

## Development of E-Modules Based on Scientific Approach for Respiratory System Material for Class VIII at MTsN Gowa

### Pengembangan E-modul Berbasis Pendekatan Saintifik Materi Sistem Pernapasan Kelas VIII Di MTsN Gowa

Bau' Febrianti Laisa<sup>1)</sup>, Andi Tenri Ola Rivai<sup>2)\*</sup>, Syahriani<sup>3)</sup>

<sup>1)2)3)</sup> Biology Education, Faculty of Education and Teacher Training, Alauddin State Islamic University Makassar, Indonesia

\* Corresponding Email: [andi.tenriola@uin-alauddin.ac.id](mailto:andi.tenriola@uin-alauddin.ac.id)

Abstract	Article Information
<p><i>The Independent Curriculum emphasizes the importance of active student participation in the learning process. Therefore, teaching materials are needed that can encourage student interest and motivation to learn. One alternative that can be developed is an e-module, because it can support independent learning while supporting a more interactive learning process. The e-module used needs to be developed with an approach so that students are more active in constructing their knowledge and skills. An approach that can encourage students to investigate and discover facts from everyday events is a scientific approach. One of the materials that is less understood by students in class is the respiratory system. This study aims to produce an e-module based on a scientific approach for the respiratory system material for grade VIII at MTsN Gowa that can help and facilitate students in learning science lessons. The research method used is Research and Development (R&amp;D). This study uses the ADDIE development model with stages, namely 1) Analysis 2) Design 3) Development 4) Implementation 5) Evaluation. The research instruments used were instrument validation sheets, teaching modules, student and educator response questionnaires, and learning outcome test instruments. Data analysis consisted of validity, practicality, and effectiveness analysis. The results of the study showed that the validity of producing e-modules based on a scientific approach to the respiratory system material developed was in the very valid category (3.7) and the practicality of producing e-modules based on a scientific approach to the respiratory system material developed was in the practical category (3.4) and was effective because 93% of students obtained a passing grade.</i></p>	<p><b>Keywords:</b> Scientific Approach; E-module Development; Respiratory System</p>
<p>Kurikulum Merdeka menekankan pentingnya peran aktif peserta didik dalam proses pembelajaran. Oleh karena itu, diperlukan bahan ajar yang mampu mendorong minat dan motivasi belajar peserta didik. Salah satu alternatif yang dapat dikembangkan adalah e-modul, karena dapat menunjang kemandirian belajar sekaligus mendukung proses pembelajaran yang lebih interaktif. E-modul yang digunakan perlu dikembangkan dengan suatu pendekatan agar peserta didik lebih aktif dalam mengkonstruksi pengetahuan dan keterampilannya. Pendekatan yang mampu mendorong peserta didik untuk menyelidiki dan menemukan fakta dari kejadian-kejadian sehari-hari adalah pendekatan saintifik. Salah satu materi yang kurang di pahami oleh peserta didik dikelas yaitu materi sistem pernapasan. Penelitian ini bertujuan untuk menghasilkan e-modul berbasis pendekatan saintifik materi sistem pernapasan kelas VIII di MTsN Gowa yang dapat membantu dan memudahkan peserta didik dalam mempelajari pelajaran IPA. Metode penelitian yang digunakan adalah <i>Research and Development</i> (R&amp;D) atau penelitian pengembangan. Penelitian ini menggunakan model pengembangan ADDIE dengan tahapan yaitu 1) <i>Analysis</i> 2) <i>Design</i> 3) <i>Development</i> 4) <i>Implementation</i> 5) <i>Evaluation</i>. Instrumen penelitian yang digunakan yakni lembar validasi instrumen, modul ajar, angket respon peserta didik dan pendidik, serta instrumen tes hasil belajar. Analisis data berupa analisis kevalidan, kepraktisan dan keefektifan. Hasil penelitian menunjukkan bahwa kevalidan menghasilkan e-modul berbasis pendekatan saintifik materi sistem pernapasan yang dikembangkan berada pada kategori sangat valid (3,7) kepraktisan menghasilkan e-modul berbasis pendekatan saintifik materi sistem pernapasan yang dikembangkan berada pada kategori praktis (3,4) dan efektif digunakan karena 93% peserta didik memperoleh nilai tuntas.</p>	<p><b>Kata kunci:</b> Pendekatan Saintifik; Pengembangan E-modul; Sistem Pernapasan</p> <p><b>History</b> Received : 12/08/2025 Revised : 07/10/2025 Accepted : 28/10/2025 Published : 31/10/2025</p>

## A. INTRODUCTION

Technology today is very advanced, so it plays a role similar to that of a teacher, being able to help deliver material or information during the learning process. (Darmayanti et al., 2023). The rapid development of technology provides great opportunities, especially in supporting learning activities in the field of education (Salsabila et al., 2020). Education is a systematic process of teaching students by enhancing their intelligence (Rizal et al., 2022). Education aims to create quality human beings who are capable of facing challenges and changes of the times (Rivai, 2022). Educational technology is the development, assessment, and application as an aid to improve the learning process of students (Kaimuddin et al., 2024).

Currently, the challenges of the era, driven by the rapid flow of globalization and technology, are increasingly demanding. Education plays an important role in responding to and preparing the current and future generations (Tamalene et al., 2023). Technological advancements are progressing very rapidly and cannot be avoided. The development of education in the digital era can enable learners to access various information quickly and easily (Aulia et al., 2024). Educators are required to further explore their abilities and be able to utilize information technology to support the advancement of education today. Learning tools are one of the supporting factors for success, where the content of these learning tools includes the plan for processes, assessments, and teaching methods (Ariandi et al., 2023). One form of presenting learning material digitally using technology is electronic modules (Istiqoma et al., 2023).

The module to be designed must meet the requirements of the applicable curriculum. The Ministry of Education, Culture, Research, and Technology of Indonesia (Kemendikbudristek) currently uses the independent curriculum, which aims to improve the quality of education by applying an approach that is in line with real-life situations, is open to all students, and positions students as the main focus of learning (Nurwendah et al., 2023). An electronic module (e-module) is a digital module, consisting of text, images, animations, graphics, and videos that can be accessed anytime and anywhere. The e-module combines digital electronic material with simulations that help students understand the material during the learning process (Latri, 2023). One of the public madrasahs in Gowa, namely Madrasah Tsanawiyah Negeri Gowa (MTsN Gowa), is designated as an educational institution that implements digital learning, where students are specifically required to use mobile devices such as tablets. Through direct observation, the use of teaching materials in the form of digital modules at MTsN Gowa has not yet been implemented.

Science lessons are one of the concepts of learning about nature that are closely related to human life. Science education greatly influences the educational process and technological advancement, as well as the understanding of the universe, which is very complex and mysterious, so that discoveries can be developed into scientific knowledge and applied in daily life (Rahmah, 2022). Science lessons, especially materials on the respiratory system, require a scientific approach, as it can make students more active in constructing their knowledge and skills. A scientific approach can also encourage students to conduct investigations to discover facts about everyday phenomena or events (Hestina et al., 2023).

The aim of this research is to develop a scientific approach-based e-module on the respiratory system material for seventh-grade students at MTsN Gowa, to determine the level of validity of the scientific approach-based e-module on the respiratory system material for seventh-grade students at MTsN Gowa, to determine the level of practicality of the scientific approach-based e-module on the respiratory system material for seventh-grade students at MTsN Gowa, and to determine the level of effectiveness of the scientific approach-based e-module on the respiratory system material for seventh-grade students at MTsN Gowa. This research is expected to provide benefits for researchers, students, educators, the school, and future researchers.

Based on the description above, the author is motivated and interested in conducting research and developing a product to address this issue, titled "Development of an e-module based on a scientific approach for the respiratory system material for 7th-grade students at MTsN Gowa." Some studies considered relevant to this research include "development of an interactive chemistry e-module based on a scientific approach using live worksheets on reaction rate material" (Yuliana et al., 2023). "Development of a scientific approach-based e-module with tracker analysis on dynamic fluid material for 11th-grade high school students" (Nurkasiani, 2020). "Development of a science-based e-module using Canva and Flip PDF Professional for science subjects" (Zulkan, 2023). "Development of a science-based e-module on energy changes in elementary schools" (Melinda et al., 2024). and "Development of a science-based mathematics e-module for 8th-grade junior high school students" (Nuranisa et al., 2024).

## B. METHOD

The type of research and development used in this study is the ADDIE development model, which consists of five stages: (analysis, design, development, implementation, and evaluation). The method used in this study is the Research and Development (R&D) research method. According to Sugiyono (2016), Research and Development (R&D) is a research method aimed at creating a specific product and testing how effective that product is. The development process follows the ADDIE model, which consists of the following five steps:

**Analysis**, requires an initial analysis of the problems present in the learning process. The analysis stage consists of six steps, namely validating learning problems, analyzing students, determining learning objectives, analyzing development needs, determining an instructional system, and preparing a development implementation plan. (Eka et al., 2022).

**Design**, three types of activities carried out at this design stage are designing the e-module (storyboard), creating research instruments, and developing testing strategies (Ramadhan et al., 2025).

**Development**, the purpose of the development phase is to produce and validate the selected teaching materials until they are ready for the trial stage. This stage involves 5 activities: 1) preparing the main material, 2) selecting or developing supporting teaching materials, 3) developing products for students or educators, 4) formative revision, 5) conducting trials. At this stage, small group trials assess the effectiveness of the e-module product in the classroom learning process. c) Revision After the validation stage, the product will be revised based on input and suggestions from media, language, and content experts to make it more engaging and suitable for the needs of students (Ramadani, 2024).

**Implementation**, this stage is useful for researchers to obtain information regarding the practicality and effectiveness of the developed teaching materials by providing response questionnaires to educators and students (Alamsyah et al., 2022).

**Evaluation**, the evaluation stage is the final step in this development model. The activities at this stage are aimed at assessing the product resulting from the development of the e-module based on a scientific approach that has been developed and implemented in the classroom.

The research subjects are students of class VIII 1, totaling 30 students. This research will be conducted at MTsN Gowa, Jl. Malino No. 7, Balang-Balang, Kec. Bontomarannu, Gowa Regency, South Sulawesi.

The research instruments used in this study consisted of qualitative and quantitative data. Qualitative data were obtained through the designed products, questionnaires for educators and students, and student learning outcome test sheets, which were then evaluated by validators using a validation sheet. The validation sheet was used to determine the validity of the e-module to be filled out by material and design experts, with the aim that this validation could produce a product deemed valid based on the validators' revisions.

Quantitative data were obtained from the validators' results from small-scale field trials of the product (Hermawan, 2019).

Data processing techniques are divided into three, namely: 1) validity testing, which is carried out by a validator using a validation attachment sheet to ensure that the created e-module is truly valid and legitimate Data processing techniques are divided into three, namely: 1) validity testing, which is carried out by a validator using a validation attachment sheet to ensure that the created e-module is truly valid and legitimate (Hidayah & Nurtjahyani, 2018); 2) practicality testing, which can be done by conducting learning outcome tests on students who have gone through the teaching and learning process. This test determines how practical the e-module is and how well educators respond to the e-module, as well as students' responses to the implementation and ease of the e-module in learning. Questionnaires can be used to find out how practical a scientifically based e-module is (Revita, 2019); 3) effectiveness testing of the e-module, which can be done by examining the learning outcomes of students who have participated in the learning process using the scientifically based e-module developed and created by the researcher (Fitra & Maksum, 2021).

Data analysis techniques are efforts to systematically seek and organize the results of observations, interviews, and other findings to enhance the researcher's understanding of the case being studied and to present it in findings for others. The implementation of data analysis must be carried out from the beginning of data collection in the field, and this needs to be done intensively so that all field data is collected (Nurdewi, 2022).

Testing the validity of the e-module is important to demonstrate the alignment between planning theory and the module that has been developed, determining whether the created module is sufficiently valid (feasible, good) or not. The results of the questionnaire obtained from expert validation are categorized according to the interpretation in Table 1.

**Table 1 Criteria for Validity Level**

Score	Criteria
$3,4 < V \leq 4$	Very valid
$2,8 < V \leq 3,4$	Valid
$2,2 < V \leq 2,8$	Fairly valid
$1,6 < V \leq 2,2$	Less valid
$V \leq 1,6$	Not valid

(Suryo, 2010)

Note: V = The average validity score from all validators

The average value refers to the interval for determining the level of practicality of the e-module based on the scientific approach in Table 2.

**Table 2 Category of Practicality Level**

Score	Criteria
3,26 - 4,00	Very practical
2,51 - 3,25	Practical
1,76 - 2,50	Quite practical
1,00 - 1,75	Not practical

(Ulfah et al., 2022)

Note: X = Average Value of Respondents

The Learning Achievement Criteria Score (KKTP) set by MTsN Gowa for the 8th-grade Science subject is 78. To determine the effectiveness of the scientific approach-based

e-module developed, learning outcome test data is used. If the score obtained meets the KKTP set at the school (score  $\geq 78$ ), the teaching material can be considered effective.

**Table 3 Effectiveness Level Categories**

<b>Level of Mastery</b>	<b>Category</b>
$90 \leq \text{TPP} < 100$	Very effective
$75 \leq \text{TPP} < 90$	Effective
$60 \leq \text{TPP} < 75$	Quite effective
$40 \leq \text{TPP} < 60$	Less effective
$0 \leq \text{TPP} \leq 40$	Very ineffective

(Hobri, 2020)

### C. RESULTS AND DISCUSSION

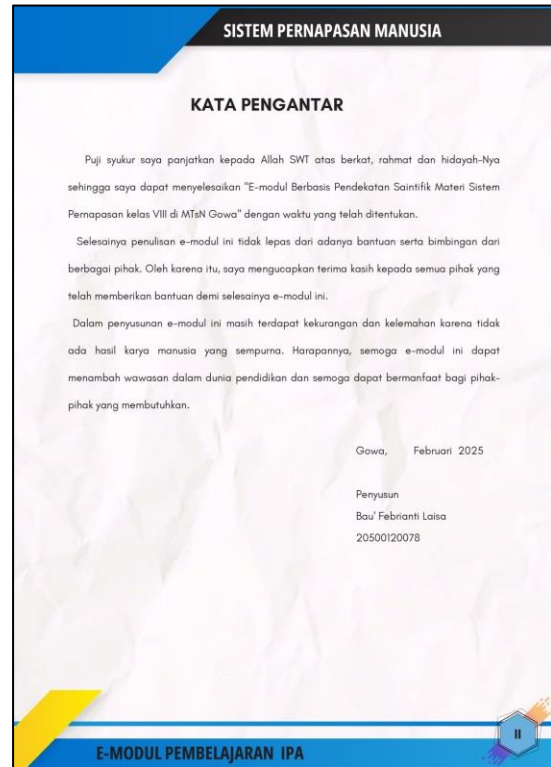
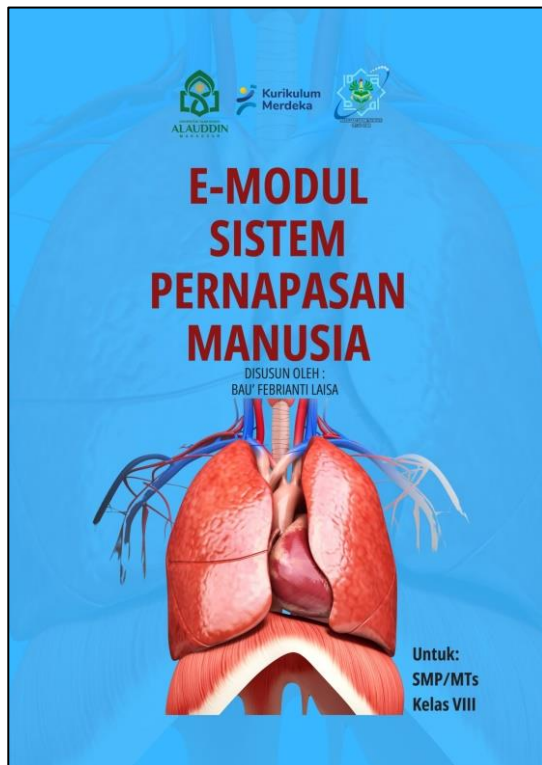
#### Development Stage of E-Module Based on Scientific Approach

The scientific approach-based e-module to be developed must have levels of validity, practicality, and effectiveness that meet the criteria. The development process of a scientific approach-based e-module is carried out in stages referring to the ADDIE model, which consists of the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage.

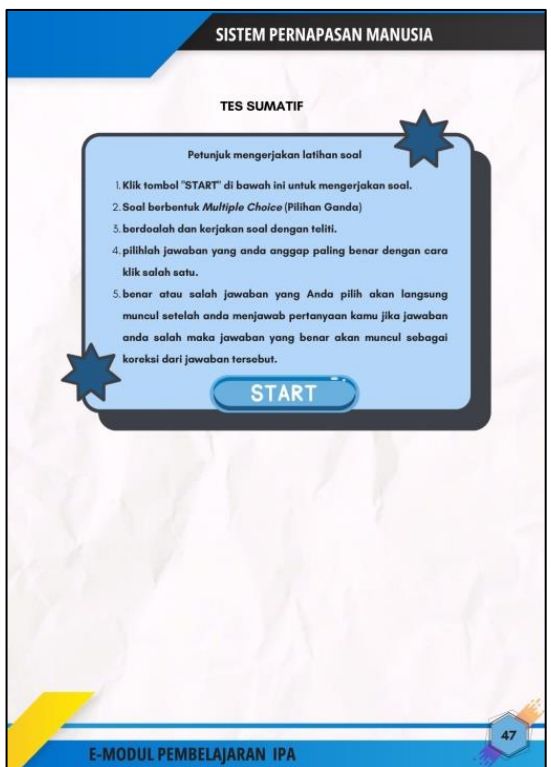
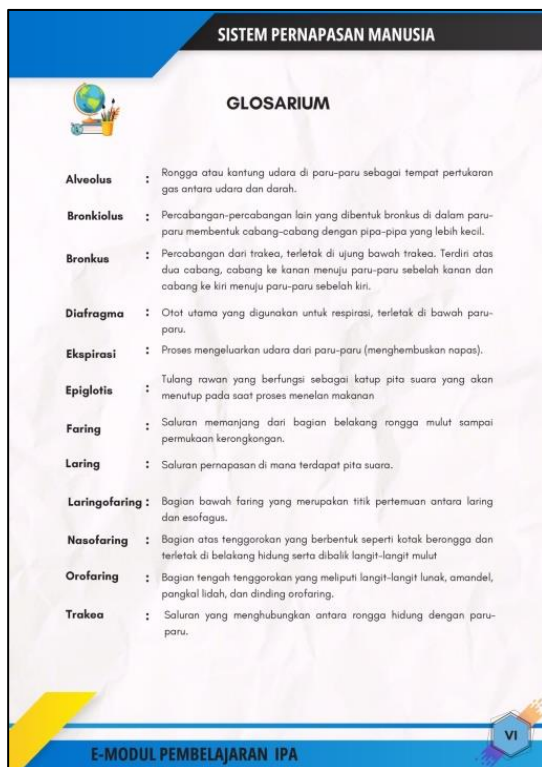
**Analysis.** Based on the results of the observation, it can be seen that the teaching materials used at MTsN Gowa are still limited, and the materials used only rely on teacher and student handbooks. The lack of variety in teaching materials can cause boredom among students, which may lead to a loss of concentration in receiving the learning material. Based on the evaluation results at the analysis stage, it can be concluded that the teaching materials available at MTsN Gowa are still not varied enough because they only rely on teacher and student handbooks. This condition has the potential to cause boredom and decrease students' concentration in following the learning process. Therefore, there is a need for innovation in developing more interactive and engaging teaching materials. One alternative that is considered appropriate is the development of e-modules based on a scientific approach, which is expected to increase motivation, active engagement, and student learning outcomes.

**Design.** In this design stage, the researcher creates an outline of the content of the e-module based on a scientific approach that will be developed. The development design can be formulated through the following stages: 1) Formulating the objectives of product development. The objective of developing this e-module based on a scientific approach is to address the problems identified during the initial observation, where students need engaging learning materials that make it easier to understand the subject matter. Based on this, the e-module based on a scientific approach can become an engaging learning resource and help students understand the material better because it allows them to clearly grasp the replica form of the human respiratory system organs through simple experiments compared to students who rely solely on their imagination. 2) Compiling the requirements for product development. The purpose of identifying product development requirements is important to determine the desired and necessary materials and tools for product development. This stage is implemented by creating a prototype (initial design of the e-module) that corresponds to the previous analysis stage. After selecting the appropriate e-module, the next activity is to create the initial e-module prototype. Activities in this stage include creating a storyboard, determining the type and size of fonts in the e-module, arranging images and adding respiratory system materials, incorporating a scientific approach, practice questions, and group assignments. This stage produces an initial e-module design or prototype which is then submitted to experts or validators to obtain a validity assessment of the developed e-module. The graphic design applications used are Canva Pro and Flip PDF Professional. 3) Developing a testing strategy. In the testing strategy, questions are created to determine the students' level of understanding of the respiratory system material. Each question is made in

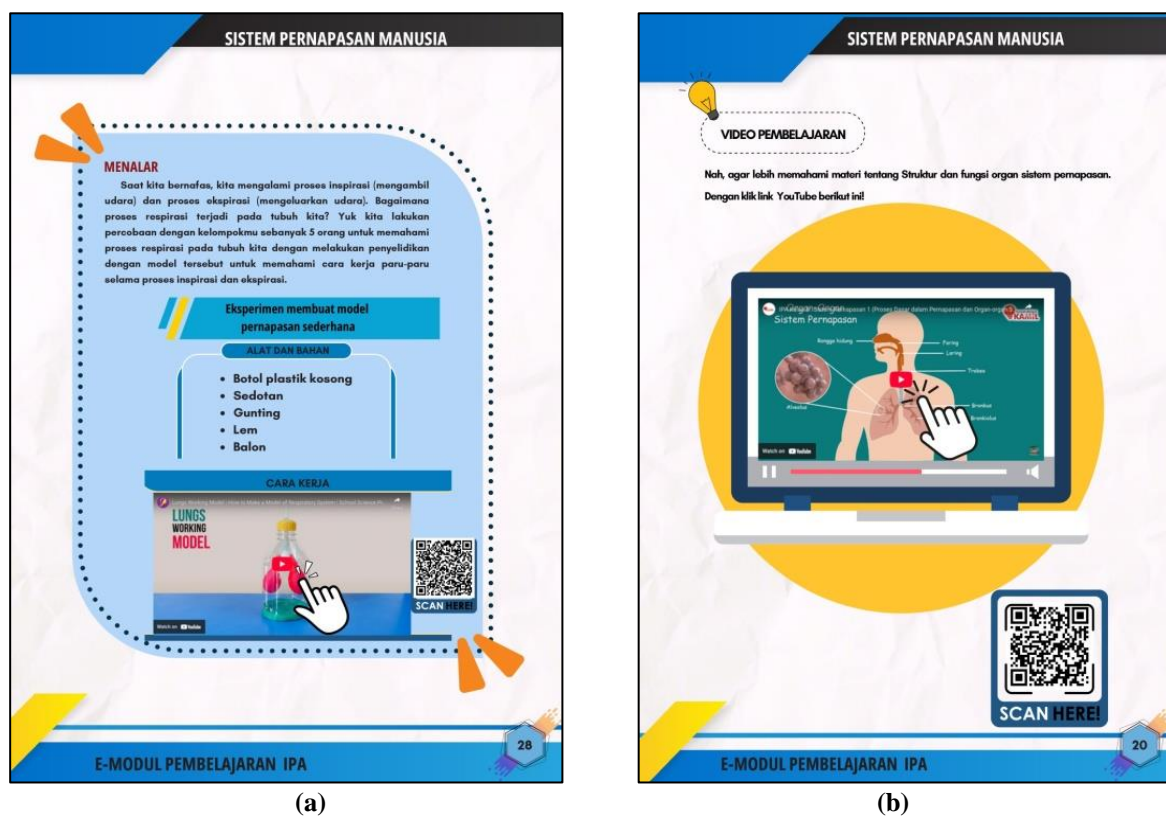
accordance with the Learning Outcomes (CP) and Learning Objectives (TP). This can be seen from the results of the students' learning tests. The initial trial results show the effectiveness of the product, with the average student learning completion reaching a score of 82.



(a) (b)  
Gambar 1. (a) Sampul, (b) Halaman kata pengantar



(a) (b)  
Gambar 2. (a) Halaman glosarium, (b) Halaman soal



Gambar 3. (a) Halaman pendekatan saintifik, (b) Halaman video pembelajaran

**Development.** The researcher realizes the design that has been created into a product, namely a scientific approach-based e-module. In addition, in this stage, validation of the developed teaching materials is also conducted, where during the validation stage, the researcher involves expert validators to provide assessment and feedback on the developed teaching materials. Based on the evaluation results at the development stage, a scientific approach-based e-module is produced that has gone through the validation process by the validators. From the validation results, it is known that the e-module still requires several improvements, both in terms of content and appearance. Some suggestions given include adjusting the sequence of materials, improving the positional map, adding Islamic integration, and using more appropriate media (Google Form for practice questions). With these improvements, the developed e-module is considered increasingly relevant, practical, and ready to be implemented in the learning process.

**Implementation.** The e-module that has been declared valid is then implemented for Class VIII.1 students at MTsN Gowa, with a total of 30 students, who are further divided into several small groups. At this stage, the scientific approach-based e-module is shared via a link to the students to be used as learning material. This implementation aims to observe how the developed teaching materials function in real learning and to see feedback on the practicality of the teaching materials from both students and teachers. In addition, the implementation stage also aims to determine the effectiveness of the teaching materials based on students' learning outcomes tests so that practical and effective teaching materials can be obtained. Based on the evaluation results during the implementation stage, it shows that the scientific approach-based e-module received positive responses from both students and teachers, in terms of practicality as well as ease of use.

**Evaluation.** This stage is where the researcher gives learning outcome test questions distributed to each student to measure the scientific approach-based e-module used during learning. Based on the evaluation results at this stage, the researcher conducts learning outcome tests on the students as an effort to measure the effectiveness of the scientific

approach-based e-module. From the implementation of the test, it was found that the e-module was able to help students understand the material better, as indicated by the increasing completeness of learning outcomes. In addition, students appeared to be more motivated in participating in the learning process because the e-module presents the material in a more attractive and interactive way. Thus, the scientific approach-based e-module is considered effective in improving students' understanding, motivation, and learning achievement.

### The Validity of E-Modules Based on the Scientific Approach

The validity of a product is obtained from the teaching material validation sheet, which contains assessment aspects in terms of appearance, content, image quality, and language. The assessment is carried out by validators (experts) who use the validation attachment. The results of the assessment from both expert validators can be seen in Table 4.

**Table 4 Validator Assessment Results**

Assessment Aspects	Validator I	Validator II	Total	Category
Display	3,4	4	3,5	Very Valid
Content	4	3,6	3,8	Very Valid
Image Quality	4	4	4	Very Valid
Language	4	4	4	Very Valid
<b>Average</b>	<b>3,8</b>	<b>3,9</b>	<b>3,8</b>	Very Valid

Based on the explanation of the analysis results in Table 4, it can be seen that the scientific approach-based e-module developed meets the criteria of being very valid. The validity of an e-module can be observed from several assessment aspects from both expert validators. This aligns with Sugiyono's assessment standard, which states that a teaching material is categorized as very valid if the average validation score is in the range of  $3.5 \leq V \leq 4.0$ . Therefore, this e-module is eligible to be field-tested although it still requires some revisions according to the input from the validators (Sugiyono, 2013).

### Practicality of E-Modules Based on the Scientific Approach

The measured level of practicality includes assessment aspects in terms of presentation technique, language appropriateness, content material, compatibility between the e-module and the material, and the use of the e-module based on a scientific approach through the distribution of questionnaires to students and educators. The overall response results from students and educators regarding the practicality of the scientific approach-based e-module can be seen in Table 5.

**Table 5 Overall Response Results**

Aspek Penilaian	Pendidik	Peserta Didik
<b>Teknik Penyajian</b>	3,8	3,2
<b>Kesesuaian Bahasa</b>	4	3,0
<b>Isi Materi</b>	4	3,1
<b>Kesesuaian E-modul dan Materi</b>	3,5	3,3
<b>Penggunaan</b>	3,7	3,2
Rata-rata	<b>3,8</b>	<b>3,1</b>
Total	<b>3,4</b>	
Kategori	<b>Sangat Praktis</b>	

Based on Table 5, the results of the questionnaire analysis on the scientific-based e-module from educator responses can be concluded that the scientific-based e-module used by students is considered very practical. The practicality of the developed e-module is supported by the

ease of using the e-module, which can be seen from the student response sheets and educator responses as results of the e-module's level of practicality. Product practicality refers to a product that is easy to use, easy to interpret, and time-efficient (Senda et al., 2022).

### Effectiveness Level of E-Modules Based on a Scientific Approach

The effectiveness level of the research was measured by giving test items to students to assess the effectiveness of the scientific approach-based e-module. The instrument used consisted of test items in the form of a written test with 20 multiple-choice questions, and the research subjects were 30 students in grade VIII at MTsN Gowa. Students were considered successful if they achieved a score greater than or equal to the Minimum Competency Criteria (score  $\geq$  KKTP). The classification of students' mastery levels can be seen in Table 6..

**Table 6 Classification of Student Proficiency Levels**

Score	Number of Students	Classification
$90 \leq \text{TPP} < 100$	5	Very effective
$78 \leq \text{TPP} < 90$	23	Effective
$60 \leq \text{TPP} < 77$	2	Quite effective
$40 \leq \text{TPP} < 59$	0	Less effective
$0 \leq \text{TPP} \leq 40$	0	Very ineffective

Based on Table 6, after analyzing the results of students' mastery levels, the classification of students' mastery levels was obtained by adjusting the students' scores according to the classification table above. If detailed, it can be seen that the very effective category consists of 5 students and the effective category consists of 23 students. Meanwhile, the students who did not achieve mastery are 2 students in the fairly effective category. Learning is said to be successful classically if at least 80% of students achieve mastery scores. The percentage of students' mastery achievement can be seen in Table 7.

**Table 7 Percentage of Students' Learning Achievement Completion**

No	Student Scores	Number of Students	Percentage
1.	78-100	28	93%
2.	0-77	2	7%
<b>Total</b>		<b>30</b>	<b>100%</b>

Based on Table 7, it can be seen that there are 28 students who have achieved passing grades, with a percentage of 93% in learning using e-modules based on the scientific approach. There are 2 students who did not pass, with a percentage of 7%. The reflection results obtained during the learning process show that some students paid less attention to the teacher's explanations and were not focused on the e-module due to limited class hours, so it was necessary to remind them and provide motivation and encouragement to the students, reinforcing the obligation to study. The overall average score of students' learning outcomes is 82, indicating that the students' mastery of the material falls into the (effective) category. The effectiveness of the e-module can be seen from the ease with which students engage in the learning process.

Based on the results obtained, it can be concluded that the e-module based on the scientific approach developed by the researchers falls into the effective category, as seen from the number of students achieving mastery in the learning process of the respiratory system material. This is supported by research stating that a developed product is considered effective if it provides results that align with the learning objectives, as shown in the learning outcome tests by students (Nursy et al., 2023). In addition, the scientific approach-based e-module has been developed with simple experiments, making it easy for students to understand and able to improve their learning outcomes.

## D. CONCLUSION

Based on the results of the research and discussion in this study, the following conclusions can be drawn: (1) The development process of a scientific approach-based e-module developed using the ADDIE model consists of five stages, namely the analysis stage, design stage, development stage, implementation stage, and evaluation stage. (2) The validity level of the scientific approach-based e-module on human respiratory system material falls into the very valid category. (3) The practicality level of the scientific approach-based e-module on human respiratory system material falls into the practical category with a response questionnaire score from educators and students. (4) The effectiveness level of the scientific approach-based e-module on human respiratory system material falls into the effective category.

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