 | Mediuam | 0.80 | Mediuam |
| 10. | 0.90 | High | 0.75 | Mediuam | 0.95 | High | 0.80 | Mediuam |
| 11. | 0.75 | Mediuam | 0.75 | Mediuam | 0.90 | High | 0.70 | Mediuam |
| 12. | 1.00 | High | 0.60 | Mediuam | 0.50 | Mediuam | 0.70 | Mediuam |
| 13. | 0.70 | Mediuam | 0.55 | Mediuam | 0.60 | Mediuam | | Mediuam |
| 14. | 1.00 | High | 0.70 | Mediuam | 0.60 | Mediuam | | |
| 15. | 1.00 | High | 0.65 | Mediuam | 0.75 | Mediuam | | |
| 16. | 0.70 | Mediuam | 0.70 | Mediuam | 0.65 | Mediuam | | |
| 17. | 0.50 | Mediuam | 0.75 | Mediuam | 0.65 | Mediuam | | |
| 18. | 0.85 | High | 0.95 | High | 0.55 | Mediuam | | |
| 19. | 0.50 | Mediuam | 0.65 | Mediuam | 0.60 | Mediuam | | |
| 20. | 0.45 | Mediuam | 0.65 | Mediuam | 0.85 | High | | |
| 21. | | | 0.75 | Mediuam | 0.50 | Mediuam | | |
| 22. | | | 0.55 | Mediuam | 0.50 | Mediuam | | |
| 23. | | | 0.65 | Mediuam | 0.50 | Mediuam | | |
| 24. | | | 0.60 | Mediuam | 0.50 | Mediuam | | |
| 25. | | | 0.60 | Mediuam | 0.70 | Mediuam | | |

| Item | Media | | Material | | Learning | | Language | |
|---|---|---|---|---|---|---|---|---|
| | V | Description | V | Description | V | Description | V | Description |
| 26. | | | | | 0.55 | Mediuam | | |
| 27. | | | | | 0.60 | Mediuam | | |
| 28. | | | | | 0.55 | Mediuam | | |
| 29. | | | | | 0.60 | Mediuam | | |

The results of the feasibility test of e-modules based on discovery learning with 5 validators obtained revisions to several aspects from validator 5 which included revision of fonts on E-MODUL, symbol consistency, and font size. Suggestions and input by validators become a basic reference in improving and perfecting discovery learning-based E-Modules to improve students' science process skills.

The limited scale test was conducted by involving 2 classes consisting of 33 students of the experimental class of MTS Negeri Filliah Kartosuro and 33 students of the experimental class of MTS N 1 Sukoharjo to determine the science process skills of students as well as to test the validity of the items and the index of difficulty of the items. In the limited scale test, the initial KPS skills test, differentiation, question difficulty index, reliability test, normality and homogeneity test were carried out. The science process skills assessment instrument was analyzed using the Rasch model. The following are the results of the Rasch model analysis, shown in Table 6.

**Table 6.** Pearson Unidimensionality

| Psychometric Attributes | Value |
|---|---|
| Raw variance explained by | 47.5% |
| measures | 52.5% |
| Unexplained variance | 0.84 |
| Cronbach's alpha | |
| Person reliability | 0.83 |
| Person separation | 2.20 |
| Item reliability | 0.84 |
| Item separation | 2.32 |

Unidimensionality of the instrument is considered very good if the raw variance is more than 40%, as shown in Table 4.6 the result is 47.5%. The person reliability value is 0.83 and the item reliability is 0.84. This shows that the consistency in answering the questions is good and the quality of the items on the Science Process Skills (KPS) instrument has a good reliability aspect. In addition, the Cronbach's alpha value of 0.84 is included in the very good category, meaning that the KPS question instrument can be relied upon to distinguish a person's ability well. The person separation index is 2.20 and the item separation index is 2.32, this value indicates the overall quality of the instrument is good because it can identify the respondent group and the item difficulty group.

Item fit explains whether the items function normally in making measurements or not. According to Boone et al., (2014) to see the suitability of the items can be reviewed from several criteria as follows:

a. Accepted outfit menas-square (MNSQ) value: 0.5 < MNSQ < 1.
b. Accepted z-standardized outfit (ZSTD) values: -2.0< ZSTD < +2.0
c. Accepted point measure correlation (Pt Measurre Corr) value:0.4 < *Pt Measure Corr* < 0.85 (Boone et al., 2014).

The suitability of the science process skills (KPS) instrument items is presented in Table 4.3. which is as follows (Table 7).

**Table 7**. Item Fit

| MNSQ | ZSTD | Pt Measure Corr |
|---|---|---|
| 0.80 | -1.3 | 0.89 |
| 0.90 | -0.3 | 0.90 |
| 0.89 | -0.6 | 0.79 |
| 0.92 | -.04 | 0.87 |
| 1.17 | 1.1 | 0.67 |
| 1.24 | 1.5 | 0.45 |
| 1.18 | 1.1 | 0.54 |
| 1.03 | 0.2 | 0.70 |
| 0.88 | -0.7 | 0.85 |

In Table 7, it can be seen that some items do not meet the requirements for Outfit MNSQ and Pt Measure Corr but for Outfit ZSTD the value is still within the allowed criteria. There are no items that do not meet all three criteria at once. Therefore, these items do not need to be changed and can be used for measuring the understanding of students' science process skills.

In the broad scale test, learning was carried out with E-MODUL based on discovery learning to determine students' process skills before and after learning. In the broad-scale product trial, paired sample T-Test analysis was conducted. The results of the analysis can be seen in Table 8.

**Table 8.** Paired Sample T-Test Analysis Results

| School | Class | Pretest | Description | Postest | Mean Description | Sig. (2-tailed) |
|---|---|---|---|---|---|---|
| MTS N 1 Filliah | Eksperiment | 56.82 | Medium | 83.82 | High | 0.000 |
| | Control | 37.12 | Low | 50.76 | Medium | |
| MTS N 1 Sukoharjo | Eksperiment | 58.56 | Mediuam | 86.97 | High | |
| | Control | 54.47 | Mediuam | 65.98 | Medium | |

The results of the analysis showed a significance value (Sig.2-tailed) <0.05, indicating a significant difference between pretests and postets. This shows that there is a significant difference in effect with discovery learning-based E-modules between pretest and posttest. The discovery-based E-Module developed has characteristics namely; (1) simple, interactive, and communicative; (2) integrated with the discovery learning model; (3) equipped with HOTS-based questions to improve students' science process skills. 4) Easy to access by teachers and students. In addition, the model: (1) Improve cognitive process skills; (2) Strengthen understanding, memory and transfer; (3) Direct their own learning activities by involving their minds for motivation; (4) Eliminate skepticism (doubt); (5) Strengthen their self-concept; (6) Students and teachers play an equally active role in issuing ideas; (7) Students will understand basic concepts and ideas better; (8) Develop memory and transfer to new learning process situations; (9) Encourage students to think and work on their own initiative and; (10) the learning process situation becomes more active (Huda, 2014).

The developed e-module is also equipped with video, audio, animation, and images that can trigger student stimulus. According to (Moreno, 2006) the use of media in learning can affect learners' understanding, retention, and engagement. Learning media needs to be designed with attention to cognitive and affective aspects can help create a more effective and interesting learning experience. Research results from (Nugraha et al., 2017) shows that problem-based learning can encourage the improvement of students' learning outcomes and science process skills. According to (Suyatman et al., 2021) encouraging students to think at a higher level. In line with the orientation of learning in the 21st century which emphasizes high-level skills (Afandi et al., 2019, 2018; Krathwohl, 2002). 21st century learning emphasizes problem-solving skills (DeHaan, 2009; Holbrook & Rannikmae, 2009; Khishfe, 2012), critical thinking skills (Astalini et al., 2023; Khishfe, 2012; Noris, M., Saputro, S., 2021; Plotnikova & Strukov, 2019), collaborative skills (Nungu et al., 2023; Pattipeilohy & Wijaya, 2020; Siew & Ahmad, 2023) and creative and innovative abilities (Avcı & Yildiz Durak, 2023; Wirayuda et al., 2022).

The advantages of learning using E-Module make it easier for teachers and students to read through laptops/android, equipped with interesting features such as animation, video, images, and audio visual. In addition, E-Module is an interactive media that can foster students' interest in learning (Husna et al., 2021; Noris et al., 2023; Zakiyah & Sudarmin, 2022). The E-Module links that can be accessed by teachers and students are as follows: https://sites.google.com/view/e-modulinteraksimakhlukhidup/beranda The E-module presents Indonesian ecology and biodiversity material that has been integrated with the discovery learning model. The E-module component developed consists of 1) Front view. 2) Learning outcomes (CP), Learning Objectives (TP), and Flow of Learning Objectives (ATP). 3) Learning material. 4) Evaluation Material consisting of pretest and posttest. 5) Developer Profile. The discovery-based E-MODUL is designed to improve students' science process skills (KPS) indicators.

In addition, the discovery-based E-Module developed received positive responses from validators, teachers and students. This shows that discovery-based e-modules can be used as learning media in improving students' science process skills. Integrating the Discovery learning model encourages active learning, focuses on the process, and involves students in self-reflection (Cindiawati & Hidajat, 2022). Active learning is designed to liven up the classroom with a fun learning atmosphere that involves students' physical movements (Fajar & Habibbulloh, 2021; Tangahu et al., 2024; Yerimadesi et al., 2019). This physical involvement will increase participation which in turn will improve student learning outcomes. In addition, the use of discovery-based E-Modules triggers students to solve more complex problems (Ali et al., 2024; Amir et al., 2024; Tangahu et al., 2024).

In addition, the results of the analysis showed that the significance value of Sig.2-tailed (0.00) <0.05, indicating a significant difference between pretests and postets. This shows that there is a significant difference in effect with E-module based on discovery learning between pretest and posttest. When viewed from the mean value, there is a significant difference before and after learning with E-MODUL based on discobery learning. This shows that there is a significant difference between pretest and postest in terms of probability value <0.05%.

*Evaluate*

Based on the results of the e-module development, it received good responses from validators and science teachers. Then suggestions and input become the basic reference for researchers in making improvements to e-modules based on discovery learning. Based on the results of the analysis of the effectiveness of using e-modules in improving students' science process skills, it shows that e-modules can be used as an effective learning media in improving students' science process skills.

## Conclusion

The characteristics of E-Modules are simple, interactive, and communicative. In addition, Emodul has been integrated with the discovery learning model that can encourage students' science process skills. The discovery-based E-Module developed is considered feasible to be used as learning media to improve students' science process skills. This can be seen from the average value of the percentage of eligibility acquisition on Discovery learning-based E-Modules ranging from 0.71% with a moderate category. Discovery-based E-Modules have a high level of effectiveness where the results of the analysis show that the significance value of Sig.2-tailed (0.00) <0.05, indicating a significant difference between pretests and postsets. This shows that there is a significant difference in effect with E-modules based on discovery learning between pretest and posttest.

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**Conflicts of Interest**
The authors declare no conflict of interest.

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