

DEVELOPMENT OF MATHEMATICS MODULE ALGEBRA MATERIAL FOR CLASS VII OF JUNIOR HIGH SCHOOL

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ABSTRACT

Teachers are required to innovate in the learning process, which is a determinant of students' ability to understand the classroom materials. One of the innovations is to make learning media, but in reality, the availability of available media is still limited. The research aims to design, create, and describe whether or not the Development of E-Learning Based Mathematics Learning Media using Moodle for Student Class VII of Junior High School (SMP) in Subject Matter of Algebra. This research is focused on the development of mathematics learning media, which is packaged in internet form. This development research using the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). His research subjects are material experts, media experts, and student's responses of SMP 1 Muhammadiyah Prambanan and SMP Muhammadiyah 17 Prambanan Klaten. Data analysis techniques use qualitative analysis and quantitative values. Data collection techniques used questionnaires. The research instruments used material expert questionnaires and instructional media experts as well as student response questionnaires. This research has succeeded in developing math learning media that have Good Quality (GQ). With the average score of an expert material assessment, 85,667 have Excellent Quality (EQ), and the average score of media expert assessment results was 38,333 with GQ. While the student response score 65,2 has EQ with scores on small class trials and 62,122 large class trials with GQ. Based on these assessments, this math learning media is worth to be used as a learning resource.

Keywords: Learning Media, Modules, ADDIE.

INTRODUCTION

The development of science and technology is overgrowing, causing new problems to emerge that must be handled creatively and innovatively. This is also in line with the increasingly developing world of education and raises new problems in education. Mathematics is one of the subjects in Indonesia. In teaching mathematics, learning is still teacher-centered, so students only listen to what is taught by educators and look at the manuals that have been determined. Students must also read the material taught and ask the teacher about material that is not yet understood. Educators can utilize modules as learning media. With modules, it allows students to work alone, be competitive, be creative, overcome the boredom of students working on practice questions, make students more skilled at working on various forms of questions, be more relaxed, and have fun while learning. Modules are defined as a book written with the aim that students can study independently without or with the guidance of the teacher.

Meanwhile, in another view, the module is interpreted as a set of teaching material presented systematically to learn with or without a facilitator or teacher. Thus, a module must be used as a teaching material to substitute for the educator's function. If the educator has a function to explain something, the module must explain something in a language readily accepted by students according to their knowledge and age.

To find out about the seventh-grade mathematics learning module in junior high school, observations and interviews were conducted at SMP Muhammadiyah 1 Prambanan and SMP Muhammadiyah 17 Prambanan information that teachers often use textbooks, worksheets, and modules in learning. However, the use of mathematics teaching materials is less optimal. Learning is still centered on the teacher, and students become less active. Students still think that mathematics is a

complicated and dull subject. Based on the description above, the need for modules so that students can understand the material presented and assist in the teaching and learning process according to the objectives of essential competencies. Therefore, researchers deem it necessary to develop a mathematics learning module to improve the quality of learning. Thus, researchers are interested in researching the title Development of Mathematical Modules for Algebra Material for Class VII Students of SMP / MTs.

Based on the background described above, the problems to be resolved are: 1) How is the Development of Mathematics Modules for Algebra Material for Class VII SMP Students? 2) Is the Algebra Material Mathematics Module for Class VII SMP Students feasible to use as learning media?

Based on the above problem formulation, research objectives can be formulated as follows: 1) Developing Algebra Material Mathematics Modules for SMP 1 Muhammadiyah Prambanan and SMP Muhammadiyah 17 Prambanan. 2) Describe the Algebra Material Mathematics Module's suitability for Students of SMP 1 Muhammadiyah Prambanan and SMP Muhammadiyah 17 Prambanan as learning media in the school.

METHODS

The research method used in this learning media development research is research and development (R&D) using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) based on simplicity so that it can easily design and develop products (Personal, Benny, 2014: 30). In this research, the product will be produced in the form of a book. The following is an explanation of the ADDIE development model and design stages:

1. Analysis. This is the first step in formulating general objectives or competencies. The analysis stage requires a needs assessment process carried out in schools. The needs assessment process is carried out to collect data and information related to the learning media that will be developed. Analysis in instructional media design analyzes the needs of learning media, material analysis, and curriculum analysis.
2. Design. In the field of education, products produced through R&D research are expected to increase the quality of educational productivity, namely graduates who are many, have quality, and are relevant to needs. Educational products such as teaching, educational media, textbooks, modules, competence of academic staff, evaluation systems, competency test models, classroom arrangement for certain learning models, production unit models, management models, employee coaching systems, payroll systems, etc. -Other.
3. Development. Development is the third step in implementing the ADDIE learning system design model. According to Benny A. Pribadi (2014: 26), the development stage is that training materials or training materials are produced or adapted so that they can be used in delivering training program content or materials to participants. At this stage a conceptual framework is developed by turning it into a learning media product that is feasible to implement both the method to be delivered and the learning objectives.
4. Implementation. According to Benny A. Pribadi (2014: 26), the steps for implementing the training program are carried out with a design that has been developed previously. This means that the delivery of learning material from the teacher or instructor to students using learning media that has been prepared and validated by experts. Then students who took part in the implementation filled out a response questionnaire to the learning media.
5. Evaluation. Evaluation can be defined as a process carried out to determine the value, price, and benefits of an object (Benny A. Personal, 2014: 28). In this case the object that is assessed is a product of learning media developed. It aims to determine the feasibility of learning media developed in the learning process. The evaluation of learning media carried out in this study was based on the results of a questionnaire from media experts, material experts, and student responses.

The subjects in this research and development consisted of material experts, media experts, and VII grade students of SMP Muhammadiyah 1 and SMP Muhammadiyah 17 Prambanan. This study uses data collection techniques, namely: interviews and questionnaires. The data obtained using the data collection instruments are as follows: the material expert feasibility test questionnaire, the media expert

eligibility questionnaire test, and the test questionnaire for student responses. After the data is collected, according to Sukarjo (2006: 55), from the data collected then the average is calculated using the formula:

$$\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$$

Information:

\bar{X} : Average score

$\sum_{i=1}^n x_i$: Total score

n : Number of evaluators

Furthermore, after all, data have been converted into qualitative using the ideal assessment criteria guideline table with the following provisions:

Table 1. Criteria for Ideal Rating Categories

No	Score	Criteria
1.	$\bar{X} > (X_i + 1,80 SB_i)$	Very good
2.	$(X_i + 0,60 SB_i) < \bar{X} \leq (X_i + 1,80 SB_i)$	Good
3.	$(X_i - 0,60 SB_i) < \bar{X} \leq (X_i + 0,60 SB_i)$	Enough
4.	$(X_i - 1,80 SB_i) < \bar{X} \leq (X_i - 0,60 SB_i)$	Less
5.	$\bar{X} \leq (X_i - 1,80 SB_i)$	Very less

(Sukarjo, 2006:53)

RESULTS AND DISCUSSION

Following are the stages of the ADDIE development model carried out in this development research:

1. Analysis. In determining the analysis of teaching material needs, observations and interviews were conducted with teachers of SMP Muhammadiyah 17 Prambanan and SMP Muhammadiyah 1 Prambanan. The researcher also collected data about the Middle Semester test scores of the seventh grade students of SMP Muhammadiyah 17 Prambanan and SMP Muhammadiyah 1 Prambanan. Researchers conducted interviews with teachers and several students in both schools. This aims to determine the teacher learning process and what teaching materials students need.
 - a. The material that will be developed in this module is algebra. The selection of material to be developed was carried out in consultation and discussion with mathematics teachers at SMP Muhammadiyah 17 Prambanan and SMP Muhammadiyah 1 Prambanan. The choice of algebraic material is because students have not mastered this material well.
 - b. Curriculum Analysis. Curriculum analysis is carried out by studying learning materials, Competency Standards (CS), Basic Competencies (BC), and learning objectives to be achieved using learning media. At this stage the results of the curriculum analysis are obtained as follows. Core Competencies and Basic Competencies

Table 2. Core Competencies and Basic Competencies

Core Competencies		Basic Competencies	
1.	Appreciate and appreciate the religious teachings they embrace	1.9	Living and practicing the teachings of the religion they adhere to.
2.	Appreciate and live honest behavior, discipline, responsibility, care (tolerance, cooperation), courteous, confident, in interacting effectively with the social and natural environment within the range of association and existence	2.9	Have internal motivation, ability to work together, consistency, discipline, self-confidence, and tolerance in different thinking strategies in choosing and implementing problem-solving strategies
3.	Understand and apply knowledge (factual, conceptual, and procedural) based on his curiosity about science, technology, art, culture related to phenomena and visible.	3.5	Explain the algebraic form and perform operations on the algebraic form (addition, subtraction, multiplication, and division)
4.	Trying, processing, and presenting in the realm of the concrete (using, unraveling, arranging, modifying, and making) and the realm of the abstract (writing, reading, counting, drawing, and composing) by what is learned in school and other sources in the same perspective /theory	4.5	Solve problems related to algebraic forms and operations on algebraic forms

1) Learning Indicator

After studying algebra material, students are expected to be able to:

- a) Students can write algebraic forms
 - b) Students can identify elements of algebraic forms, which include variables, coefficients, terms, and constants.
 - c) Students can know the number of terms in algebraic form.
 - d) Students can distinguish between similar and not similar tribes.
 - e) Students can operate algebraic forms
 - f) Students can change contextual problems into algebraic forms
2. Design. This stage consists of 3 steps, namely, to outline the module's contents, design the module's contents, and compile the module assessment instrument.
- a. Arrange an outline of the contents of the module

The module outline contains the initial plan of what was written and what order the presentation of the material. The module content outline covers the following learning activities by the curriculum analysis that has been carried out in the previous stage.

 - 1) Learning Activities 1 Element of Algebraic Forms
 - 2) Learning Activities 2 Calculate Operations for Algebraic Forms
 - 3) Learning Activities 3 Fractions of Algebraic Forms
 - 4) Learning Activities 4 Modeling Algebraic Forms
 - b. Develop a module content design. The module content design made consists of several components, among others, as shown in Figure 1.

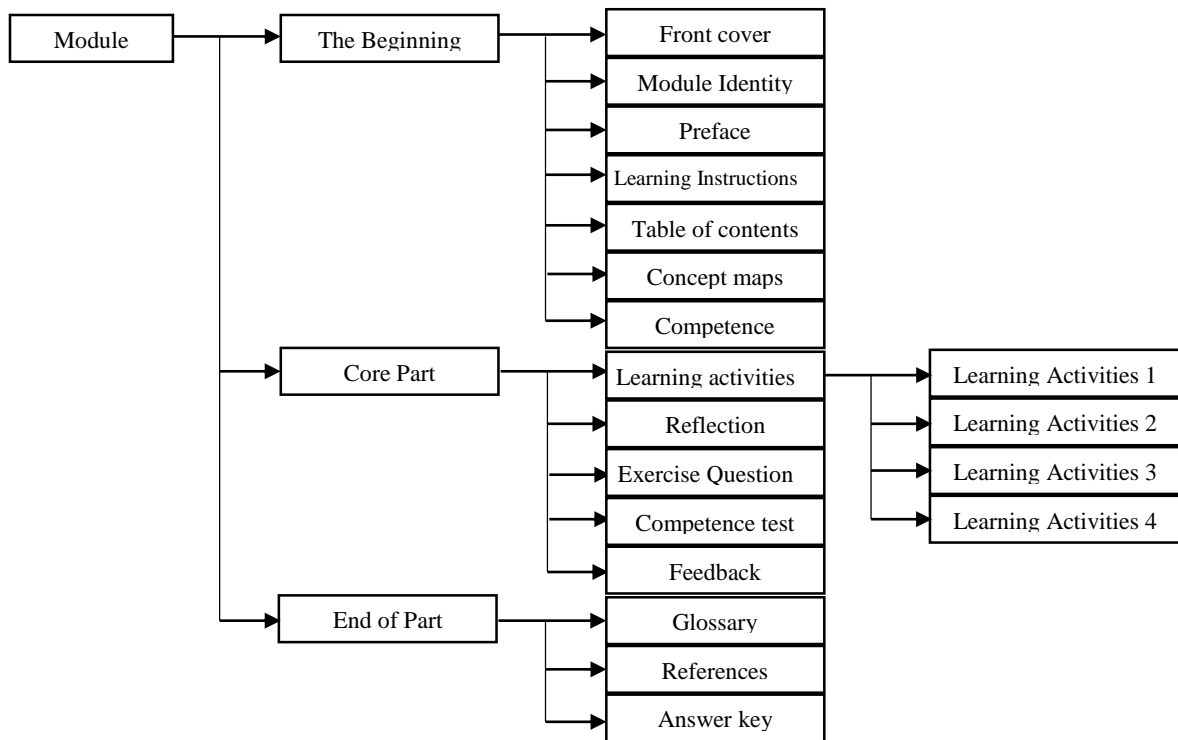


Figure 1. Module Components

- c. Develop module assessment instruments

The next step is to arrange the assessment instrument for material experts, media experts, and questionnaires for student responses to the module. The questionnaire consisted of 5 answer choices, namely SS (Strongly Agree), S (Agree), CS (Fair Agree), TS (Disagree), and STS (Strongly Disagree). The material expert assessment instrument consists of 20 points of assessment covering several aspects: the content's appropriateness, linguistic, presentation, graphic, and contextual approach. The media expert assessment instrument consists of 9 items that cover several aspects of assessment: linguistic, presentation, and visual aspects. The instrument for evaluating student responses consisted of 15 items, including aspects of language, presentation, graphics, and expediency. After the instrument is finished, the instrument is consulted with the supervisor, validated by competent expert lecturers who study the questionnaire. The validation of the material expert questionnaire, media expert, and student response was carried out by Mr. Puguh W.P, M.Sc., a lecturer in the Mathematics Education study program at Ahmad Dahlan University Yogyakarta.
3. Development. In this development stage, it is the stage where the design of instructional media is translated into actual appearance. The stages are as follows.
 - a. Reference Collection. In this stage, reference studies are carried out to prepare learning media material that will be developed. In this case, the researchers used five mathematics books used for reference.
 - b. Module Writing. At the stage of doing this module, the module design that was made was developed into a mathematics module of algebra material for seventh-grade junior high school students. To develop this module, researchers used application support programs including Corel Draw X7 and Word 2013
 - c. Module Validation. Validation is intended to request consideration from experts, namely material experts and media experts on the modules developed.
 - d. Small Class Trial. Small class trials were conducted in a class containing ten students of class VII in SMP 1 Muhammadiyah Prambanan and ten students in grade VII in SMP Muhammadiyah 17 Prambanan Klaten. The selection of small class pilot students was carried

out randomly by the researcher. There is no input from students regarding the learning media developed at this stage, but there is a revision from students about writing on page 14 and revised so that the next stage can be done.

4. Implementation. After the learning module's development phase is completed, the next step is applying the learning module to the actual classroom conditions in learning mathematics. A massive class test is a final test in this development process. The large class test was attended by 36 students from SMP Muhammadiyah 17 Prambanan on 21-11-2018 and 28 students from SMP Muhammadiyah 1 Prambanan on 22-11-2018. The trial was conducted by giving a product accompanied by a questionnaire to students. The questionnaire used has the function of obtaining data in the form of student assessment of the modules' quality. There was no revision in the large class trials because the learning module was considered acceptable in terms of the material and the media.
5. Evaluation. The final step in the ADDIE learning system design model is evaluation. Evaluation is a process carried out by someone to provide an assessment of something; in this case, the quality of the learning module. Assessment is given on several parts, namely the quality of learning modules based on aspects of the material, aspects of the media, and students' responses to the learning modules. The assessment will be used as a reference in determining whether or not a learning module is developed.

The feasibility of learning material is assessed by the three material experts, with the results of the feasibility questionnaire calculation can be seen in the following table:

Table 3. Results of Expert Material Calculation

No	Evaluator	Position	Score	Criteria
1	Puguh W.P, M.Sc	Lecturer	86	Very good
2	Hasan B.A, S.Pd.	Teacher	85	Very good
3	Risma, S.Pd	Teacher	86	Very good
Amount			257	
Average			85,667	Very good

Based on the above table, the results show that the modules developed in terms of material received an assessment of 85,667, so that it is included in the excellent category.

The feasibility of instructional media is assessed by the three media experts, with the results of the feasibility questionnaire calculation can be seen in the following table:

Table 4. Media Expert Calculation Results

No	Evaluator	Position	Score	Criteria
1	Puguh W.P, M.Sc	Lecturer	34	Good
2	Hasan B.A, S.Pd.	Teacher	41	Good
3	Risma, S.Pd	Teacher	40	Good
Amount			115	
Average			38,333	Good

These results indicate that the module developed in terms of multimedia display received a rating of 38.333, so that it is included in the excellent category.

Student responses to the developed module are known based on the questionnaire results given and filled out by students during small class trials and large class trials. Here are the results of a small class trial:

Table 5. Results of Calculation of Student Response Questionnaire in Small Class Trials

No	Evaluator	Score	Quantitative Category
1.	SMP Muhammadiyah 1 Prambanan	65,6	Very good
2.	SMP Muhammadiyah 17 Praban	64,8	Very good
	Average	65,2	Very good

Based on the table above, the average score of the assessment results for small class trials is 65.2. Based on the guideline table, student responses' assessment criteria are included in the Very Good category. The following are the results of the product trial:

Table 6. Results of Questionnaire Calculation of Student Responses on Product Trials

No	Evaluator	Score	Quantitative Category
1.	SMP Muhammadiyah 1 Prambanan	65,361	Very good
2.	SMP Muhammadiyah 17 Praban	58,883	Good
	Average	62,122	Good

Based on the table above, the average score of the product trial's assessment results is 62,122, so based on the guideline table, the criteria for assessing student responses are included in the Good category.

Revising the learning media developed in the design and development process is essential in designing and developing a learning media. The revision process is done before learning media is used on students.

Table 7. Input from Material Experts

No	Feedback / Suggestions	Follow-up
1	There was a writing error on the page on several pages	Improve writing on the page
2	On page 18, there is no explanation of the variables a, b and c	Explain with variables a, b and c
3	On page 19, the formula is incompatible	Improve the formula
4	On page 23, there is no example of a negative rank.	Give an example with a negative rank.

The revised learning module changed the module content aspect. However, the revised learning module structure did not change from the initial design. The final product study of the learning module has the following arrangement.

1. Initial Section
 - a. Module cover
 - b. Title identity
 - c. Foreword
 - d. Study Instructions
 - e. Table of contents
 - f. Concept maps
 - g. Competence
2. Core Parts
 - a. Preliminary: 1) Competence, 2) Learning Objectives, 3) Indicator, and 4) Instructions.
 - b. Learning Activities: Learning activities 1, Learning activities 2, Learning activities 3, and Learning activities 4
 - c. Reflection
 - d. Exercises
 - e. Competence test
 - f. Feedback
3. Final Section: Glossary, Bibliography, and Answer key

CONCLUSION

The conclusions obtained from the research on the development of algebra material mathematics modules for seventh-grade junior high school students are:

1. Develop a medium for learning mathematics with the ADDIE development model. The explanation is as follows:
 - a. Analyst. At this stage, the researchers conducted observations and interviews with teachers at SMP 17 Prambanan and SMP Muhammadiyah 1 Prambanan about the use of teaching materials in the learning process and the availability of teaching materials used in learning, as well as interviews with students about teaching materials used and made by teachers for obtaining an overview of teaching materials that will be developed by researchers.
 - b. Design. The researcher makes the module a design / initial design, consisting of several parts: the beginning, the core, and the final part. The initial part includes cover, title page, module identity, preface, module position map, table of contents, and introduction. The introduction includes instructions for using the module, competencies, learning objectives, concept maps. The core part includes learning activities, quizzes, reflections, summaries, evaluations, feedback, and remedial. The final section includes a glossary, bibliography, and answer key.
 - c. Development. Development of module teaching materials using Microsoft Word 2013 computer programs with CorelDRAW X7 supporting programs. The compiled module consists of several sections by the contents of the module that has been made. Three experts carried out module validation in terms of material and media. The initial product design is validated to obtain an assessment and input on the product to obtain the strengths and weaknesses. These deficiencies are then given a follow-up in the form of improvements.
 - d. Implementation. The material experts have validated the module's final product, and the media is then applied to students in the class to get responses from students.
 - e. Evaluation. A product revision is then carried out to improve the product being developed based on input from material experts and media experts. Evaluation is a process carried out to provide an assessment of the quality of the learning modules.
2. Mathematics Learning Module for Algebra Material for Class VII SMP / MTs that was developed included in both categories based on the average calculation of material experts at 85,667, media experts at 38,333, student responses in small class trials at 65.2, and student response results in large class trials that are 62.122. Thus, the Algebra Material Mathematics Module for Class VII SMP / MTs is suitable for the learning process.

Based on these results, it can be concluded that the algebra material mathematics module for seventh-grade junior high school developed is suitable for use in the process of learning mathematics that has good quality (B). With an average score of 85,667 material expert assessment results, which have a Very Good quality (SB) and an average score of 38.333, media expert results have a Good quality (B). While the score of students' responses to the scores in the small class trial 65.2, which has Very Good quality (SB), and large class trials 62.122 have Good quality (B). Based on this assessment, mathematics learning media is appropriate for students as a learning resource.

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