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DEVELOPMENT OF NUMERACY-BASED MATHEMATICS LEARNING MODULES ON FLAT SIDE SPACE BUILDING MATERIALS

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Abstract

The numeracy abilities of some students in class VIII SMP Plus Al Fatimah are still relatively low so special measures are needed, accompanied by ineffective teaching materials because there are too few material descriptions and the learning methods used are still conventional. So, it is necessary to develop teaching materials in the form of numeracy-based mathematics learning modules as a companion to the textbooks provided by the school. The research aims to develop a mathematics module on flat-sided geometric material that is valid and practical. The type of research used is Research and Development (R & D) with the ADDIE development method (analysis, design, development, implementation, and evaluation). The results of the development research obtained a numeration-based mathematics learning module on flat-sided geometric material with valid and practical categories. The learning module was declared valid by the validator, media experts scored 72.5% in the "valid" category and material experts scored 82.6% in the "very valid" category, the average score was 77.9% in the "valid" category. For the results of the student trials, the practical aspect obtained an average score of 83.195% in the "very practical" category. It can be concluded that the learning module that has been developed is suitable for use.

Keywords: *Learning Module, Numeracy, ADDIE.*

INTRODUCTION

Mathematics is a science that must be studied starting from the most basic education and is the subject of other sciences such as physics, chemistry, biological sciences, accounting, economics, and others. In studying mathematics, a person is trained to think critically, creatively, honestly and be able to apply mathematics in solving problems that occur in real life daily and in other sciences (Anggoro, 2015). The ability to solve problems and mastery of mathematical concepts will help students in solving math problems as well as the ability to apply math problems directly to real life. Problem-solving skills and mastery of mathematical concepts will help students when solving problems as well as the ability to apply math problems directly to real life. Mathematics is a person's provision to be able to solve problems, problems that occur in learning activities and masala that occur in daily life (Fitri, Kurniawati, & Mubaroh, 2021). However, learning today many teachers apply conventional learning methods, teachers do not distribute knowledge widely but tend to ask students to memorize concepts without trying to apply them to problems in daily life.

The use of conventional learning results in students not being able to analyze critically, so that students have difficulty formulating problems, solving problems and applying real context to mathematical models and vice versa. Mastery of

mathematical concepts can help students in solving problems accompanied by numeracy skills. Numeracy skills are the ability that a person has in formulating and applying mathematics in various contexts, the ability to do amethyst reasoning, and the ability to use mathematical concepts, procedures, and facts to describe an event (Cahyanovianty & Wahidin, 2021). Mastery of concepts can be improved in addition to the use of teaching materials during the learning process in the form of modules. Modules are learning media that are systematically arranged, which contains as complete learning as possible that has been planned and compiled with the aim of helping students master learning and evaluation materials (Agusta, 2022).

Based on field analysis, the results were obtained that the method used during learning was a conventional method, namely the use of lecture methods, group discussions and assignments to students. As well as the results of the interview with the resource person, namely a grade VIII mathematics teacher at SMP Plus Al Fatimah that the need for additional teaching materials/modules as companion books to the package books provided by the school, because the package books are felt to have inappropriate content, too excessive and there are also incomplete ones in each material. As well as the difficulty of students in solving problems that use formulas that are related to grade VII, because students are not used to doing practice questions so that students find it difficult to remember formulas and understand concepts. Then data was obtained on the quality of education at SMP Plus Al Fatimah Bojonegoro in 2022, namely, 26.67% of advanced numeracy skills, 44.44% of proficient numeracy skills, 26.67% of basic numeracy skills, and 2.22% of numeracy skills need special intervention. Therefore, it is necessary to improve numeracy skills for students whose numeracy skills are still relatively low.

Mathematics and numeracy are different things, numeracy includes the application of mathematical concepts and teachings, while a person who has knowledge of mathematics does not necessarily make a person have numeracy skills. (Ismanto, 2022). The definition of numeracy ability itself is that numeracy ability is the ability to apply the concept of mathematical numbers and mathematical calculation operations skills in daily life such as living at home and in the community, and the ability to interpret all forms of calculation that exist around us, this ability also leads to the recognition and understanding of mathematically stated numbers, such as tables, charts, and charts (Mahmud & Pratiwi, 2019). Improvements are needed in the learning process to improve students' numeracy skills which are still relatively low with the use of teaching materials. As said by Supriadi (2015), providing interactive and quality learning resources will greatly affect students' learning outcomes.

Now that we have entered the 21st century era, learning emphasizes the ability of students to think critically in mastering technology, applying knowledge to the real world, and the ability to communicate with people around them (Fitri, Fathoni, & Ilmiyah, 2023). By applying literacy and numeracy competencies, especially numeracy competencies in mathematics learning subjects, it will help in developing students' ability to think critically and connect knowledge with the real world. The use of numeracy-based modules can help students master the concept of mathematics learning, and apply it to daily life. Therefore, it is necessary to develop numeracy-based mathematics learning modules to improve students' ability to apply the concept of mathematical calculation in daily activities and critical thinking skills.

One of the materials that is closely related to problem-solving skills and mastery of concepts is geometry. According to Jones (in Kurniawati and Sari, 2019), providing accurate geometry learning will help students develop critical thinking

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skills, intuition, skills in the form of pictures, problem solving, logical thinking and proving from problem solving. Therefore, the geometry of building a flat side space is very important, to increase problem-solving skills and concept mastery so that students' numeracy skills can be improved. Applying mathematics learning methods to building a conventional flat-sided room will cause students to have difficulty developing problem-solving and critical thinking skills, difficulty in doing problems, students will only use formulas that they have memorized without critically analyzing. Numeracy methods can help students solve math problems and master mathematical concepts. With the help of numeracy-based mathematics modules on flat side spaces (cubes and blocks) can be used as companion books to improve numeracy skills, mastery of mathematical concepts and problem-solving skills.

Based on this description, the formulation of the problem of this research is how the validity and practicality of the mathematics learning module that has been, while the purpose of this development research is to develop teaching materials in the form of mathematics modules based on numeracy on flat side room building materials that are valid and practical, so that learning modules can be used by students.

RESEARCH METHODS

The method in this study is to use a type of research and development method, namely *the Research and Development (R&D) method.* The development model is ADDIE development model whose development design has been systematically compiled. The activities in this model have been arranged programmatically according to the order of stages for learning problem-solving efforts related to learning resources according to the required learning characteristics (Tegeh & Kirna, 2013). The steps arranged in the ADDIE development model consist of 5 stages, namely *Analysis, Design, Development, Implementation,* and *Evaluation.*

This research was conducted at SMP Plus Al – Fatimah Bojonegoro which is located on Jalan Pondok Bambu No. 01 Sukorejo Bojonegoro. The subjects in this study are 20 students in grade VIII of SMP Plus Al-Fatimah, experts in the field of media from lecturers in the field of engineering and experts in mathematics learning materials from lecturers in the field of mathematics. This research obtained data from the results of interviews and questionnaires. Interviews to find out information from problems that occur in the field and questionnaires are assessment sheets filled out by both validators to obtain the validity value of the module and students to get the value of the practicality of the module.

Data collection from the results of assessment sheets that have been filled out by experts in the field of media, experts in the field of mathematics learning materials, and educators. The data that has been collected is then analyzed according to the score category, namely the score of 4 = strongly agree, 3 = agree, 2 = somewhat agree, and 1 = disagree. The validity of the mathematics learning module is assessed by media experts and mathematics learning material experts, and students are then calculated based on the following formula:

$$Presentase\ nilai = \frac{Skor\ yang\ diperoleh}{jumlah\ skor\ tertinggi} \times 100\%$$

After the data is processed into a presentation, then the category of validity of the module and the practicality of the module are shown the category of validity/practicality that has been modified from (Nabila, Adha, & Febriandi, 2021) next:

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Table 1. Validity and Practicality Categories

Score Interval	Klasifikasi
$80\% \leq skor \leq 100\%$	Very Valid/Practical.
$60\% \leq skor < 80\%$	Valid/Practice.
$40\% \leq skor < 60\%$	Quite valid/practical.
$20\% \leq skor < 40\%$	Less Valid/Practical.
$0\% \leq skor < 20\%$	Invalid/Practical.

RESULTS AND DISCUSSION

Development and research were carried out in grade VIII of SMP Plus Al Fatimah Bojonegoro. The research produced a product in the form of a Mathematics Learning Module based on numeracy on flat side space building materials that focus on cubes and blocks. The 5 stages are carried out as follows.

a. Analysis Stage *(Analisys)*

The results of the interview were about information on problems in the learning process, characteristics of students and the development of teaching materials, and from observation activities in learning activities in grade VIII of SMP Plus Al-Fatimah. The data from the observation activity are:

1) Current learning uses conventional learning methods, so students' problem-solving skills and mastery of mathematics are relatively low.
2) Based on the results of the report card, there are 26.67% of basic numeracy skills and 2.22% of numeracy skills need special intervention, so it is still necessary to develop students' numeracy skills.
3) Students need additional teaching materials/modules as companion and complementary books for students to increase student insight, because the package books used are considered inappropriate, some have excess material and some have too little.

And the results of the curriculum analysis are obtained basic competencies (KD), indicators of competency achievement and learning objectives which are compiled as guidelines in developing modules.

b. Design Stage

At this stage, the design and preparation of the planning of the module framework to be developed, the collection of references as a reference and also the preparation of instruments to assess the validity and practicality of the modules. The stages carried out by the researcher in module planning are as follows:

1) Preparation of materials
   The researcher searched and collected material on flat side space building from various sources, including one source from the book Spatial Geometry and Learning Methods written by Dr. Akhmad Jazuli, M. Si and several other reference books.
2) Design products
   The researcher uses numeracy-based learning methods as the basis for presenting material, making sample questions and making questions in

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modules. In this study, the researcher used *the Canva application.*

3) Creating Practice Questions and Evaluations
Practice questions and equipped with an answer key at the end of the module page can be used as a measuring tool to see students' understanding of the presentation of the material in the module.

c. Development Stage

This development stage is the stage in the development of teaching material products in the form of learning modules, from design planning to becoming a real product according to the design that has been designed by the researcher. The product produced at this stage is in the form of a math module. At this stage it is divided into 2 stages, namely:

1) Creation of Learning Media
The creation of media in the form of modules using Canva is then printed into hardware that has been designed according to the purpose of creating media. Here's what the modules that have been developed look like:

a. Front cover

Figure 1. Cover

b. Concept map

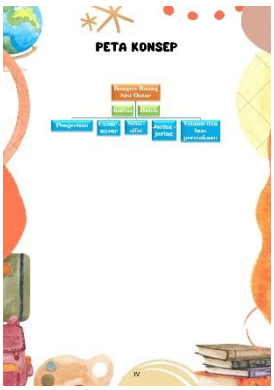

Figure 2.Concept Map

c. Competence

Figure 3. Competence

d. Material

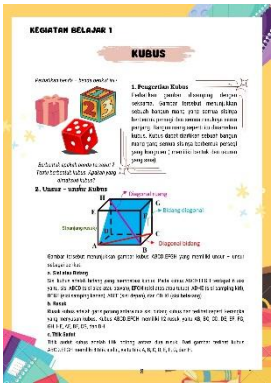

Figure 4. Material

e. Example questions

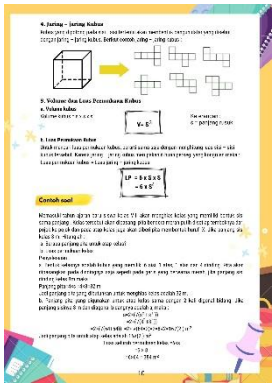

Figure 5. Example questions

f. Practice questions

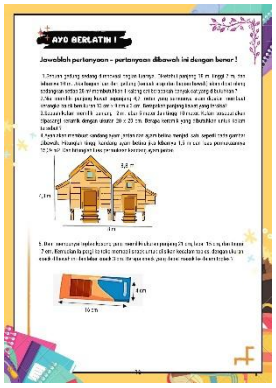

Figure 6. Practice questions

g. Discussion of the question

h. About the author

i. Back cover

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Figure 7. Discussion of questions

Figure 8. About the author

Figure 9. Cover

The developed learning media or modules are equipped with introductions, achievement indicators, introduction to learning, material presentations, practice questions, bibliography, and discussion of practice questions so that students can use them to learn independently.

2) Learning Module Validation

After the module is developed, the second stage of development is module validation to validate the module so that it is suitable for testing for students. This learning module was validated by 2 validators, each of whom was a lecturer at Nahdlatul Ulama University Sunan Giri, a media expert by a lecturer in the Informatics Engineering study program, Mr. Mula Agung Barata, S. S. T., M. Kom. and mathematics subject matter expert by Mathematics Education Lecturer Mrs. Fakhrun Nisa, M. Si. The results of the first validation by media experts are as follows:

Table 2. Media Expert Validation Results

Assessment Aspects	Indicator	Number of Components	Total Value	Presentase
Media Eligibility	Letters and writing	8	24	75%
	Design	4	12	75%
	Picture	4	11	68,75%
	Module Appearance	4	11	68,75%

Based on this calculation, the results of the module validity assessment were 72.5% which in the table was vulnerable to a score of 61% to 80% included in the "**Valid**" category, with information that was feasible to be tested to students with the following revisions:

a. The modules developed have met the requirements of mathematics learning materials or modules at the junior high school or MTs level, but the enrichment of literature studies can be multiplied as a reference.
b. The selection of images on the module can be improved to make it clearer and easier to understand
c. Not using *Screenshoot* in module descriptions.

The second validation is the validation of the content material in the module by the math subject matter expert of the modified analysis indicators from

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(Lestari, Revita, & Irma, 2022). The results are as follows.

Table 3. Material Expert Validation Results

Assessment Aspects	Sum	Total	Presentase
Didactic Requirements	7	24	85%
Construction Requirements	13	42	80%
Numeracy Method	3	10	83%

Based on this calculation, the value of the percentage of practicality of the module in the validation of subject matter experts is 82.6% adjusted to the table of practicality in the range (81 – 100) % that the module is included in the **category "Very Valid".** And it is worth testing for students with the following revisions:

a. Basic competencies with inappropriate material content
b. Pay attention to some inappropriate writing in the discussion (bolstering the writing in the sub-chapter)
c. There are some illustrations of images that are not clear and pay attention to the writing information on the formulas.

From the two assessments from experts, the average score is sought to obtain the validity value of the module that has been developed. Media experts with a score of 58 with the highest score of 80 and material experts with a score of 76 with the highest number of sectors 92. So, the total score of media experts and subject matter experts is 134 and the highest score is 172, then the validity value obtained is as follows:

$$Nilai\ validitas = \frac{134}{172} \times 100\% = \ 77{,}9\ \%$$

Based on this calculation, the validity value of the module in expert validation was 77.9% adjusted to the validity table in the range (61 – 80) %, it was stated that the learning module was in the **"Valid" category.**

d. Implementation Stage

After the module is revised and declared feasible for students, then the implementation or trial of the module is carried out. This product trial was given a questionnaire to 30 students in grade VIII of SMP Plus Al Fatimah to find out the practicality of the module. The results of the assessment are as follows:

Table 4. Results of Practicality Assessment

Students to-	Total score	%
1	63	87,5
2	50	69,4
3	58	80,6
4	59	81,9
5	67	93,1
6	65	90,3
7	65	90,3
8	62	86,1

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9	63	87,5
10	63	87,5
11	52	72,2
12	59	81,9
13	55	76,4
14	56	77,8
15	56	77,8
16	57	79,1
17	62	86,1
18	64	88,9
19	64	88,9
20	58	80,5
Sum	1.198	

The assessment of the mathematics learning module given in the group trial obtained a practicality percentage score of 83.195% which was given the category **of "very practical".** Based on the analysis of the input and suggestions from the students, it was stated that there were no revisional inputs, suggestions, and comments.

e. Evaluation Stage

At this stage, an analysis of the results of module validation and test results by students was carried out. The modules that have been developed are declared valid and very practical, even so the modules that have been developed still have advantages and disadvantages of the module, here are the results of the module evaluation stage:

1) Excess
   a) This module is easy to use and carry because it is in the form of *a hard file,* so the module can be used by students to learn independently.
   b) This numeracy-based learning module can develop the ability to solve problems in real situations.
   c) This module can attract interest in learning, because there are illustration images and to make it easier for students to understand the material.
   d) In the module, examples of questions and practice questions that can be solved are provided to measure students' understanding.
   e) There is a discussion of questions so that students are able to assess their own abilities.
2) Deficiency
   a) The material developed in limited modules only develops cubes and blocks.
   b) To print quality modules, it requires a relatively expensive cost.

CONCLUSION

This development research was obtained in the form of teaching materials, namely numeracy-based mathematics learning modules on flat side room building materials with a valid and very practical ADDIE development method. The results of the validation of media experts and experts in mathematics learning materials obtained an average validity score of 77.9% with the category of valid and feasible to be tested. The practicality assessment of the results of the module trial for grade VIII students of SMP Plus Al Fatimah obtained an average practicality score of 83.195% which is classified as very practical. Modules can be used in the learning process in

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the classroom or learning independently.

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