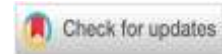




## Development of biology e-modules on environmental change integrated with wahdatul ulum



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### Article Info

### ABSTRACT

#### Article History:

Received 11 March 2025

Revised 22 March 2025

Accepted 08 April 2025

Published 30 April 2025

#### Keywords:

Biology E-Modules

Environmental Change

Wahdatul Ulum



This study aims to develop teaching materials in the form of biology E-Modules on environmental change materials integrated with Wahdatul Ulum in class X SMA/MA, which are valid, practical, and effective with the Four-D model, which includes the stages of defining, designing, developing, and disseminating. The research was conducted on class X-A students at MAN 2 Model Medan. The types of data used are quantitative and qualitative. Quantitative data were obtained through validation test sheets, practicality test sheets, and effectiveness test sheets. Meanwhile, qualitative data was obtained through suggestions and criticisms from validators and educators. Data collection instruments were carried out by observation, validity test, practicality test, and effectiveness test. The results of this study illustrate that (1) A score of 90,38% (Very Valid) was obtained on material testing, 97% (Very Valid) on media validation testing, and 96,66% (Very Valid) on religious validation testing. (2) A score of 80% (Practical) was obtained in the practicality test, which included testing the educator's response, and 78% (Practical) in testing the students' response. (3) A value of 0,53 (Moderate) or (Quite Effective) was obtained on the student learning outcomes test by evaluating the pre-test and post-test, referring to the N-gain scale.

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**Citation:** Nasution, E.K., & Anas, N. (2025). Development of biology e-modules on environmental change integrated with wahdatul ulum. *JPBIO (Jurnal Pendidikan Biologi)*, 10(1), 100-113. DOI: <https://doi.org/10.31932/jpbio.v10i1.4545>

### INTRODUCTION

The Al-Qur'an is said to be one of the supporting factors for increasingly developing science, which can be seen through discussions about praise, knowledge, and high degrees in several verses of the holy Qur'an and is intended for those who know, and for those who seek knowledge they will always receive rewards (Makhmudah, 2018). There are two forms of Allah's verses, including kauniyah and kauliyah, which represent the entire universe and the revelations in it, so that in the Islamic view, it is believed that all existing knowledge is derived from the Almighty God (Qadir,



2019). Kauliyah verses refer to verses in the Al-Qur'an which regulate sharia law, rules and commands of Allah SWT, while kauniyah verses describe natural phenomena and events around them as proof of the greatness of Allah SWT and lessons for humans to reflect on His power, from the kauliyah and kauniyah verses various kinds of sciences that can be studied by humans are created, such as Biology (Alamsyah et al, 2024).

In scientific learning at this time there was a concept that integrated science and religion, called *wahdatul ulum*. Seyyed Hossein Nasr explained the important meanings in Islamic science related to ethics and spirituality, while Ismail Raji Al-Faruqi explained the mechanism for integrating religion and science with the concept of Islamization of science (Abduh and Kerwanto, 2023). *Wahdatul Ulum* is all knowledge that is connected in a harmonious network to become one and complement each other. *Wahdatul Ulum* emphasized that all knowledge is a substance that arises and flows from Allah SWT directly or indirectly through His revelation (Fatimah, 2021). Biology is a part of science that includes knowledge about the phenomena of life in generalizations, theories, concepts, and facts. Implementing a module that integrates science (biology) and religion will certainly support teaching and learning activities in biology subjects. This is due to the combination of religion with scientific facts about biological concepts (Khairani et al, 2023). According to the Islamic view, science and religion are united as confirmed in the QS. Al-Alaq verse I.

إِقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ

Meaning: “Read by (mentioning) the name of your Lord Who created”.

According to M. Quraish Shihab in the interpretation of Al-Misbah, if contextualized in education, learning is not only limited to reading but being able to internalize the values of tawhid and teach the truth (Dozan, 2020).

The rapid development of technology requires a shift from print media to information technology in learning. However, the emergence of conflict until now is that there are still many applications of conventional teaching materials applied by the majority of educators (Pramana et al., 2020). One of them is a module that is part of the type of teaching material. A module is a composition of material that is packaged attractively and systematically with learning objectives, content, and assessments that can be implemented independently. Students currently have high enthusiasm for something based on modern technology that allows them to create teaching materials such as electronic modules (Nurhidayah et al., 2021). The Islamic values implemented in the module are expected to be a strong pillar of religion for students, in addition to biology learning and insight in the form of Islamic teachings to be used as a guide for life (Larasati et al., 2020).

This E-Module study was created using flipbook media. Digital flipbooks are the compilation of media containing material in the form of sound, objects, and even text that is packaged systematically in digital format. Flipbooks can encourage users to be interactive because they contain multimedia elements (Sari and Ahmad, 2021). Environmental change is a change experienced by various environmental elements, including biodiversity, soil, water, and air, caused by natural factors or human intervention (Mardin, 2024). Environmental change is one of the materials that must be understood by students, because through this material students can understand current environmental changes, the condition of which is very worrying (Aqil et al., 2022). E-Modules are modules that include images, text, or even a combination of the two in digital form and contain digital electronic materials using simulations that are suitable for learning. This is designed to encourage an increase in students' understanding of learning outcomes and their concepts (Dewi and Lestari, 2020).

The use of learning modules allows learning activities not to always focus on the teacher (teacher-centered) but rather tend to be student activities (student-centered) that have been

adjusted to the curriculum updates in Indonesia (Najuah et al., 2020). E-Modules have advantages over printed modules, including quiz features and formative tests so that there is an opportunity to provide direct feedback; besides that, they are also interactive, where they make navigation easier and can display animations, videos, audio, and even images (Irmawati et al., 2023). This has an important role in the learning process, namely being able to support independent learning and knowing the level of understanding that students have (Latri, 2023).

Referring to research from (Pratiwi and Indana, 2022), it is said that in order to train students' digital literacy understanding using E-Modules with QR-Code in environmental change material, it is considered effective and valid if implemented for the learning process. This encourages them to have a high understanding of digital literacy in improving learning outcomes. The study carried out (Larasati et al., 2020) stated that the development of E-Modules integrated with Islamic values was considered feasible to be implemented in the learning process of biology subjects, specifically the respiratory system material, accompanied by very good assessments. A study by (Mellisa and Imania, 2022) proved that according to the validation value of the responses of students, science teachers, and experts, it was found that the product in the form of learning media using the Canva application in environmental pollution material was categorized as very valid to be implemented in teaching and learning activities.

Referring to the background, researchers were motivated to conduct a study entitled "Development of Biology E-Modules for Environmental Change Material Integrated with Wahdatul Ulum in Class X SMA/MA". This study aims to determine the effectiveness, practicality, and validity of the E-Module, so that it is hoped that it will be able to develop an E-Module for biology material for environmental change integrated with Wahdatul Ulum in class X SMA/MA that is effective, practical, and valid.

## RESEARCH METHODS

### Research Design

The use of methods in this study is Research and Development (R&D) or development research, which will create a product, and conduct testing related to the effectiveness of the products produced (Giawa et al., 2022). The development and model chosen, namely the Four-D (4D) model by S. Thiagarajan and Semmel (1994) includes four stages, including defining (Define), designing (Design), developing (Develop), and disseminating (Disseminate) (Amir and Mesach, 2018). The research location was at MAN 2 MODEL MEDAN on Jl. Williem Iskandar No.7A, Bantan Tim, Kec. Medan Tembung, Medan City, North Sumatra on Wednesday, February 19, 2025. The following are the steps in developing a 4-D model which can be seen in Figure 1.

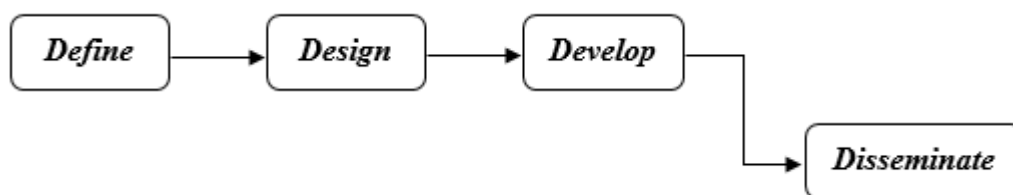


Figure 1. Development Steps of the 4-D Model.

### Population and Samples

The selected population is students of Class X MAN 2 MODEL MEDAN totaling 20 classes, while the sample used is students of Class X-A MAN 2 MODEL MEDAN totaling 30 students. The use of sampling techniques is non-probability sampling through a technique called purposive sampling or a technique used in taking samples by considering several things. Research sampling is based on E-Module needs analysis, where the wahdatul ulum integrated biology E-Module on environmental change material developed by researchers is very appropriate if applied at

MAN 2 MODEL MEDAN, because there is Islamic integration content in accordance with the curriculum at madrasah aliyah.

### Instruments

The types of data collected are qualitative and quantitative. Qualitative data is obtained through suggestions or criticism by educators and validators, while quantitative data is obtained through the E-Modul effectiveness level test sheet, which is packaged in pre-test and post-test questions, the E-Modul practicality test sheet (response questionnaire), and the E-Modul validation test sheet. Data collection instruments used observation, validity test, practicality test, and effectiveness test. The observation sheet is used as initial data or as the basis for the development to be carried out, to collect accurate information obtained from the biology teacher of the school to be studied, which totals 7 questions. The material expert validation instrument contains 13 statements that include aspects of assessment in the form of self-instruction, self-contained, stand-alone, adaptive, and user-friendly. The media expert validation instrument contains 25 statements covering aspects of assessment in the form of screen design appearance, ease of use, utilization, consistency and format, and graphics. The religious expert validation instrument contains 15 statements covering aspects of assessment in the form of integration of environmental changes with *wahdatul ulum*, suitability, language, and utilization. The practicality test sheet contains a response questionnaire for educators and students, totaling 15 statements. The effectiveness test sheet contains pre-test and post-test questions in the form of multiple choices, totaling 5 questions.

### Procedures

The definition stage is used as a definition and determination of the needs in learning activities that first analyze the objectives of the material limitations to be developed for the electronic module, namely, environmental change. If a problem has been obtained in the definition stage, the next is the design stage which produces a design of certain teaching materials in the form of E-Modules so that they can be implemented in Biology subjects, then the development stage to create teaching materials in the form of E-Modules biology integrated environmental change material *wahdatul ulum* in class X SMA/MA. The last stage is the dissemination stage, which is to disseminate teaching materials in the form of E-Modules.

### Data Analysis

#### Observation

The observation sheet is used as initial data or as a basis for development that will be carried out by collecting accurate information obtained from the biology teacher MAN 2 MODEL MEDAN, as shown in Table I.

**Table I.** Questions on the observation sheet

No	Question
1	Do you use teaching materials in learning biology?
2	What teaching materials do you use in the biology learning process?
3	Are the teaching materials that you use adequate to support the biology learning process?
4	Are the teaching materials that you use integrated with <i>wahdatul ulum</i> ?
5	Have you ever used teaching materials integrated with <i>wahdatul ulum</i> ?
6	Do you think biology learning will be more interesting if the teaching materials are integrated with <i>wahdatul ulum</i> ?

- 
- 7 How do you respond to the Development of Biology E-Modules on Environmental Change Integrated with Wahdatul Ulum?
- 

### 1. Validity Analysis

Descriptive statistical analysis was used to analyze the research data. The validators who assessed several aspects of validation were presented in the form of a rating scale. This type of scale applies a Likert scale with a score of 1-4, as shown in Table 2.

**Table 2.** Indicator variable scale model Likert

No	Score	Indicator Score
1	4	Strongly Agree
2	3	Agree
3	2	Disagree
4	1	Strongly Disagree

The following formula will be used as an analysis of the validation results that have been listed on the E-Module validation sheet:

$$P = \frac{f}{N} \times 100\%$$

Description:

N = Total maximum score

f = Total score acquisition

P = Percentage of questionnaire data

The percentage of validity obtained will be interpreted according to the criteria based on Table 3.

**Table 3.** Criteria for validity and practicality

No	Assessment	Criteria
1	$81 \leq P \leq 100\%$	Very Valid/Very Practical
2	$61 \leq P < 81\%$	Valid/Practical
3	$41 \leq P < 61\%$	Quite Valid/Quite Practical
4	$21 \leq P < 41\%$	Not Valid/Not Practical

### 2. Practicality Analysis

The technique of distributing the response questionnaire was carried out to test the practicality of the E-Module. To obtain responses from students and educators regarding the practicality of the E-Module, it is necessary to compile a response questionnaire that applies the Likert scale shown in Table 2. The teacher and student response questionnaires produced are then analyzed using the same formula as the validity analysis formula, and then the percentage of practicality obtained will be interpreted into categories based on Table 3.

### 3. Effectiveness Analysis

Testing the effectiveness of the E-Module used the technique of distributing learning result sheets in the form of initial tests (pre-test) and final tests (post-test) to students, then the pre-test and post-test assessments were used as a measure of increasing the success of implementing the E-Module as an effort to improve learning outcomes. The N-gain test was applied to calculate the results of the pre-test and post-test through the following formula.

$$N\text{-gain} = \frac{\text{Skor Post Test} - \text{Skor Pre Test}}{\text{Skor Maksimal} - \text{Skor Pre Test}}$$

The N-gain calculation is done for each learner's score. The final results of N-gain are then averaged and adjusted according to Table 4.

**Table 4.** N-gain score criteria

No	N-gain	Category	Criteria
1	$N\text{-gain} > 0,7$	High	Effective
2	$0,3 \leq N\text{-gain} \leq 0,7$	Medium	Moderately Effective
3	$N\text{-gain} < 0,3$	Low	Less Effective

## RESULTS

Based on the observation of Biology teachers at MAN 2 MODEL MEDAN, in learning biology, the material presented has not been integrated with *wahdatul ulum*. Teachers in learning activities still emphasize the delivery of biological science without being accompanied by literature related to *wahdatul ulum*. Biological science is delivered only sourced from reference books, which refer to Western science without being based on *wahdatul ulum*. Teaching materials used are still in the form of textbooks and have not been used with E-Modules, so according to biology teachers, learning will be more interesting if the teaching materials are integrated with *wahdatul ulum*, and the response of biology teachers strongly supports the development of E-Modules Biology Environmental Change Integrated *Wahdatul Ulum*.

The Four-D (4D) model was used in the research and includes four components, including defining (Define), designing (Design), developing (Develop), and disseminating (Disseminate).

### I. Define Stage

The role of this stage is to define and determine the needs in learning activities in advance to analyze the objectives of the material boundaries that will be developed for the E-Module. There are five steps at this stage, namely:

#### a. Front-End Analysis

The initial-final analysis is conducted to identify the basic problems in the development of the E-Module. At this stage, facts and alternative solutions are presented so that it is easier to determine the initial steps in the development of the E-Module that are appropriate to be developed.

#### b. Learner Analysis

Student analysis is done by observing student characteristics. This analysis is carried out by students filling out pre-test and post-test questions given by the researcher. The pre-test is given before the researcher explains the material, and after the material is delivered, the researcher asks students to answer the post-test questions.

#### c. Concept Analysis

Concept analysis is explaining the concepts of the material that will be discussed in the teaching materials in the form of E-Modules, as can be seen in Table 5.

**Table 5.** Basic competencies of KI 3 and indicators of competency achievement in the material on environmental change

Basic Competencies	Competency Achievement Indicator
3.11 Analyze data on environmental changes, their causes and impacts on life.	3.11.1 Describe the concept of environmental change
	3.11.2 Analyze various environmental changes based on environmental indicators
	3.11.3 Describe the types of environmental pollution
	3.11.4 Describe the factors that cause environmental change

- 
- 3.II.5 Analyze the causes of environmental change
  - 3.II.6 Analyze source data on the impact of environmental changes on life
  - 3.II.7 Determine ways to conserve the environment
- 

d. Task Analysis

The purpose of task analysis is to identify the main tasks carried out by students, as can be seen in Table 6.

**Table 6.** Basic competencies of KI 4 and indicators of competency achievement in environmental change material

Basic Competencies	Competency Achievement Indicator
4.II Formulate ideas for solving environmental change problems that occur in the surrounding environment	4.II.1 Create problem-solving from environmental changes that occur in the surrounding environment through studies from information media
	4.II.2 Analyze the results of experiments on the effects of pollutants on living things
	4.II.3 Communicate the results of an analysis study of the impact of information media
	4.II.4 Find efforts to conserve the environment
	4.II.5 Communicate the results of a report on efforts to conserve the environment

e. Specifying Instructional Objectives

This stage is carried out by compiling learning objectives for the environmental change material. The learning objectives are obtained and derived from the Competency Achievement Indicators contained in KD 3.II and KD 4.II.

## 2. Design Stage

The design stage is carried out after identifying problems in the defining stage. The purpose of this stage is to produce a design of certain teaching materials in the form of E-Modules so that they can be implemented in Biology learning. The design of the biology E-Module on environmental change material can be seen in Table 7 and Figure 2.

**Table 7.** E-Module design stage

Design Stage	Description
Material Review	Based on the material analysis stage used to compile the E-Module, is environmental change material for class X. Environmental change material consists of environmental changes, environmental pollution, and environmental management. The steps in preparing this E-Module product design include adjusting the core competencies and basic competencies and the 2013 curriculum.
Initial Design	The form of the E-Module uses ISO standard size paper, namely A4 (21 cm x 29.7 cm). The making of the E-Module starts with making the cover design and content design on the E-Module. Images contained in the E-Module are sourced from the internet. Learning activities using E-Modules begin with the presentation of material about environmental changes, then there are several questions related to the material.

Creation Tool

The equipment used in making this E-Module is software and hardware devices. The software devices used are Microsoft Word 2016, Canva and Heyzine Flipbook, while the hardware devices used are handphones and laptops.



Figure 2. E-Module biology material on environmental change

3. Development Stage

This stage is intended to create teaching materials in the form of E-Module biology material on environmental change integrated with *wahdatul ulum* in class X SMA/MA. Researchers at this stage carry out validation testing (feasibility) through validators on the development of E-Module teaching material products, then, the next stage is to revise or improve based on suggestions and input from experts.

a. Validity Analysis

The next step is to get an assessment from expert validators regarding the validation of this test which is carried out after designing the e-module design. The validators include material experts, media experts, and religious experts, each consisting of 1 person, in order to obtain certainty regarding the development of the E-Module to be suitable for implementation in learning as well as recommendations provided as material for improvement. The following validation results from expert validators as a whole are known in Table 8.

Referring to the validation test table from expert validators, the results obtained were 96,66% (very valid) in the validity of religious experts, 97% (very valid) in the validation of media experts, and 90,38% (very valid) in the validity testing of material experts, so that overall the results of the validity test of the E-Modul development obtained an average of up to 94,68% including very valid. The assessment results illustrate the development of E-Modules Biology

Material Environmental Change Integrated Wahdatul Ulum in Class X SMA/MA to be implemented in learning activities is said to be feasible and valid.

**Table 8.** Validation results from expert validators

No	Validator	Validator Score	Maximum Score	Percentage	Criteria
1	Material Expert	47	52	90,38%	Very Valid
2	Media Expert	97	100	97%	Very Valid
3	Religious Expert	58	60	96,66%	Very Valid
Average				94,68%	Very Valid

b. Practicality Analysis  
The

The next step is the product trial which is carried out after the expert validator states that the product is valid and feasible. The trial aims to get a response from research respondents to the development of E-Modules. The targeted respondents included 30 students of MAN 2 MODEL MEDAN and 1 educator's. The following are the overall results of the responses of students and educators presented in Table 9.

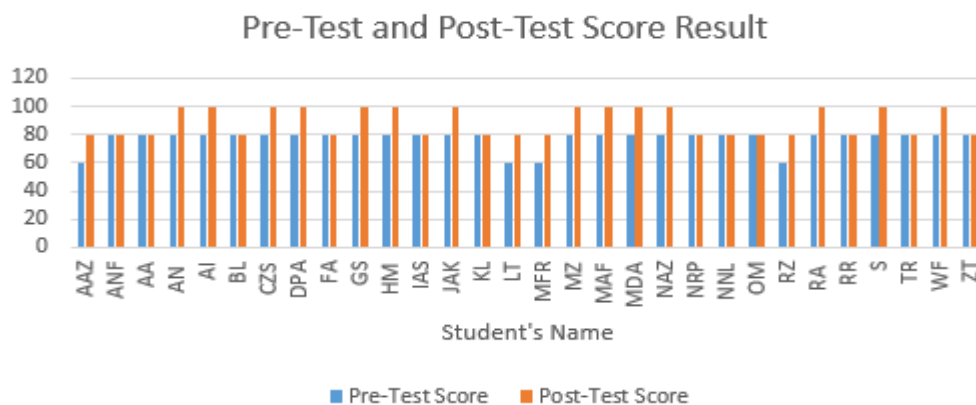
**Tabel 9.** Educator and student response results

No	Respondent's	Respondent's Score	Maximum Score	Percentage	Criteria
1	Educator	48	60	80%	Practical
2	Student's	1.412	1.800	78,44%	Practical
Average				79,22%	Practical

Based on the Table 9, the results of the response of students and educators, the results of students' responses obtained a value of 78,44% of the practical category and the results of the educator's response as much as 80% of the practical category, so that overall the results of the practicality test of E-Modul development obtained an average value of 79,22% of the practical category. The test results illustrate the development of E-Modules Biology Material Environmental Change Integrated Wahdatul Ulum in Class X SMA/MA to be implemented in learning activities is said to be practical.

### c. Effectiveness Analysis

By comparing the scores from the students' pre-test and post-test sheets, it can be seen whether the learning outcomes of the environmental change material by applying E-Modules have increased. The achievement of students who have been analyzed is shown in Figure 3.



**Figure 3.** Diagram of pre-test and post-test assessment

Based on the resulting evaluation, the lowest score of students based on the pre-test is 60, and the highest pre-test value is 80, while the lowest score of students based on the post-test is 80, and the highest post-test value is 100. The next step is to determine whether or not there is an increase in student learning outcomes by using the E-Module by testing the N-gain, which can be seen in Table 10.

**Table 10.** N-gain calculation

Student's	Average		N-gain Score	Criteria
	Pre-test	Post-test		
30	77,33	89,33	0,53	Moderately Effective

Referring to Table 10, there was an increase in learning outcomes in students based on the calculation of pre-test and post-test scores. Before implementing the E-Module, the average pre-test result was 77,33, while after implementing the E-Module, the post-test result was 89,33, indicating an increase in learning outcomes. The N-gain result reached 0,53, which is classified as quite effective criteria, where it shows that student learning outcomes have increased. The results of these values illustrate the development of the Wahdatul Ulum Integrated Environmental Change Material Biology E-Module in Class X SMA/MA, which was implemented in learning activities was quite effective.

#### 4. Dissemination Stage

Disseminate is the last stage of the research and development process with the Four-D (4D) model, at this stage the distribution of the developed product is carried out on a limited basis, namely by distributing the E-Module that has been developed to class X-A MAN 2 MODEL MEDAN students.

## DISCUSSION

Based on the research results previously described, the development of E-Module biology of environmental change materials integrated wahdatul ulum contains three objectives. The first is to determine the validity of the E-Module biology of environmental change materials integrated wahdatul ulum in class X SMA/MA that has been developed. The second objective is to determine the practicality of the E-Module biology of environmental change material integrated wahdatul ulum in class X SMA/MA. The third objective is to determine the effectiveness of E-Module biology of environmental change materials integrated wahdatul ulum in class X SMA/MA.

This research uses the Four-D (4D) model with several stages, including defining (Define), designing (Design), developing (Develop), and disseminating (Disseminate). This development model has advantages such as stages that are described systematically and in detail. The development of learning tools will be more appropriate if applying the 4D model and before the trial requires the role of several experts to provide an assessment so that later it will be used as material for revision of the product in accordance with suggestions, input, or assessments from experts (Salsabila et al., 2023).

E-Module development aims to provide facilities or containers for students to obtain material practically and flexibly. The access needed is also very easy because it can be downloaded in the desired format according to the use of the device at that time, for example a cellphone or laptop or accessed online. This is an opportunity for students where learning activities are adjusted to their wishes, without coercion from other parties or place and time (Kadir et al., 2024). The selection of environmental change material is expected to be able to train students' environmental literacy skills. This is associated with the content of environmental change material that discusses environmental pollution and its management which is directly proportional to environmental



literacy values. Through environmental change material, it is hoped that students can get closer to their environment so that they can foster a sense of caring for their surroundings (Nariswati et al., 2022).

### **Feasibility of E-Module biology material on environmental change integrated wahdatul ulum based on the validation results of material experts, media experts and religious experts**

Based on religious expert validation testing, the results showed 96,66% in the very valid category, media expert validation found 97% including very valid, and material expert validation showed 90,38% in the very valid category, so that overall testing of the validity of E-Module development resulted in an average of 94,68% classified as a very valid category. (Dewi et al., 2021) revealed that the product developed can be said to be feasible from the validator and can be applied during learning activities because the product has undergone revisions. The results of relevant research and literature review can be seen that e-flipbooks can foster enthusiasm for learning and interest in students (Wahyuliani et al., 2016). The selection of environmental change material that raises surrounding environmental issues that are poured into learning resources in the form of e-flipbooks can also train and improve environmental literacy skills in students (Suryaningsih, 2018).

### **Practicality of E-Module biology material on environmental change integrated with wahdatul ulum based on the results of the response assessment of educators and students**

Referring to the results of the practicality test of the educator's response, it obtained a value of 80% of the practical category, while the value of the learner's response was 78,44% of the practical criteria, so that overall the results of the E-Module practicality test developed showed an average result of 79,22% of the practical category. From these results, it can be concluded that the biology E-Module on environmental change material integrated with wahdatul ulum can be used as a learning experience for students, not easily bored and encourage enthusiasm in learning, find answers to problems in questions, and support students to gain an understanding of the concept of material through the application of E-Modules. This is in accordance with the opinion (Muthia et al., 2024) which says that the practicality of learning devices has been achieved, because teachers are able to use learning devices and most students give positive responses.

### **Effectiveness of biology E-Modules on environmental change materials integrated with wahdatul ulum**

Generally, effectiveness can be measured through the achievement of learning objectives, if there is a significant difference in learning outcomes in students' understanding before and after learning, then it can be said that the learning is effective. The effectiveness test of the E-Module uses pre-test and post-test values as an effort to improve student learning outcomes and aims to determine the level of success of using the E-Module. Before the E-Module is used during learning, the teacher can provide a pre-test to be carried out first, after that is the use of the post-test. The post-test is given at the end of learning with the E-Module biology material on environmental change integrated with wahdatul ulum. The average pre-test score before the E-Module was used was 77,33, while the average post-test score after the E-Module was used was 89,33. The average N-gain score reached 0,53 indicating a moderate category which places it in the fairly effective category.

The application of learning with E-Modules provides opportunities for students to develop their knowledge independently through learning activities. With the module design that is designed in favor of students will make their learning activities more directed which are carried out independently. The module has several components, including: 1) Introduction, contains learning

objectives, Basic Competencies (KD), to instructions for using the module. 2) Content, contains material including procedures, facts, and concepts. 3) Learner Worksheet, contains work steps to do the task in it 4) Evaluation, this is usually presented with questions and answer keys to find out how far the level of completeness of students (Asih et al., 2018). Digital technology with proper utilization in learning can create good teaching and learning activities and provide an increase in learning outcomes, interest, and motivation of students (Rodiyah et al., 2023).

## CONCLUSION

Referring to the results of the research “Development of Biology E-Modules on Environmental Change Integrated with Wahdatul Ulum in Class X SMA/MA” using the Four-D (4D) model, it can be concluded that the acquisition of religious expert validation shows a result of 96,66% very valid category, the acquisition of media expert validation found a result of 97% including very valid, and the acquisition of material expert validation showed a result of 90,38% very valid category, so that overall the results of the E-Module validity test conducted by the development reached an average value of 94,68% including very valid. Student response testing obtained a value of 78,44% for practical criteria, while the practicality of the educator's response received a value of 80% practical category, so that overall, the results of the E-Modul development practicality test showed an average value of 79,22% with practical criteria. The E-Modul effectiveness test uses the results of the pre-test and post-test to determine the level of success when applying the E-Modul, which aims to improve learning outcomes in students. The average pre-test score before the E-Modul was used was 77,33, while the average post-test score after the E-Modul was used was 89,33. The average N-gain score of 0,53 shows a moderate category and places it in the moderately effective category. Based on these results, this study implies that the Biology E-Module on Environmental Change Integrated with Wahdatul Ulum in Class X SMA/MA is feasible, practical, and effective to be applied in learning activities at school.

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