



## DEVELOPMENT OF AN E-MODULE CONTAINING ICARE (INSTRUCTION, CONNECTION, APPLICATION, REFLECTION, AND EXTENSION) IN THE TOPIC OF TRIANGLES FOR EIGHTH GRADE

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### Abstract

*The development of mathematics e-modules to support learning has been widely conducted; however, e-modules designed with ICARE components on the topic of triangles remain limited. This study aims to develop mathematics teaching materials in the form of an ICARE-based e-module for the topic of triangles for eighth-grade students. The research type used is development or Research and Development (R&D) employing the ADDIE development model. However, the implementation was limited to three stages: Analysis, Design, and Development. The subjects of this study were two mathematics teachers. The e-module was validated by content experts and design experts. Instruments used to collect data included interviews, validation questionnaires, and educator response questionnaires. The analysis stage results indicate that students require alternative digital teaching materials to support learning. In the design stage, an ICARE-approach mathematics e-module on triangles was developed to facilitate student understanding. The development stage included validation tests by content and design experts, yielding highly valid results. The e-module's content validity reached 91.35%, categorized as very valid, while its design validity reached 87.21%, also categorized as very valid. Additionally, a practicality test by educators yielded a result of 66.80%, categorized as sufficiently practical. Thus, this e-module is expected to serve as an alternative digital teaching material that effectively supports the mathematics learning process and acts as a self-learning medium for students, thereby increasing student motivation. It is also expected that future research will consider this e-module as an additional learning resource for teachers that can support differentiated instruction.*

**Keywords:** Development, E-Modul, ICARE

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**INTRODUCTION**

Effective teaching materials are those that can meet the needs of learners according to their abilities, whether high, medium, or low (Yuliastuti and Soebagyo, 2021). In addition, quality learning media can encourage students' interest in learning due to the use of easily understood language and can serve as a guide for students to study independently without the presence of an instructor (Wicaksono, Handayanto, and Happy, 2020).

Based on observations and a needs analysis survey involving 25 respondents at SMP Negeri 8 Cirebon, it was found that mathematics is considered a difficult subject by 52% of students. Regarding teaching materials used at the school, data showed that Student Worksheets are the most dominantly used materials, with a percentage of 92%. Additionally, printed textbooks are still widely utilized by teachers and students, accounting for 64%. Meanwhile, other teaching materials such as Student Activity Sheets constitute 32%, and e-modules only 16%. From interviews with eighth-grade mathematics teachers, it was revealed that previous learning primarily relied on conventional printed module books, with teachers only delivering material and example problems according to the instructions contained in the printed modules.

These findings indicate that Student Worksheets and textbooks remain the primary choices in school learning, while the utilization of technology-based media such as e-modules is still relatively low. Based on the above issues, the researcher is

motivated to develop an e-module that has been designed for validation so that it is suitable for use in the learning process. In line with Nopriana et al. (2023), to improve the quality of classroom learning, it is advisable for teachers to innovate by designing digital-based teaching materials to assist and support the learning process.

Teaching materials are designed by adjusting to student conditions and the teaching strategies used by teachers. One type of teaching material that can be developed in the learning process is the e-module (Elvarita, Iriani, and Handoyo, 2020). The e-module is a form of teaching material developed in a digital format that includes interactive features such as images, videos, and animations to support learning activities so that they can be conducted interactively, with the expectation that students can use it autonomously to improve learning outcomes (Isnaini, Listiadi, and Subroto, 2022). E-module teaching materials integrate the use of digital technology with the aim that students have independent learning materials that can be accessed anywhere without being limited by space and time (Astuti, Wigati, and Asnilawati, 2023).

The use of e-modules is certainly very important in the learning process because e-modules are innovative teaching materials that can increase student motivation and prevent boredom during learning activities (Arsalan, Rosita, and Dewi, 2019). E-modules are also highly effective in enhancing student participation during learning, and their practical and efficient use is expected to encourage students to improve their thinking skills in solving problems contextually

(Ramadanti, Mutaqin, and Hendrayana, 2021).

Several advantages of e-modules compared to other conventional learning media include interactivity and multimedia capabilities (Senja, Medriati, and Putri, 2024). According to Muljo, Anggreni, and Maulida (2024), the advantages of e-modules lie in their ability to display text, images, animations, and videos through electronic media such as computers, laptops, or smartphones, which can be accessed anytime and anywhere. Other advantages include facilitating mobility since e-modules are not physical materials that burden students, more affordable production costs, good durability and resistance to long-term damage, flexibility, and the ability to embed audio and video within a single presentation.

The development of teaching materials in the form of electronic modules using the ICARE stage method is expected to facilitate students in constructing learning stages as well as building initial interest and knowledge about the learning topic, connecting the topic with students' prior experiences and knowledge, providing opportunities for students to apply knowledge in daily life, encouraging students to reflect on learning and evaluate each student's understanding, and offering additional challenges and opportunities to deepen comprehension (Yuniati, Sari, and Wapajjarna, 2024).

E-modules can be developed using instructional models. ICARE can be chosen as a learning model to develop e-modules. The ICARE learning model consists of five stages: Introduction, Connection, Application, Reflection, and Extension. The

development of e-modules assisted by ICARE is designed to align with the stages of ICARE and tailored to material that can utilize the ICARE learning model (Munazad, Hafizah, and Sauqina, 2023). The use of e-modules will not be effective without being supported by an appropriate learning model. By using the ICARE learning model as a classroom learning tool, it is expected to facilitate students in carrying out teaching and learning activities using interactive e-modules that can be easily applied to everyday life (Latifah, Irianti, and Azizahwati, 2024).

From the explanations above, it can be concluded that an e-module is a digital teaching material that contains multimodal media and learning tools, featuring various elements such as images, audio, videos, and educational games for tests, quizzes, and so forth. E-modules can be accessed via mobile phones, laptops, and similar devices anytime and anywhere. E-modules are more effective when combined with the ICARE method, as it includes five essential stages that support student learning success. Learning using e-modules is also expected to enhance the learning process because by utilizing e-modules, students become more interested and motivated to learn. This study aims to develop mathematics teaching materials in the form of an ICARE-based e-module on the topic of triangles for eighth-grade students.

The use of the ICARE-based learning model in e-modules aims to provide systematic and structured learning in the instructional process, enabling students to more easily and optimally absorb the teaching material. The ICARE stages influence the

equitable distribution of student learning by employing structured steps and applying concepts in real-life contexts, thereby assisting students in developing skills used in daily life. The difference in using ICARE-based e-modules compared to previous studies lies in the highly focused learning approach that provides access to active student involvement in learning activities, which contrasts sharply with conventional learning that centers solely on one-way information delivery. Research by Arianti, Astawan, and Krisnaningsih (2021) demonstrated that the use of the ICARE learning model is very effective in improving students' cognitive learning outcomes by 46.2% compared to conventional learning models. The novelty of using ICARE-based e-modules lies in its structured approach that integrates essential stages in the learning process. The learning focus on developing critical thinking skills, collaboration, communication, and the use of ICARE in e-modules is highly relevant for addressing the educational needs of the 21st century. The use of e-modules in learning holds significant urgency as a suitable alternative solution aligned with current technological needs and developments.

The use of digital teaching materials in the form of e-modules enables students to access learning content anytime and anywhere using digital devices, thereby providing highly flexible and convenient access. E-modules integrate various multimedia elements such as text, images, audio, and video, allowing students to understand complex

material concepts more engagingly and enhancing their learning motivation. In this context, although e-modules have several advantages, they are not a singular solution to replace printed textbooks; many other alternatives can help balance the delivery of instruction to students. Therefore, a well-considered and contextual approach, along with a broader analysis of student learning needs, is required to select appropriate learning media for students. E-modules represent an innovation in education that offers flexibility, interactivity, and efficiency in learning, with usage adapted to the needs, conditions, and contexts of students and subject teachers. The collaboration between e-modules and printed textbooks will create richer and more effective learning experiences.

## **METHOD**

In this study, the author employs a development research type known as Research and Development (R&D) (Gall, Gall, and Borg, 2007). Research and development is a process or set of steps aimed at developing a new product or refining an existing product in an accountable manner. The model used in this development research is the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Branch, 2009). However, in this study, the researcher only conducted the Analysis, Design, and Development stages of the ADDIE model. The research was limited to the Development stage due to time constraints, and thus the Implementation and Evaluation stages will be conducted in subsequent research.

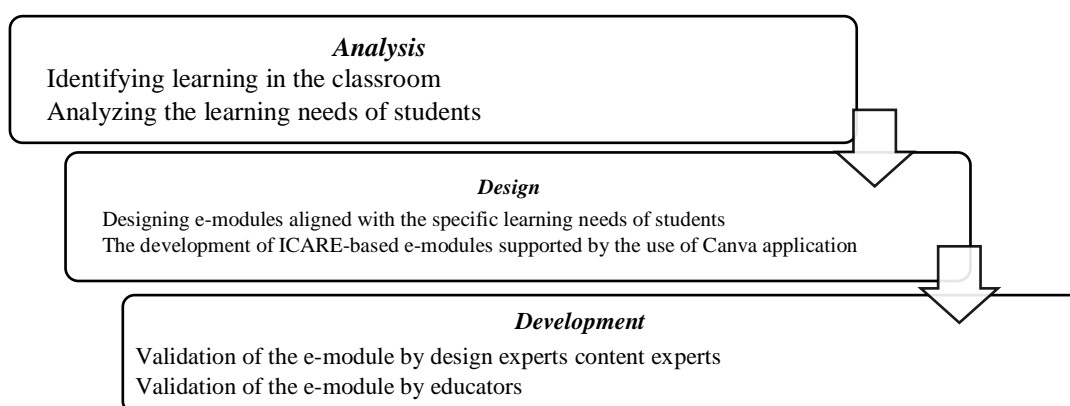


Figure 1. ADDIE research stages conducted

In the analysis stage, the learning problems were identified and the needs of students and teachers regarding the ICARE-based e-module (Introduction, Connection, Application, Reflection, and Extension) were analyzed. The data used in this study consisted of qualitative data obtained from e-module validation questionnaires and teacher response questionnaires. Qualitative data were also collected through interviews with teachers. The data sources included two mathematics teachers at SMP Negeri 8 Cirebon and validators who validated the e-module based on expertise in mathematics content; these validators are lecturers at Universitas Swadaya Gunung Jati Cirebon specializing in mathematics education. Meanwhile, the design experts are lecturers at the same institution specializing in mathematics learning media. Consistent with the study by Maniq, Karma, and Rosyidah (2022), the analysis stage is conducted to assess the learning resource needs of students as support for the effective implementation of learning.

In the design stage, the structure, appearance, and interactive features of the e-module were determined. Relevant learning materials aligned with the curriculum and ICARE

principles were prepared and organized. Instruments for data collection, such as media validity questionnaires and practicality questionnaires, were also developed. Consistent with the study by Turnip, Rofi'i, and Karyono (2021), in the design stage, the researcher prepared and designed learning tools, expert validation sheets, and developed e-module media based on a contextual approach.

In the development stage, the e-module was validated by content experts, design experts, and education practitioners to obtain feedback for improvements. The e-module was revised based on the expert validation results. Data collection instruments used included interviews, expert validation sheets, and educator response questionnaires. Consistent with the study by Irawati and Setyadi (2021), in the development stage, the researcher conducted e-module validation according to the required aspects. Subsequently, the collected data were analyzed using the following steps:

#### **Expert Team Validation Data Analysis**

The instruments for content validation and design validation

questionnaires use a Likert scale as a form of product assessment, complemented by comments and suggestions for trial use in the research phase. According to Purwanto (2018), the validation assessment criteria using a Likert scale consist of five score levels that represent the degree of validator agreement with a statement. The highest score of 5 is assigned to “Strongly Agree (SA),” a score of 4 for “Agree (A),” 3 for “Neutral (N),” 2 for “Disagree (D),” and the lowest score of 1 for “Strongly Disagree (SD).”

To determine the percentage of data validity obtained from the item scores, the calculation can be performed using the following formula:

The resulting validity percentage is classified according to the percentage criteria shown in Table 1.

Table 1. Classification of e-module validity percentage

Validity Level (%)	Validity Criteria
85 – 100	Very Valid
70 – 84,9	Valid
50 – 69,9	Less Valid
0 – 49,9	Invalid

*Adapted from: (Arikunti and Jabar, 2018)*

An e-module is considered good and feasible for use if it is declared valid by validators with a minimum validity criterion of “adequately valid.”

#### **Teacher Response Data Analysis**

The analysis of data from teacher responses aims to measure the practicality of the ICARE-based e-module (Introduction, Connection, Application, Reflection, and Extension) on the topic of triangles for eighth-grade students. Based on the questionnaire distributed, teachers were freely allowed to provide

comments and suggestions to facilitate the researcher in revising the teaching material. To determine the practicality of the e-module, scoring was conducted using the same criteria as in the expert validation data analysis, namely the Likert scale. Subsequently, the collected data were analyzed using descriptive quantitative methods and then described using a data frequency analysis technique with the following formula:

$$V_s = \frac{\text{Total score per indicator}}{\text{Maximum score per indicator}} \times 100\%$$

The score classification is then interpreted in qualitative statements based on the qualifications in Table 2.

Table 2. Classification of e-module practicality percentage

Practicality Level (%)	Practicality Criteria
80 – 100	Very Practical
60 – 74,9	Practical
40 – 59,9	Less Practical
20 – 39,9	Impractical
0 – 19,9	Very Impractical

*Diadaptasi dari: (Akbar, 2013)*

## **RESULT AND DISCUSSION**

### **Analysis**

In the Analysis stage, based on observations, interviews, and identification of the school environment, it was found that mathematics learning has not fully met practical and effective criteria. This issue is reinforced by the finding that 92% of students still use learning materials in the form of Student Worksheets (LKS). Additionally, conventional printed textbooks are still widely used by teachers and students, accounting for 64%, and the uneven distribution of books has resulted in less conducive and suboptimal

learning conditions. Therefore, the development of teaching materials needs to be adjusted to students' needs and follow technological advancements to ensure all students have equal access to learning.

Students' initial knowledge and learning outcomes that remain below average are among the problems, including a lack of interest and motivation in learning. The presence of monotonous and unengaging textual material causes students with low literacy skills to fall behind in learning. Therefore, these issues have motivated the researcher to develop a learning module packaged with digital innovation, resulting in a learning

product in the form of a mathematics e-module on the topic of triangles for eighth-grade students, incorporating the ICARE components to facilitate students in studying mathematics material in class.

### **Design**

In the design stage, the ICARE-based e-module was developed, where the layout of the triangle e-module includes the initial display featuring a cover page, foreword, module usage instructions, table of contents, concept map, pre-learning test, learning materials, example problems and discussions, summary, exercises and quizzes, as well as a bibliography.

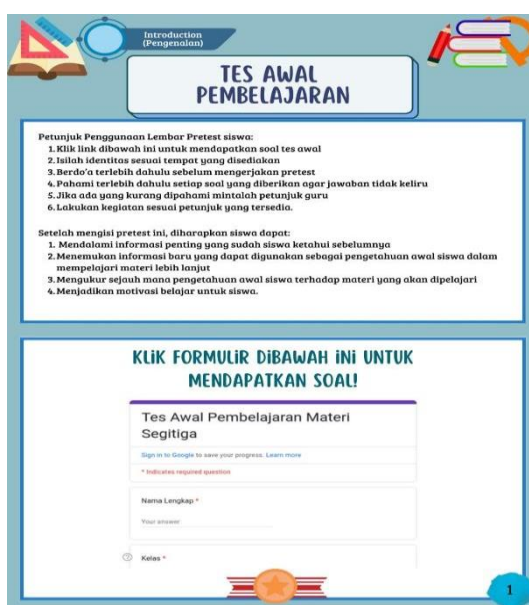


Figure 1. Introduction stage in the e-module

This ICARE-based mathematics e-module is structured according to the ICARE framework, beginning with the Introduction stage, which is presented at the start of the learning activities. This section includes several pretest questions delivered through a Google

Form covering basic knowledge on the topics of triangles and the Pythagorean theorem. Students are then guided to complete the pretest in the Google Form to build their initial understanding of the triangle material.

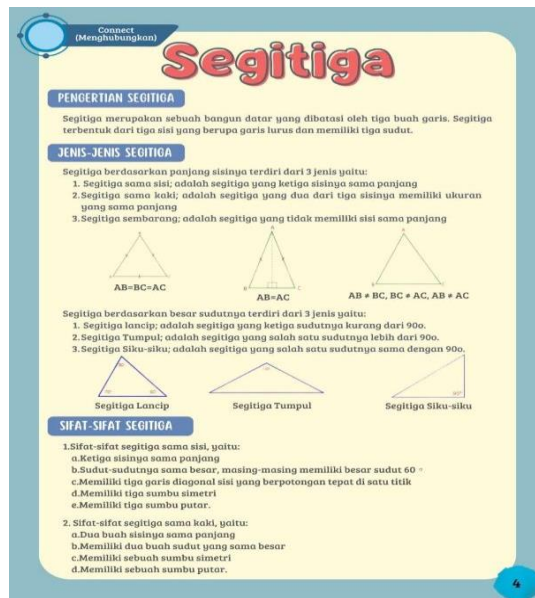


Figure 2. Connection stage in the e-module

Secondly, in the Connection stage, students are asked to explain the definition of a triangle, the types of triangles, properties of triangles, the formula for the area of a triangle, the

formula for the perimeter of a triangle, and to relate the concept of triangles to real-life examples to enhance students' understanding and motivation.



Figure 3. Application stage in the e-module

Thirdly, the Application stage involves practice, where students are given exercises and relevant problems,

encouraging them to apply triangle concepts in various situations, both in calculations and problem-solving.

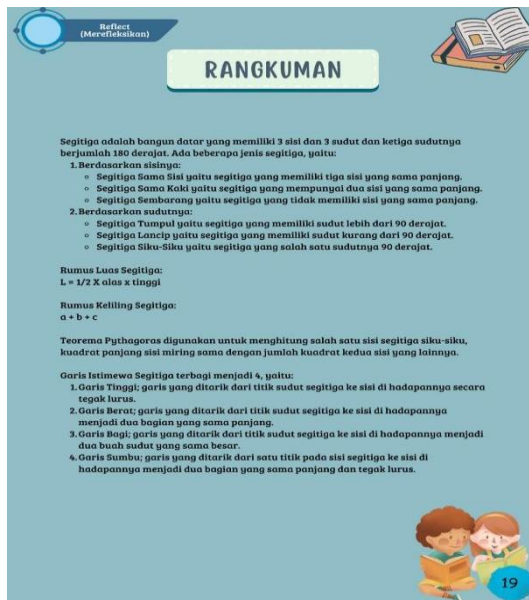


Figure 4. Reflection stage in the e-module

Fourth, the Reflection stage involves reflecting on what has been learned through a summary of the triangle material.

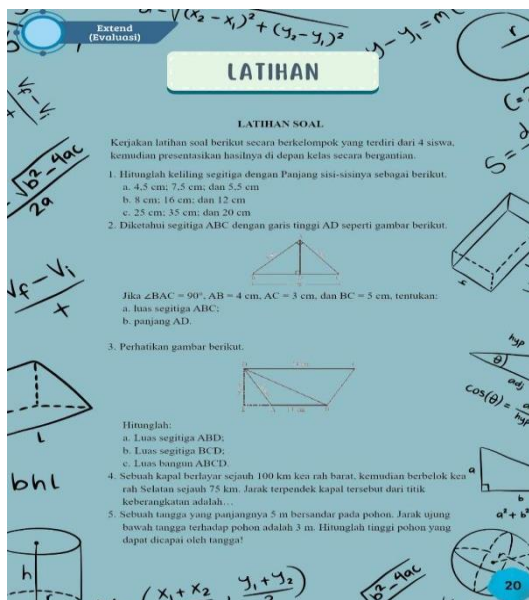


Figure 5. Extension stage in the e-module

Finally, the Extension stage serves as an evaluation, presenting exercises and quizzes to assess and expand students' knowledge and skills in studying triangles.

### Development

In the development stage, the results obtained from this development research consist of ICARE-based e-module teaching materials (Introduction, Connection,

Application, Reflection, Extension) on the topic of triangles for eighth-grade junior high school students. The assessment supporting the evaluation of the e-module includes instrument evaluations by experts. Several instruments were used to determine the feasibility of the ICARE-based e-module, including a design validation instrument administered to design experts, a content validation instrument given to content experts, and a practicality instrument provided to subject teachers who are experts in their fields. The practicality assessment of the ICARE-based e-module by mathematics subject teachers was conducted using a practicality questionnaire, which is expected to provide significant feedback for the designed e-module so that it is deemed suitable for use in learning.

Based on the development process of the ICARE-based e-module on the topic of triangles, the following results were obtained:

### **E-Module Validity Test**

The e-module validity test was conducted to assess the validity of the e-module product. The instrument used in this study was a closed-ended questionnaire; however, validators were also encouraged to provide free comments and suggestions regarding the e-module. This was followed by content validation conducted by content experts, who evaluated the ICARE-based e-module teaching materials across several aspects, including content accuracy, relevance, language quality, content completeness, and adherence to the ICARE framework.

After the validation stage by content experts, validator scores were obtained based on the completed questionnaires. According to Table 3, the content validation results for the e-module showed that Validator 1 scored 97.67%, categorized as very valid, while Validator 2 scored 85.00%, also categorized as very valid. Thus, the average validation score by content experts was 91.35%, which falls under the very valid category.

Table 3. Content validation results by content experts

Validator	No	Research indicators	Total score obtained (V1)	Total score obtained (V2)	Percentage V1 (%)	Percentage V2 (%)	Average result of validation by content experts
Content expert	1	Content Accuracy	28	24	93,33	80,00	
	2	Content Relevance	10	8	100,00	80,00	
	3	Language Usage	19	13	95,00	65,00	
	4	Content Completeness	10	10	100,00	100,00	
	5	ICARE-Based Approach	10	10	100,00	100,00	
<b>Final Result</b>					<b>97,67</b>	<b>85,00</b>	<b>91,35%</b>
<b>Criteria</b>					<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>

**Ojah Siti Nurfaajah, Sulis Wahyuni, Irmawati Liliana Kusuma Dewi, Tri Nopriana**

Development of An E-Module Containing ICARE (Instruction, Connection, Application, Reflection, and Extension) in The Topic of Triangles for Eighth Grade

After completing the content validation stage by content experts, the next step is validation by design experts. The design validator in this study is a lecturer from the Mathematics Education Department at Universitas Swadaya Gunung Jati.

Design validation also used a closed-ended questionnaire, but the validator was encouraged to provide suggestions and feedback on the ICARE-based e-module freely. The design assessment covered several aspects, including writing, visual appearance or graphics, and the characteristics of the e-module. In the design expert's evaluation of the developed e-module, several comments and suggestions were provided: On the e-module cover, the institution and study program logos were in black, which appeared less harmonious with the cover background; therefore, the color was

changed to white for clearer and more harmonious visibility. In the Introduction stage of the e-module, the Google Form for the initial learning test was inaccessible to the reviewer, and the fonts were inconsistent. After revision, the Google Form became accessible, and the fonts were standardized. Additionally, a watermark/logo from Canva appeared on the icon labeled "Masalah 1"; after revision, the icon no longer contained the Canva watermark/logo.

The design validation assessment by design experts yielded a score of 94.48% from Validator 1, categorized as very valid, while Validator 2 scored 79.94%, categorized as sufficiently valid. Thus, the average validation score by design experts was 87.21%, classified as very valid. The design validation results are presented in Table 4.

Table 4. Design validation results by design experts

Validator	No	Research Indicators	Total Score Obtained (V1)	Total Score Obtained (V2)	Percentage of V1 (%)	Percentage of V2 (%)	Average Content Expert Validation Result
Design Expert	1	Writing	15	13	100,00	86,67	
	2	Appearance E-Module	32	27	91,43	77,14	
	3	Characteristics	23	19	92,00	76,00	
<b>Final Result</b>					<b>94,48</b>	<b>79,94</b>	<b>87,21%</b>
<b>Criteria</b>					<b>Very Valid</b>	<b>Valid</b>	<b>Very Valid</b>

### Practicality Test of the E-Module by Educators

The practicality test of the e-module was conducted to obtain initial feedback from educators or mathematics subject teachers regarding the developed e-module's

practicality before it was trialed with students. In this study, the practicality test was carried out on two eighth-grade mathematics teachers at SMP Negeri 8 Cirebon. The instrument used in the practicality trial consisted of a closed-ended questionnaire, while

validators were free to provide comments, suggestions, and feedback on the developed ICARE-based e-module. The aspects assessed in the questionnaire included content feasibility, language, completeness of components, presentation, and practicality.

Next, after the researcher provided the instrument to the mathematics teachers, they reviewed and assessed the e-module and also provided feedback in the form of comments and suggestions regarding the practicality of the e-module. The

subsequent improvement made by the evaluator based on the teachers' comments and suggestions was on Problem 1 in the story problems section, where the type of triangle was not specified. After revision, a description was added indicating that the triangle in question is a right-angled triangle.

After the e-module practicality test, scores were obtained from the teachers based on the previously completed questionnaires. The results of these questionnaires are presented in Table 5.

Table 5. Practicality questionnaire results by teachers

Instrument	No	Indicator	Total Score Obtained (V3)	Total Score Obtained (V4)	Percentage of V3 (%)	Percentage of V4 (%)	Average Practicality Questionnaire Result by Educators
Practicality Questionnaire Results of the E-Module by Educators	1	Content Feasibility	16	23	53,33	76,67	
	2	Language Quality	9	12	60,00	80,00	
	3	Component Completeness	15	17	60,00	68,00	
	4	Presentation	6	8	60,00	80,00	
	5	Practicality	12	14	60,00	70,00	
<b>Final Result</b>					<b>58,67</b>	<b>74,93</b>	<b>66,80%</b>
<b>Criteria</b>					<b>Less Practical</b>	<b>Practical</b>	<b>Practical</b>

Table 5 shows the results of the practicality questionnaire by educators, where the assessment results indicate that Validator 3 gave a practicality level of 56.67%, categorized as less practical, while Validator 4 gave 74.93%, categorized as quite practical. Thus, the average practicality score of the e-module by educators was 66.80%, classified as quite practical.

Based on the presented data, it was found that the development of the ICARE-based mathematics e-module

on the topic of triangles for eighth-grade students yielded positive and significant responses in content validation, design validation, and practicality testing, supporting its use as teaching material in learning. These results are supported by several previous studies that demonstrated increased student interest, motivation, and eagerness to learn. Consistent with research conducted by Tamur and Pantaleon (2023), their findings showed that the use of e-modules integrated with the Kahoot! game

effectively helped students independently learn material both inside and outside the classroom. This finding is further reinforced by positive student responses regarding the effectiveness of e-module usage in the context of secondary education.

A subsequent study by Nuranisa, Indiati, and Rahmawati (2024) found that a scientifically based mathematics e-module was more effective in the experimental class. An engaging, practical, and effective e-module was proven to enhance students' learning outcomes. According to Patri and Heswari (2021), their findings indicated that an ethnomathematics e-module is suitable for use in the learning process on the topic of quadrilateral plane figures, thereby improving students' logical thinking skills. Additionally, Adam, Abbas, and Badu (2024) revealed that a flipbook-based mathematics e-module developed using the PLOMP model received positive responses from both students and teachers. Meanwhile, Danuri and Nurjanah (2022) demonstrated that mathematics e-modules significantly influenced students' mathematical reasoning abilities, as evidenced by a marked increase in students' average learning outcomes.

## CONCLUSION

This study produced teaching materials in the form of an ICARE-based e-module (Introduction, Connection, Application, Reflection, Extension) on the topic of triangles for eighth-grade junior high school students. The ICARE-based mathematics e-module was designed using Canva and Microsoft Word

applications, resulting in a PDF flipbook aimed at facilitating students in learning the triangle material for eighth grade. The e-module is equipped with example problems and exercises presented with solutions aligned to learning indicators and connected to real-life contexts, with the expectation of enhancing students' thinking skills and conceptual understanding, thereby making it easier for students to comprehend and apply the knowledge they have acquired.

The quality of the e-module was assessed based on two criteria: validity and practicality. In terms of content, the e-module achieved a validity level of 91.35%, categorized as very valid, while in terms of design, it attained a validity level of 87.21%, also categorized as very valid. The practicality level of the e-module, as evaluated through questionnaires completed by educators, was 66.80%, classified as quite practical.

The ICARE-based e-module on the topic of triangles for eighth-grade students can be utilized by schools and educators as an alternative teaching material in the learning process, as well as an additional resource for students to study the triangle material. The researcher recommends that future development studies explore creating mathematics e-modules using different supporting applications with advanced creativity, aiming to make mathematics learning more engaging. Examples include using Powtoon for creating presentations and interactive animated videos, Assemblr Edu for designing interactive learning

activities with 3D and Augmented Reality (AR) modes, Snappa, and Adobe Express for diverse graphic design and video editing tailored to the needs of the teaching materials.

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