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Development of Problem Solving E-Modules to Improve Critical Thinking Skills and Learning Outcomes on Human Body Organ System Material

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ABSTRACT
Learning about the human body organ systems in elementary schools is still often ineffective, as many students show low critical thinking skills and suboptimal learning outcomes due to the dominance of conventional teaching and limited learning resources. This study aims to develop a valid, practical, and effective problem solving based e-module on the topic of the human body organ system. The study employs the Research and Development (R&D) method using the 4D model. The problem solving based e-module demonstrated a high validity score of 91.4%. It achieved an average practicality percentage of 87.5% in small-group trials and 88.6% in large-group trials, both categorized as very practical. In small-group trials, the developed e-module showed high effectiveness, with average n-gain scores of 0.76 for learning outcomes and 0.77 for critical thinking skills. Similarly, in large-group trials, the n-gain scores were 0.75 for learning outcomes and 0.78 for critical thinking skills, both also classified as high. Additionally, the student response questionnaire indicated very good results, with an average percentage of 87% in small classes and 86% in large classes. Therefore, the problem-solver-based e-module on the human body organ system is considered suitable for use in the learning process.

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1. INTRODUCTION

In 21st-century learning, teachers are required to be more creative, innovative, and possess skills aligned with developments in science and technology. This aligns with Mulyasa's (2023) view on the implementation of the Merdeka curriculum, which states that teachers must be able to develop and enrich themselves by learning and seeking new information related to teaching and improving the overall quality of education. Therefore, teachers must cultivate the habit of seeking learning resources whether from books or the internet engaging in discussions, and collaborating to obtain information that aligns with current developments.

In this era of globalization, equipping students with critical thinking skills is one of the expected outcomes of education. Critical thinking involves managing one's thought processes to become deeper, more detailed, and more concrete. It is a key competency required for problem-solving and for enhancing the quality of human resources to responsibly face the challenges of 21st-century development (Nugraha & Susilaningsih, 2017; Sholikhah & Arif, 2024). Critical thinking skills encompass several abilities, including effective reasoning, systematic problem analysis, asking specific questions, solving problems, and reflecting on possible outcomes in the decision-making process (Wahono et al., 2022).

These skills train students to make decisions from multiple perspectives in a careful, thorough, and logical manner. Developing critical thinking skills helps students identify learning problems and positively impacts their learning outcomes. However, several studies have shown that critical thinking skills among elementary school students remain low. According to the 2022 PISA results, the average science score of Indonesian students was 383 points, compared to the OECD average of 485 points. The low PISA scores of Indonesian students are influenced by several factors. Many learning practices still focus on memorization rather than higher-order

thinking skills, so students are less trained in problem-solving and critical analysis. Limited school facilities and unequal access to technology also reduce opportunities for interactive learning. In addition, teachers often face challenges in applying HOTS-based approaches, which makes students less prepared to face complex tasks such as those assessed in PISA. Moreover, only 34.16% of Indonesian students reached Level 2 in scientific literacy, far below the OECD average of 75.51%. A pre-cycle science test conducted by Setiawan (2020) reported an average critical thinking score of 49.06, with only 6% of students or 2 out of 32 scoring above the minimum passing grade score was 70.

The low level of students' critical thinking skills in science learning is largely due to teachers' limited reliance on textbooks and the lack of instructional resources aimed at developing critical thinking. Sari & Sutihat (2022) argue that when students are faced with complex problems, teachers often provide only brief and straightforward problem-solving steps. As a result, students struggle to grasp the deeper meaning necessary to analyze the core of the problem. Additionally, students have difficulty understanding scientific terminology, drawing conclusions, and applying scientific concepts to more complex situations (Ramdayani et al., 2024). Therefore, it is essential for teachers to take action to improve students' critical thinking skills at the elementary level.

Students' critical thinking skills significantly influence their learning outcomes. According to Rizqa (2022), learning outcomes reflect observable behavioural changes in cognitive, affective, and psychomotor aspects, and are influenced by both internal and external factors. These outcomes are determined after students go through the teaching and learning process. Based on science learning results in several public elementary schools in the Klakah, many students continue to score below the Minimum Competency Standards, indicating that their learning outcomes remain suboptimal. To address this, teachers should engage students in learning activities that develop their thinking and problem-solving abilities within an enjoyable learning environment (Yuliati & Lestari, 2019).

Teachers can optimize science learning outcomes by utilizing teaching methods, media, and instructional materials that connect subject matter to students' real-life experiences. However, in practice, many teachers still rely on conventional approaches. This is in line with Nurfajriani & Chairani (2023), who stated that a major reason for the underdevelopment of students' thinking skills is the lack of teaching materials beyond textbooks and worksheets. Field observations conducted by Septiani (2019) revealed that teachers' instructional methods and media remain limited, often focusing only on practical or project-based approaches. Monotonous teaching methods hinder students from fully absorbing the material, leading to reduced interest in learning and a mismatch between instructional methods and the type of content being delivered.

Further observations conducted by researchers at several public elementary schools in the showed that teachers primarily use school-provided instructional materials, such as teacher and student guidebooks. Teaching is often carried out through lecture-based methods alone. Moreover, many teachers are not yet skilled in utilizing technology or engaging learning media to stimulate student activity and participation.

Based on the facts outlined above, there is a need for a method that can improve the quality of learning. The use of instructional methods, media, and materials aligned with the current curriculum can help enhance students' 21st-century skills. One such approach is the use of e-modules as teaching materials. Media used as learning tools assist and facilitate teachers in delivering content more easily and meaningfully (Putra et al., 2023).

E-modules are instructional materials designed to support learning activities and can be used independently by students. These electronic teaching materials aim to make the learning process more engaging and interactive. Designed for self-paced learning without direct teacher supervision, e-modules can be accessed through smartphones to enhance learning quality (Ningrum et al., 2022; Permana et al., 2021; Wahyuni et al., 2020). They serve as structured and engaging learning tools, incorporating methods, boundaries, and assessments to help achieve learning objectives (Sari & Lubis, 2024). E-modules are preferred due to their affordability, efficiency, and time-saving benefits, as well as their use of visual elements such as images, videos, and animations (Widiari et al., 2023). Students who have used e-modules report that they are easier to understand and allow for focused, independent learning (Yovita et al., 2023). Thus, e-modules can be defined as electronic teaching materials accessible anytime and anywhere via laptops or smartphones, and suitable for independent study.

The effectiveness of e-modules in science learning can be further enhanced when combined with a problem-solving model. This model supports students in addressing learning challenges. Problem-solving is a learning approach that guides and encourages students to think critically and systematically in resolving academic issues (Anas, 2017). It plays a vital role in enabling students to observe situations, consider logical consequences, focus on key problems, identify connections among pieces of information, and draw conclusions. These processes help develop students' critical thinking skills (Repelitawati, 2022; Ningrum, 2022).

Based on this background, the researcher proposes a study entitled " Development of Problem Solving E-Modules to Improve Critical Thinking Skills and Learning Outcomes on Human Body Organ System Material" This study aims to validate the problem solving based e-module, as well as to assess its practicality and effectiveness in the learning process.

2. RESEARCH METHOD

This research will be conducted in public elementary schools in Lumajang Regency during the even semester of the 2024–2025 academic year. Lumajang Regency was selected as the research site due to the limited innovation among teachers in developing teaching materials. The method used in this study is Research and Development (R&D) with a 4D model. The 4D development model, proposed by Thiagarajan (1974), consists of four stages: Define, Design, Develop, and Disseminate.

This study involved three validators, consisting of two lecturers from the Science Education Program at the University of Jember and one elementary school teacher. The small-group trial was conducted with 15 fifth-grade students at SD Negeri Mlawang 01, while the large-group trial involved 28 fifth-grade students at SD Negeri Klakah 01. In addition, one classroom teacher participated in the implementation process to observe the learning activities. The schools were selected using a purposive sampling technique, based on the consideration that teachers had limited innovation in developing instructional materials.

The research instruments were developed based on the data collection needs at each stage. These instruments include an e-module validation sheet, an e-module implementation observation sheet, a student response questionnaire, a learning outcomes test, and a critical thinking skills test. The e-module validation sheet is used to obtain expert evaluations of the developed e-module from instructional media experts. The implementation observation sheet is used to observe teacher and student activities during the learning process using the problem-solving-based e-module. The student response questionnaire gathers data on students' perceptions and responses to the e-module.

The development of the teaching materials was analyzed using quantitative analysis techniques. The data included expert validation results, observation sheets on learning implementation, learning outcomes, and critical thinking test results, as well as student response questionnaire data. Product validation analysis was conducted to determine the validity of the e-module. This validity was assessed based on the scores provided by validators using a Likert scale as the measurement instrument in the validation process.

Table 1. Rating Scale for Validation Sheet

Symbol	Category	Score
SS	Strongly Agree	4
ST	Agree	3
TS	Disagree	2
STS	Strongly Disagree	1

Source: adapted from Sugiyono (2019)

Next, it was calculated using the following formula.

$$\textbf{Percentage (\%)} = \frac{\sum \textit{the score obtained } x \textbf{ 100 \%}}{\sum \textit{maximum score}}$$

Based on table 1, the assessment of the e-module can be categorized as valid if the validation test value reaches the range of 85-100%.

Table 2. E-Module Validity Criteria

Percentage	Category	Information
85% < V ≤ 100%	Valid	No revision
70% < V ≤ 85%	Quite Valid	Sufficient revision
50% < V ≤ 70%	Less Valid	Partial revision
25% < V ≤ 50%	Not Valid	Full revision

Source: Akbar (2017)

The practicality of the e-module was measured using an implementation observation sheet. This sheet was used to review the implementation of the e-module based on the stages of the learning process using the problem-solving-based e-module. The observation results were then calculated using the following formula.

$$\textbf{Percentage (\%)} = \frac{\sum \textit{the score obtained } x \textbf{ 100 \%}}{\sum \textit{maximum score}}$$

Table 3. E-Module Practicality Categories

No.	Achievement Level (%)	Category
1	80% < P ≤ 100%	Very Practical
2	65% < P ≤ 80%	Practical
3	25% < P ≤ 65%	Quite Practical
4	P ≤ 25%	Not Practical

Source: adapted from Pratama & Effendi (2021)

The effectiveness of the e-module is assessed based on students' cognitive learning outcomes and critical thinking skills. The completeness of student learning outcomes is obtained from the pretest and posttest scores for cognitive learning outcomes and critical thinking skills. These pretest and posttest scores are then calculated using the following formula.

$$\textbf{N-Gain} = \frac{Score\ posttest - score\ pretest}{Maximum\ score - score\ pretest}$$

Description:
N-Gain = Normalized Gain
Pretest = Initial learning score
Posttest = Final learning score

Table 4 N-Gain Score Categories

No.	N-Gain Value	Category
1	0,7 ≤ g	High
2	0,3 ≤ g < 0,7	Medium
3	g < 0,3	Low

Source: Hake (2002)

The effectiveness of the e-module can also be seen from the student response questionnaire which is then calculated using the following formula.

$$\textbf{Percentage (\%)} = \frac{\sum Score\ obtained x\ 100\ \%}{total\ score}$$

Table 5. Classification of Student Responses

No.	Percentage (%)	Criteria
1	81% < R ≤ 100%	Very Good
2	61% < R ≤ 80%	Good
3	26% < R ≤ 60%	Fairly Good
4	R ≤ 25%	Poor

Source: adapted from Simatupang (2023)

3. RESULT AND DISCUSSION

Researchers employed the 4D model in developing problem-solving-based e-module teaching materials. This model consists of four stages: (1) Define, where researchers conducted a needs analysis, curriculum analysis, and technology analysis; (2) Design, where the problem-solving-based e-module was conceptualized and designed; (3) Develop, where the product underwent validation by several experts to receive evaluations, feedback, and suggestions for improvement; and (4) Disseminate, where the finalized product was prepared for broader distribution. The developed e-module was evaluated by a team of learning media experts, consisting of two lecturers from the Science Education Program at the University of Jember and one civil servant elementary school teacher. The evaluation covered several aspects, including visual appearance, ease of use, consistency, graphic quality, content relevance, language clarity, and overall presentation. The results of the e-module validation are presented in Table 6.

Table 6. Summary of E-module Validation Results

No	Aspects	Score			Average	Category
		V1	V2	V3		
1.	Visual appearance	8	7	8	7,7	Valid

No	Aspects	Score			Average	Category
		V1	V2	V3		
2.	Ease of use	15	18	18	17	Valid
3.	Consistency	16	12	16	14,7	Valid
4.	Graphics	19	20	20	19,7	Valid
5.	Content suitability	22	21	22	21,7	Valid
6.	Language suitability	6	8	7	7	Valid
7.	Presentation	15	14	15	14,7	Valid
Total Score		101	100	106	102,3	Valid
Percentage		90,2%	89,3%	94,6%	91.4%	Valid

Based on the recapitulation results above, the total score obtained from validator 1 was 101 with a percentage of 90.2%, validator 2 was 100 with a percentage of 89.3% and validator 3 was 106 with a percentage of 94.6%. The average percentage obtained was 91.4% with a valid category. Visual displays need to be as engaging as possible to increase student interest in learning. Ease of use means that the e-modules are easy to use, practical, and provide clear information, avoiding confusion. Instructions should also be easily understood by students. Consistency: The use of words, terms, sentences, shapes, fonts, layout elements, and paragraph separation are clear and consistent. Graphics: images, videos, color, and narrative are also clearly visible and easy to understand.

Content-based learning activities are presented clearly and appropriately, reflecting the appropriateness of the content, material, and learning objectives. The presentation of images, videos, and questions can also facilitate student learning and encourage critical thinking. Ramadayanty et al. (2021) also explain that e-modules allow teachers to display images, audio, video, animations, and formative tests or quizzes, allowing for rapid feedback.

In terms of language, the sentences used are in accordance with the KBBI (Big Indonesian Dictionary) and utilize communicative language without creating multiple interpretations. The presentation of the material is coherent and engaging. Students will be more motivated to learn because the content in the e-module is structured in an engaging manner, hoping to facilitate understanding (Wulandari et al., 2021). Learning activities in the e-module also enhance student independence. Based on the description above, the e-module is considered valid by learning media experts because the content presented in the e-module is appropriate and interconnected with the learning material provided. Furthermore, the presentation is coherent and engaging, thus motivating students to learn.

The practicality of using the problem-solving-based e-module was measured using an e-module implementation observation sheet. The use of the problem-solving e-module was initially piloted in a small class at Mlawang 01 Public Elementary School, Klakah District, with 15 students. This pilot test was conducted over two sessions. The results of observations of the implementation of learning carried out during two meetings using problem-solving-based e-modules in small classes at Mlawang 01 State Elementary School, Klakah District can be seen in table 7.

Table 7. Summary of Observation Results on the Implementation of E-Modules in Small Classes

No.	Aspects	Meeting 1		Meeting 2		Average	Category
		O1	O2	O1	O2		
Introduction							
1.	Students were given Chromebooks with e-modules already installed.	4	4	4	4	4	very practical
2.	Students reviewed the descriptions and user guides for the e-modules.	4	4	4	4	4	very practical
3.	Students reviewed the learning outcomes, indicators, and concept maps in the e-modules.	3	4	4	4	3,8	very practical
4.	Students reviewed the learning objectives in the e-modules.	4	4	4	4	4	very practical
Core							
5.	Students identify problems in the e-module.	3	3	4	3	3,3	very practical
6.	Students work on the worksheet (LKPD) with their group members.	3	3	3	4	3,3	very practical
7.	Students observe additional materials and resources (videos, external links) in the e-module that support problem-solving exploration.	3	3	3	4	3,3	very practical

No.	Aspects	Meeting 1		Meeting 2		Average	Category
		O1	O2	O1	O2		
8.	Students write down their problem-solving results in the answer column in the e-module.	3	3	4	3	3,3	very practical
9.	Students evaluate and draw conclusions based on the problem-solving results in the e-module.	3	3	3	4	3,3	very practical
Closing							
10.	Students work on practice questions and quizzes in the e-module.	3	3	4	3	3,3	very practical
11.	Students reflect on the e-module.	3	3	3	4	3,3	very practical
	Total score	36	37	40	41	38,5	very practical
	Percentage	81,8 %	84,1 %	90,9 %	93,2%	87,5%	very practical

Table 7 shows that the problem-solving-based e-module piloted in small classes at Mlawang 01 Public Elementary School, Klakah District, achieved an average score of 38.5. The average practicality percentage was 87.5%, categorized as very practical. These results suggest that the problem-solving-based e-module can be used in large classes, specifically at Klakah 01 Public Elementary School, Klakah District.

Subsequent learning implementation observations were conducted in large classes at Klakah 01 Public Elementary School, Klakah District. The total number of fifth-grade students enrolled was 28. The large class activities were conducted over two meetings. The results of the two meetings of observations using the problem-solving-based e-module in large classes at Klakah 01 Public Elementary School, Klakah District, are presented in Table 8.

Table 8. Summary of Observation Results of E-Module Implementation in Large Classes

No.	Aspects	Meeting 1		Meeting 2		Average	Category
		O1	O2	O1	O2		
Introduction							
1.	Students were given Chromebooks with e-modules already installed.	3	4	4	4	3,8	very practical
2.	Students reviewed the descriptions and user guides for the e-modules.	4	3	4	4	3,8	very practical
3.	Students reviewed the learning outcomes, indicators, and concept maps in the e-modules.	4	4	4	4	4	very practical
4.	Students reviewed the learning objectives in the e-modules.	3	3	3	4	3,3	very practical
Core							
5.	Students identify problems in the e-module.	3	3	3	3	3	practical
6.	Students work on the worksheet (LKPD) with their group members.	3	3	3	4	3,3	very practical
7.	Students observe additional materials and resources (videos, external links) in the e-module that support problem-solving exploration.	4	3	3	3	3,3	very practical
8.	Students write down their problem-solving results in the answer column in the e-module.	3	4	4	4	3,8	very practical
9.	Students evaluate and draw conclusions based on the problem-solving results in the e-module.	3	3	3	3	3	practical
Closing							
10.	Students work on practice questions and quizzes in the e-module.	4	4	4	3	3,8	very practical
11.	Students reflect on the e-module.	3	4	3	4	3,5	very practical
	Total score	37	39	40	40	39	very practical
	Percentage	84.1%	88.6%	90.9%	90.9%	88,6%	very practical

Table 8 shows that the problem-solving-based e-module was implemented in large classes at Klakah 01 Public Elementary School, Klakah District. This e-module received an average score of 39. The e-module's

practicality level reached 88.6%, categorized as very practical. The observation assessment of the e-module's implementation was based on the ease of learning activities using the e-module. The e-module does not require complex device specifications. The instructions for use and the e-module's features are clearly displayed and easy to operate, thus not complicating students' learning. During the e-module use, students did not encounter any obstacles and were able to complete assignments within the allocated time.

During the learning activities, the researcher conducted the e-module using the problem-solving learning steps. Problem-solving is an activity that aims to provide understanding and engage students in problem-solving by examining, reflecting on, and investigating a problem to find the right solution (Agustina & Yuwaningsih, 2023; Repelitawati, 2022).

Learning activities using e-modules, conducted using a problem-solving model, can help students develop critical thinking. This is because the e-modules provide clear and sequential problem-solving steps, along with practice questions that support critical thinking. Students will also play an active role in learning activities, selecting and finding information or data to then draw conclusions (Fitrisyahni & Ningsih, 2023). The use of these e-modules can also encourage student engagement, both independently and collaboratively in groups.

Problem-solving-based e-modules are considered highly practical because they facilitate the learning process. Furthermore, students can easily learn to complete the stages of problem-solving. Based on this, the use of e-modules will enable students to develop skills in technology-based learning and develop critical thinking skills.

The effectiveness of the developed problem-solving-based e-modules was measured using pretest and posttest scores from learning outcome tests and critical thinking skills. Furthermore, the effectiveness of the problem-solving-based e-modules was measured using student questionnaire responses. The following presents the results of the e-module's effectiveness. The learning outcome and critical thinking skills tests were calculated using the n-gain formula. Details of the learning outcome and critical thinking skills tests can be seen in table 9 and 10.

Table 9. Details of Learning Outcome Test Results in Small Classes

Test Indicator	N	$\bar{x}$. SD		Average N-gain	N-gain Category
		Pretest	Posttest		
Learning Outcomes	15	34 ± 12,9	84 ± 3,7	0,76	High

Based on data from a small class trial at Mlawang 01 Elementary School in Klakah District, it was found that students' cognitive learning outcomes achieved an average pretest score of 34 with a standard deviation of 12.9. Meanwhile, the average posttest score was 84 with a standard deviation of 3.7. The average n-gain from the cognitive learning outcome test was 0.76, categorized as high.

Table 10. Details of Critical Thinking Skills Test Results in Small Classes

No.	Critical Thinking Indicators	$\bar{x}$. SD		Average N-gain	N-gain Category
		Pretest	Posttest		
1.	Interpretation	34 ± 13	86 ± 7	0.79	High
2.	Analysis	48 ± 14	90 ± 12	0.81	High
3.	Inference	40 ± 11	88 ± 8	0.79	High
4.	Evaluation	27 ± 14	82 ± 9	0.75	High
5.	Exploration	40 ± 18	88 ± 12	0.81	High
6.	Self-Regulation	48 ± 11	82 ± 9	0.65	Medium
Average				0,77	High

Table 4.5 shows a very significant increase in all critical thinking indicators, as reflected in the comparison of the average pretest and posttest scores, as well as the average n-gain value. The overall average n-gain value was 0.77, categorized as high. This indicates that the problem-solving-based e-module provided was highly effective in improving students' critical thinking skills across the board.

Learning outcome and critical thinking skills tests were also administered to large classes at Klakah 01 Public Elementary School, Klakah District. This test aimed to measure students' mastery of the material and critical thinking skills on a broader scale. A complete breakdown of the test results can be seen in Tables 11 and 12.

Table 11. Details of Learning Outcomes and Critical Thinking Test Results in Large Classes

Test Indicator	N	$\bar{x}$. SD		Average N-gain	N-gain Category
		Pretest	Posttest		
Learning Outcomes	28	44 ± 10,6	86 ± 4,3	0,75	High

Based on data from large classes at Klakah 01 Public Elementary School, Klakah District, it is known that students' cognitive learning outcomes obtained an average pretest score of 44 with a standard deviation of 10.6. Meanwhile, the average posttest score was 86 with a standard deviation of 4.3. The average n-gain from the cognitive learning outcome test was 0.75, which is in the high category. This indicates that the developed problem-solving-based e-module is effective in improving student learning outcomes.

Table 12. Details of Critical Thinking Skills Test Results in Large Classes

No.	Critical Thinking Indicators	$\bar{x}$. SD		Average N-gain	N-gain Category
		Pretest	Posttest		
1.	Interpretation	38 ± 10,5	85 ± 5,4	0.76	High
2.	Analysis	46 ± 16,7	91 ± 14	0.84	High
3.	Inference	41 ± 19,6	89 ± 7,7	0.82	High
4.	Evaluation	33 ± 8,5	84 ± 11,1	0.77	High
5.	Exploration	42 ± 23,6	88 ± 12,7	0.78	High
6.	Self-Regulation	38 ± 15,6	83 ± 9,8	0.75	High
Average				0,78	High

Table 12 presents detailed results of the critical thinking skills test implemented in the large-class trial. This data is crucial for assessing the effectiveness of the e-module on a broader scale. Overall, the data indicate a significant increase in students' critical thinking skills, although there was variation in the improvement categories for each indicator. The overall average n-gain value was 0.78, categorized as high. This indicates that the problem-solving-based e-module developed is effective in improving critical thinking skills in the larger population.

The n-gain results from the learning tests at the two schools yielded similar results. Meanwhile, the n-gain on the critical thinking skills test decreased. The slight decrease in the n-gain scores of critical thinking skills, particularly in the large-class trial, may be caused by the heterogeneity of student abilities, which makes it more challenging for all learners to progress equally. In addition, indicators such as evaluation and self-regulation generally require higher levels of cognitive control and independent learning, which many students still find difficult. To address this, teachers are advised to provide additional scaffolding and guidance, for example by giving more structured feedback, offering practice tasks that target evaluation and self-regulation, and facilitating peer discussions that allow students to reflect on their problem-solving processes. These strategies can help strengthen the indicators that showed lower improvement. Although this decrease occurred, the scores were in the same category. The effectiveness of the e-module, as seen from the learning and critical thinking skills test results, is due to the e-module's integration with problem-solving-based learning. Consequently, the pretest results, which were previously low, improved.

The effectiveness of the problem-solving-based e-module was also measured through a questionnaire administered to students. The questionnaire was administered at the completion of the two learning sessions. This questionnaire aims to explore students' experiences using e-modules, thereby providing an in-depth understanding of the benefits of the developed learning media. The following are the results of the questionnaire, which collected student responses in small classes at Mlawang 01 Public Elementary School, Klakah District.

Table 13. Recapitulation of Student Response Questionnaire in Small Classes

No.	School Name	Percentage of Student Response Questionnaire	
		Meeting 1	Meeting 2
1.	SD Negeri Mlawang 01	85%	89%
Average Percentage		87%	
Criteria		Very Good	

Based on data from student response questionnaires in small classes at Mlawang 01 Public Elementary School, Klakah District, the percentage of students responding to the questionnaire was 85% in the first meeting. In the second meeting, the percentage increased to 89%. The average percentage across the two meetings was 87%, with very good effectiveness criteria.

Student response questionnaires were also administered to large classes at Klakah 01 Public Elementary School, Klakah District. The purpose of administering these questionnaires was to obtain feedback from students in the large classes. The following are the results of the student response questionnaires administered to small classes at Klakah 01 Public Elementary School, Klakah District.

Table 14. Recapitulation of Student Response Questionnaire in Large Classes

No.	School Name	Percentage of Student Response Questionnaire	
		Meeting 1	Meeting 2
1.	SD Negeri Klakah 01	85%	87%
Average Percentage		86%	
Criteria		Very Good	

Based on student questionnaire data from small classes at Mlawang 01 Elementary School, Klakah District, the percentage of students responding to the questionnaire was 85% in the first meeting. In the second meeting, this percentage increased to 87%. The average percentage across the two meetings was 86%, indicating very good effectiveness.

According to students, the e-modules presented were easy to understand, the material was engaging, the illustrations and fonts were clear, and the images and videos were engaging. They also helped deepen the material. The e-modules were also beneficial for expanding knowledge, engaging students' attention, increasing their learning engagement and motivation, facilitating problem-solving, facilitating teacher delivery, and making learning more effective and efficient (Lastri, 2023). However, the developed e-module also has some limitations. Its interactive features are still relatively simple, the problem-solving tasks are limited in variety, and the design focuses only on the human body organ system material. In addition, its effectiveness depends on the availability of digital devices, so teacher guidance remains necessary for optimal use in diverse school contexts.

4. CONCLUSION

Based on the results of the analysis and discussion from the research on the development of a problem-solving-based e-module to improve critical thinking skills and learning outcomes in elementary school students, it can be concluded that the developed e-module achieved an average validity score of 91.4%, categorized as valid and suitable for use in Grade V learning. The practicality test showed an average score of 87.5% in small group trials and 88.6% in large group trials, both falling into the very practical category. The effectiveness of the e-module was demonstrated through average n-gain scores of 0.76 for learning outcomes and 0.77 for critical thinking skills in small classes, and 0.75 and 0.78 respectively in large classes, all of which were categorized as high. In addition, student responses indicated very good criteria, with average satisfaction scores of 87% in small classes and 86% in large classes. These results indicate that the problem-solving-based e-module is valid, practical, effective, and well-received, making it suitable for use in Grade V elementary school.

5. ACKNOWLEDGEMENT

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6. REFERENCES

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