DEVELOPMENT OF MATHEMATICS MODULE WITH NUMBERED-HEADS TOGETHER (NHT) COOPERATIVE LEARNING MODEL ON SQUARE AND TRIANGLE FOR JUNIOR HIGH SCHOOL

Hujjatul Muslimah[a], Suparman[b]
Program Studi Pendidikan Matematika Universitas Ahmad Dahlan
Jalan Ring Road Selatan, Tamanan, Banguntapan, Bantul, Yogyakarta
[a]muslimahhujjah24@gmail.com, [b]suparmancict@yahoo.co.id

ABSTRACT

This research is based on the less optimal use of student books as teaching material and unavailability of modules, mainly facilitating students to learn in groups. Modules with NHT cooperative learning model can be used as teaching materials to ease students in learning mathematics by group discussion. This development research aims to manage and develop teaching materials in the form of Mathematics Module with Numbered-Heads Together (NHT) Cooperative Learning Model on the two-dimensional figure (Square and Triangle) for VII grade students. This study also aims to determine the feasibility of modules developed based on material experts, media experts, and student responses. This research was conducted using the ADDIE development model. The development steps include Analysis, Design, Development, Implementation, and Evaluation. The Mathematics Module on two-dimensional figures (Square and Triangle) for grade VII Students is developed by integrating NHT cooperative learning steps. This product has passed through a revision phase based on the advice and inputs of material experts and media experts. This research shows that the teaching materials in the form of Mathematics Module with Numbered-Heads-Together (NHT) Cooperative Learning Model on the two-dimensional figure (Square and Triangle) for Junior High School Students in Grade VII have excellent quality proven from validity criteria. Based on the materials expert assessment, the average score of 137 meets the very - good criteria, and the assessment of media experts obtained an average of 136.3 that fulfills the criteria very well. The students' responses obtained an average of 131.6, which meets the criteria very well as well. Based on the results of the research, the Mathematics Module with Numbered-Heads-Together (NHT) Cooperative Learning Model on two-dimensional figure material (Square and Triangle) for Junior High School Students in Grade VII is suitable for mathematics learning.

Keywords: Mathematics Module, Cooperative Learning, Numbered Heads Together (NHT), ADDIE, two-dimensional figures (Square and Triangle).

INTRODUCTION

The rapid development of technology and information in various aspects of life, including in education, is an attempt to bridge the present and future by introducing updates. The need for individual services for students and the improvement of learning opportunities have become a significant driver of the emergence of educational reform. Education programs in schools can develop students' thinking skills and abilities to solve existing problems, therefore, in this case, the Ministry of Education and Culture is always working to improve the quality of national education in terms of both process and outcome. The purpose of national education in Law Number 20 of 2003 concerning the National Education System, Article 3 states that the purpose of national education is to develop capabilities and shape the character and civilization of a dignified nation to educate the life of the nation, aiming at developing the potential of students to become human beings have faith and be devoted to God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. To achieve these educational goals, a curriculum was formed which were used as a reference for learning activities in each school. The curriculum used as a reference in learning activities is inseparable from mathematics's teaching and learning process. In the Big Indonesian Dictionary (2012: 888), Mathematics is the science of numbers, the relationship between numbers, and operational procedures used in solving numbers.

The concept of learning, especially in learning mathematics, is now more dominated by students or student-centered. Students who do more interaction in class, both with teaching materials and with other student friends. Students search for scientific information from a variety of literature, discuss their findings, practice the skills to operate their knowledge, conduct analysis, and conclusions. The teacher accompanies students to learn, guides students to do the exercises to operate their theories in class, and even guides them to conduct trials. To support the learning process, we need a teaching material with a learning model suitable for the students' characteristics. One of the teaching materials used is a module with a cooperative learning model type Numbered Heads Together (NHT). According to the Ministry of National Education (2008: 20), Modules are a set of teaching materials that are presented systematically so that users can learn with / or without a facilitator/teacher.

Based on the results of interviews with mathematics teachers in Muhammadiyah Junior High School 1 Yogyakarta (SMP Muhammadiyah 1 Yogyakarta) and State Junior High School 13 Yogyakarta (SMP Negeri 13 Yogyakarta), the curriculum used in SMP Negeri 13 Yogyakarta and SMP Muhammadiyah 1 Yogyakarta is the Education Unit Level Curriculum (KTSP). While learning mathematics, there are still many students who have not participated actively in learning, and the teacher's role still dominates learning. Teaching materials used in SMP Negeri 13 Yogyakarta are the Mathematical Electronic School Book (BSE) published by the Ministry of Education and Culture. In learning mathematics, mathematics textbooks have not been used optimally to help in learning because of several things, among others, due to the limited number of textbooks students have. Also, students tend to be lazy to read textbooks, and the textbooks used are difficult to understand. Teaching material in the form of modules is not yet available in SMP Negeri 13 Yogyakarta and SMP Muhammadiyah 1 Yogyakarta; besides that, no module allows students to study in groups in each learning activity, especially with the NHT type cooperative learning model.

Based on the description above, it can be concluded that it is very much needed a mathematics teaching material that can support learning in the classroom, especially group learning that can increase student activity and learning activities. Thus researchers interested in researching the title Development of Mathematical Modules with Cooperative Learning Models Type Numbered Heads Together (NHT) on Flat Build Material (Rectangular and Triangle) for Class VII Middle School Students.

Based on the background described above, the problems to be resolved are: 1) How to develop mathematical modules with NHT type cooperative learning models on flat material (rectangles and triangles) for seventh-grade junior high school students. 2) What is the feasibility of the mathematics module with the NHT type cooperative learning model on flat material (rectangles and triangles) for seventh-grade junior high school students? 3) What is the response of students to the mathematics module with the NHT type of cooperative learning model on flat material (rectangles and triangles)?

Based on the above problem formulation, research objectives can be formulated as follows: 1) Producing a Mathematics module with NHT type cooperative learning models on flat material (rectangles and triangles) for grade VII junior high school students. 2) Knowing the feasibility of the Mathematics module by modeling NHT type cooperative learning on flat figure material (rectangles and triangles) for seventh-grade junior high school students. 3) Knowing students' responses to the mathematics module with NHT type cooperative learning models on flat shapes (rectangles and triangles).

METHODS

This type of research used in this research is a research and development method (Research and Development) using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). According to Pribadi, Benny (2014: 23), The ADDIE learning system design model is simple and can be done in stages or systematically. The product produced in this study is a module with an NHT type cooperative learning model on flat (rectangular and triangle) material for seventh-grade junior high school students.

The following explains the stages of the ADDIE development model and design according to the chart above:

1. Analysis. In this stage, an analysis of several things is carried out to obtain a picture of the teaching material to be developed. This analysis phase was carried out in two schools, namely, SMP Negeri 13 Yogyakarta and SMP Muhammadiyah 1 Yogyakarta. Analysis of the teaching materials' design includes analysis of teaching material requirements, material analysis, and curriculum analysis.
2. Design (planning). The design or planning step is carried out after the researcher has interviewed, observed, and collected information. This stage consists of three steps, namely outlining the module contents, module content design, and compiling module assessment instruments. This stage includes (1) information gathering, (2) module writing, (3) validation and assessment, (4) small class trials.
3. Development. At this stage, the learning module application is carried out to the actual classroom conditions, namely in learning mathematics. The product is tested to determine the feasibility of the module being developed.
4. Implementation. The evaluation step is a process carried out to provide value to the modules that are developed. The aim is to find out how the module is developed. The module is evaluated based on an assessment questionnaire from material experts, media experts, and student responses.
5. Evaluation (evaluation). The evaluation step is a process carried out to provide value to the modules that are developed. The aim is to find out how the module is developed. The module is evaluated based on an assessment questionnaire from material experts, media experts, and student responses.

The subjects in this research and development consisted of material experts, media experts, and VII graders of SMP Negeri 13 Yogyakarta and VII graders of SMP Muhammadiyah 1 Yogyakarta. This research development uses data collection techniques, namely: observation, interviews, and questionnaires. The research data were obtained using the following data collection instruments: the material expert eligibility questionnaire, the media expert eligibility questionnaire, and the student questionnaire for student responses.

After the data is collected, in Sukarjo (2006: 55) the average is calculated, using the formula:

$$\overline{X_1} = \frac{\sum_{i=1}^{n} X_i}{n}$$

Information:

$\overline{X_1}$: average score

$\sum_{i=1}^{n} X_i$: total score

n: many assessors

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

Table 1. Criteria for Ideal Rating Categories

No	Score	Criteria
1.	$X_i > \overline{X_1} + 1{,}8 \times SB_i$	Very good
2.	$\overline{X_1} + 0{,}6 \times SB_i < X_i \leq \overline{X_1} + 1{,}8 \times SB_i$	Well
3.	$\overline{X_1} - 0{,}6 \times SB_i < X_i \leq \overline{X_1} + 0{,}6 \times SB_i$	Enough
4.	$\overline{X_1} - 1{,}8 \times SB_i < X_i \leq \overline{X_1} - 0{,}6 \times SB_i$	Less
5.	$X_i \leq \overline{X_1} - 1{,}8 \times SB_i$	Very less

(Sukarjo, 2006:53)

RESULTS AND DISCUSSION

The trial data in this research development was obtained by the research process of developing the ADDIE model with the following steps:

a. Analysis (analysis). In this stage, the analysis process obtained is a reference in the development of learning modules. So researchers do some analysis to provide an overview of the learning modules that will be developed. The analysis carried out is as follows:
   1) Analysis of Teaching Material Requirements. Analysis of the need for teaching materials aims to determine the availability of teaching materials by the applicable curriculum, find out the teaching materials used by teachers in the learning process, and determine the teaching materials needed at the school.
   2) Material Analysis. After analyzing the need for teaching materials, the next step is to choose the developed material. The selection of material is made by consulting with mathematics teachers at SMP Negeri 13 Yogyakarta and SMP Muhammadiyah 1 Yogyakarta.
   3) Curriculum Analysis. Curriculum analysis is done by studying learning material, core competencies, basic competencies, and learning objectives that must be achieved by students in learning.

b. Design. This stage consists of 3 steps: outline the contents of the module, design the contents of the module, and compile the module assessment instrument.
   1) Outline the Module Content. This process begins by arranging the order in which the material is presented in the module.
   2) Module Content Design. The contents of the module design that the researchers developed consisted of the initial part, the core part, and the final part.
   3) Develop a Module Assessment Instrument. This study's module assessment instrument was a questionnaire consisting of a material expert assessment questionnaire, a media expert evaluation questionnaire, and a student response assessment questionnaire. Before the questionnaire is used, validation is done first by the validator.

c. Development. The development of teaching materials is the stage where the initial design is translated into actual appearance. The stages are as follows.
   1) Collection of References. At this stage, a reference review is carried out, which will be used to prepare the material in the learning module to be developed. In this stage, the researcher used three mathematics books that were used as references.
   2) Writing Module. At this stage, the initial design of the product that has been made is developed into a learning module.
   3) Validation and Assessment. Validation is intended to request assessment and input from experts, namely material experts and media experts, on the learning modules developed.
   4) Small Class Trial. Small class trials were conducted in two schools, namely SMP Negeri 13 Yogyakarta and SMP Muhammadiyah 1 Yogyakarta, which involved ten students in each school.

d. Implementation. The implementation is carried out by testing the modules to students in large class trials to determine the module's suitability if used in learning. Students who take part in the implementation fill in the questionnaire responses to the module.

e. Evaluation. Assessment is given to several parts, namely the aspects of the material to be assessed by material experts, aspects of the media that will be assessed by media experts and assessment by students (student responses). The assessment will be used as a reference to determine whether or not the learning module developed.

Three material experts assessed the feasibility of the learning material, the criteria of the material expert assessment were divided into three aspects namely the content feasibility aspect, the feasibility of the presentation, and the NHT type cooperative learning with the results of the feasibility questionnaire calculation can be seen in the following table.

Table 2. Results of the Calculation Questionnaire for Material Feasibility

No	Evaluator	Score	Quantitative Category
1.	Dra. Sumargiyani, M.Pd.	139	Very good
2.	Lailatun Naimah, S.Pd.	142	Very good

3.	Wahyu Syamrohani, S.Pd.	130	Very good
	Average	137	Very good

Based on expert assessment of material from three aspects of assessment obtained an average content worthiness score of 64 and included in the very good category, the average score for presentation eligibility was 36.7 and included in the excellent category, the average score of cooperative learning in the NHT type was 36.3 and included in both categories. Based on table 2 above, that the average score of the material expert assessment results is 137. These results indicate that the learning modules developed were reviewed in terms of the material included in the excellent category.

Three media experts assessed the feasibility of the learning material, the criteria for the assessment of the media experts were divided into three aspects, namely: linguistic, presentation, and graphic, with the results of the feasibility questionnaire calculation can be seen in the following table:

Table 3. Results of the Media Feasibility Questionnaire Calculation

No	Evaluator	Score	Quantitative Category
1.	Anggit Prabowo, M.Pd.	141	Very good
2.	Ahmad Suryani, S.Kom.	129	Very good
3.	Wahyu Syamrohani, S.Pd.	139	Very good
	Average	136,3	Very good

Based on the assessment of media experts from the three aspects of the assessment obtained an average linguistic score of 28.3 and included in the category of very good, the average score of presentation of 17 and included in the category of very good, the average score of graphics of 90.7 and included in the excellent category. Based on table 3 above, that the average score of the material expert assessment is 136.3. So it can be concluded that the learning modules developed were reviewed in terms of media included in the excellent category.

Student responses to the learning modules that are developed are known from students' assessment results through a questionnaire given during small class trials and large class product trials. The criteria for evaluating student response questionnaires were divided into five aspects: the appropriateness of the content, presentation, linguistics, graphics, and expediency. Following are the results of the calculation of student response questionnaire on a small class trial of the learning module:

Table 4. Results of Calculation of Student Response Questionnaire in Small Class Trials

No	School	Score	Quantitative Category
1.	SMP Negeri 13 Yogyakarta	136,1	Good
2.	SMP Muhammadiyah 1 Yogyakarta	128,7	Very good
	Average	132,4	Very good

Based on the assessment of student questionnaire responses from five aspects of the assessment obtained an average score of the worthiness of 26.7 and included in the excellent category, the average presentation score was 35.6 and included in the good category, the average linguistic score was 26, 3 and included in the very good category, the average score of graphics was 22.5 and included in the very good category, while the average benefit score was 21.8 and included in the very good category. Based on table 4 above, that the average score of the results of the assessment of student responses in small class trials is 132.4. Based on the guideline table, the criteria of learning module assessment of student responses are included in the excellent category.

Following are the results of the calculation of student response questionnaires in a large class of learning modules testing:

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

No	School	Score	Quantitative Category
1.	SMP Negeri 13 Yogyakarta	133,3	Very good
2.	SMP Muhammadiyah 1 Yogyakarta	128,1	Very good
	Average	130,7	Very good

Based on the assessment of student response questionnaire from five aspects of the assessment obtained an average content worthiness score of 26.2 and included in the excellent category, the average presentation score was 34.9 and included in the good category, the average linguistic score was 26, 1 and included in the very good category, the average score of the graphic was 22.3 and included in the very good category, while the average score was 21.4 and included in the very good category. Based on the table above, it can be seen that the average score of the results of the assessment of student responses in large class trials is 130.7, so based on the guideline table, the evaluation criteria of learning modules from the aspects of student responses are included in the excellent category.

Revising the learning modules developed in the design and development process is an important step in designing and developing learning modules. The revision process is carried out before the learning module is tested on students. The revised learning module has the following arrangement:

1. The initial part that contains: Cover/cover, title page, module identity, preface, table of contents, module position map, module description, study instructions, Competency Standards (CS) and Basic Competency (BC), learning objectives, concept maps
2. The core section contains Learning activities 1-9: material, sample questions, LAS, self-test, and summary.
3. The final part is consisting of a glossary, bibliography, and answer key.

CONCLUSION

The results of this study are a teaching material in the form of a mathematics module with NHT type cooperative learning models on flat material (rectangles and triangles) for seventh-grade junior high school students packed in book form. This research and development use the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The results of the assessment carried out in connection with the module's eligibility are as follows:

1. The feasibility of a mathematical module with the Numbered Heads Together (NHT) type of cooperative learning model on flat build material (rectangles and triangles) for seventh-grade junior high school students which were developed based on an average calculation of material experts of 137 and included in the excellent category, especially in the aspects of the appropriateness of content and the appropriateness of the presentation. In the aspect of cooperative learning, the type of NHT module is still included in both categories.
2. The feasibility of a mathematics module with the Numbered Heads Together (NHT) type of cooperative learning model on flat figure material (rectangles and triangles) for grade VII junior high school students which were developed based on an average calculation of media experts of 136.3 and belongs to the very category good, especially in aspects of language, presentation and graphic.
3. The feasibility of a mathematical module with the Numbered Heads Together (NHT) type of cooperative learning model on flat figure material (rectangles and triangles) for seventh-grade junior high school students developed based on the average calculation of student response questionnaire of 132.4, trial II of 130.7 and the average student response of 131.6 and included in the excellent category. The assessment aspect, which is considered reasonable, is the aspect of content worthiness, linguistic, graphic, and expediency, while the aspect of module presentation is included in the good category.

Thus, the mathematics module with the NHT type of cooperative learning model on flat material (rectangles and triangles) for grade VII junior high school students is suitable for use in the learning process.

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