

DEVELOPMENT OF MATHEMATICS MODULE IN TRIGONOMETRY MATERIAL BASED ON DISCOVERY LEARNING FOR GRADE 10TH

Nesti Puspendari^a, Widayati^b

Program Studi Pendidikan Matematika Universitas Ahmad Dahlan
Jalan Ring Road Selatan, Tamanan, Banguntapan, Bantul Yogyakarta
^apuspandarina@gmail.com, ^bummunabilah67@gmail.com

ABSTRACT

Limited learning resources is a problem that affects the achievement of learning goals. Teaching materials that can help students learn independently with or without a teacher's guidance is a module. This research is the development research to compose a mathematics module in trigonometry material based on discovery learning for grade 10th of Senior High School (SMA). Knowing the module that is developed is suitable or not if used in a mathematics lesson. This research uses Research and Development to identify potential and problems, collect the information, design a product, design validation, design revision, experiment, and product revision. This research and development of the module are material expert, media expert, and students in SMA Muhammadiyah 3 Yogyakarta and SMA Muhammadiyah 7 Yogyakarta. The Mathematics Module is developed using a Likert scale that changes the qualitative value into a quantitative value based on discovery learning. Data collection techniques in the form of interviews and questionnaires. The research results indicate that the mathematics module in statistics material based on discovery learning for grade 10th of SMA/MA has a good quality seen from the validity criteria. Based on material experts and media experts' assessment, an average score is 89,67 and 104, including very well criteria. The student's response to the module indicates that the module's good quality obtained an average score is 76,58. Based on the research results, the mathematics module in trigonometry material based on discovery learning for grade 10th of SMA/MA is suitable for the mathematics lesson.

Keywords: Module, Trigonometry, Discovery Learning

INTRODUCTION

One of the things that reflects the quality and quality of human resources in education. Education makes humans develop their potential to have the abilities and skills needed by themselves, society, nation, and country. Based on the Law of the Republic of Indonesia number 20 of 2003 article 1 paragraph 1 concerning the national education system, education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential to have religious, spiritual strength, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation, and state. Therefore, education must be designed to understand and improve critical thinking, creativity, and innovation.

Learning resources are a critical component of learning. One source of learning is teaching material. Teaching Materials can be printed teaching materials and electronic teaching materials. Printed teaching materials are written text teaching materials that are so well structured. Various printed teaching materials include handouts, books, modules, student activity sheets, brochures, leaflets, wall charts, photos, or drawings. Simultaneously, electronic teaching materials are teaching materials that utilize well-designed and attractive software in their preparation. Various types of electronic teaching materials include interactive CDs, learning videos, and websites.

The module is one of the written teaching materials used in the learning process. The module contains materials that students can study independently and contains exercises related to the material and packaged excitingly and systematically. The module's function is as a sequence to train students' independence in understanding learning material. The content or presentation material of a module must be presented in full and discussed through the presentations to feel they understand enough about the particular field of study from the module's learning outcomes.

In Suherman et al. (2003: 16-17), there are several opinions from experts who define the notion of mathematics, which is as follows.

- a. In their mathematical dictionary, James and James say that mathematics is the science of logic about shapes, structures, quantities, and concepts related to one another with a large number divided into three fields: algebra, analysis, and geometry.
- b. In his book, Johnson and Rising say that mathematics is a thinking pattern, organizing patterns, and logical proof. Mathematics is a language that uses terms that are defined carefully, clearly, and accurately, its representation with symbols and reliable, more a symbolic language about ideas rather than about sound.
- c. Their book says that mathematics is a study of patterns and relationships, away or patterns of thinking, an art, a language, and an instrument.
- d. In his book, Kline also said that mathematics is not a solitary knowledge that can be perfect because of itself. However, mathematics is primarily to help humans understand and mastering social, economic, and natural problems.

So, mathematics is one branch of science about a mindset, an art, a symbolic language, and a tool with a vast and abstract scope of objects to cause logical and directed thoughts divided into three fields: algebra, analysis, and geometry. In this research, what is meant by mathematics is about school mathematics.

School mathematics, according to Suherman et al. (2003: 55), is as follows. School mathematics is taught in schools, namely mathematics taught in Primary Education (SD and SLTP) and Secondary Education (SLTA). It was explained that school mathematics consisted of selected mathematics parts to develop abilities and form personal and guided in developing science and technology. Suherman et al. (2003: 56) also mentioned that the function of mathematics as a tool, mindset, and science. These three functions should be used as a reference in learning mathematics in school. Based on school mathematics's understanding and function, it can be concluded that school mathematics has essential characteristics, namely having abstract objects and having a deductive mindset (can produce conclusions), and being consistent (fixed). The system of teaching and learning process serves to achieve educational goals. School mathematics aims to prepare students to deal with changing world conditions that are always developing and use mathematics in daily life. According to the Ministry of National Education's Directorate General of Primary and Secondary Education Management in the Teaching Materials Development Guide (2008: 7), teaching materials are all forms of material used to assist teachers/instructors in carrying out teaching and learning activities. The material referred to can be either written material or unwritten material.

Based on the description above, it can be concluded that teaching materials are all forms of material in the form of both written and unwritten materials arranged systematically to help teachers deliver teaching material to create an atmosphere of teaching and learning that enables students to learn. Unwritten teaching materials can be in sound recordings (audio), recorded sound images (audiovisual), and interactive teaching materials. Written teaching materials can be in the form of books, modules, brochures, leaflets, Student Activity Sheets (LAS), handouts, wallcharts, and so on. One of the written teaching materials used as aids in the learning process is a module.

In the Ministry of National Education Teaching Materials Development Guide (2008: 20), understanding is one of the printed teaching materials used as aids in the learning process. The module is a book written with the aim that students can study independently without or with the guidance of the teacher. According to Prastowo (2013: 107-108), as one form of teaching materials, modules have the following functions. According to Prastowo (2013: 107-108), as one form of teaching materials, modules have the following functions: 1) Independent teaching materials. 2) Substitute the educator's function. 3) Evaluation tools. 4) Reference material for students.

While the purpose of preparing or doing modules in Prastowo (2013: 108-109) are students can study independently without or with the guidance of educators (which is minimal), the role of educators is not too dominant and authoritarian in learning activities, Train the honesty of students,

Accommodate various levels and speed of learning of students, and students can measure themselves the level of mastery of the material that has been learned.

So the module is a printed teaching material. This complete unit stands alone and consists of a series of learning activities. Modules can be used as aids in the learning process to stimulate students' minds to solve existing problems more independently where the teacher only provides minimal assistance in guiding.

Based on interviews with mathematics teachers in SMA Muhammadiyah 3 Yogyakarta and SMA Muhammadiyah 7 Yogyakarta, information was obtained that the two schools implemented an education unit level curriculum. In class X mathematics learning, SMA Muhammadiyah 3 Yogyakarta teachers use a short module covering all grade X mathematics material. In comparison, SMA Muhammadiyah 7 teachers use textbooks distributed by the government. At the two schools, there is no guided discovery of the trigonometry based mathematics module. The interview results obtained information that most students scored below the Minimum Completeness Criteria (MCC).

Based on this background, the following problems can be formulated: 1) How to develop a guided discovery-based Trigonometry mathematics module for grade X / SMA / MA students? 2) What is the guided discovery-based mathematics module's feasibility for guided trigonometry material for SMA / MA grade X students?

METHODS

This research uses a research model called Research and Development. Sugiyono (2014: 407) states that Research and Development is a research method used to produce certain products, and test its effectiveness. This research is focused on the Development of Trigonometry Material Mathematics Modules for SMA / MA Class X students.

The procedure of developing this research refers to Sugiyono's development model. The steps of research development are as follows.

1. Potential and Problems. The potential for student motivation is high, while the problem in the form of module limitations is owned, so students cannot carry out learning activities to the maximum.
2. Data collection. After the problem can be shown factually and up to date, it is necessary to gather the information used to plan certain products expected to overcome it.
3. Product Design. The final result of research and development activities is a new product design, complete with specifications. Product designs must be embodied in drawings or charts to be used as a guide to assessing and treating them.
4. Design Validation. Design validation is a process of activities to assess product design. Product validation can be done by presenting several experts or experts. Each expert is asked to assess the design so that further weaknesses and weaknesses can be identified. Validation is adjusted to the evaluation. The evaluation in question is by the evaluation component of the Ministry of National Education.
5. Design Revision. After the design has been validated by the expert and known for its shortcomings and weaknesses, the researchers who developed the product have corrected the validated product designs' flaws and weaknesses.
6. Product Testing. Product trials are carried out to determine the product's suitability to run as expected. Through this activity, the researcher also collects information for product improvement. Product trials are conducted twice, namely in small classes and large classes.
7. Product Revision. Product revision aims to overcome the shortcomings and weaknesses of module products tested in the first trial with limited samples and improve the module to be more effective.
8. Product Results. Product results were not conducted in this study. Due to time, cost, and workforce constraints, the development of trigonometry based mathematics modules for guided discovery for SMA / MA grade X students was limited to product revisions.

The research was conducted at SMA Muhammadiyah 3 Yogyakarta and SMA Muhammadiyah 7 Yogyakarta. This study's subjects were grade X students at SMA Muhammadiyah 3 Yogyakarta with

32 students and SMA Muhammadiyah 7 Yogyakarta with 30 students. Students provide assessments and suggestions for module improvement.

The instrument used to collect data in this study was a questionnaire. The type of questionnaire used was the checklist questionnaire. Three questionnaires were developed: a material expert assessment questionnaire, a media expert evaluation questionnaire, and a student response assessment questionnaire. The questionnaire was given at the evaluation stage, namely the validation and product trial activities. In the validation stage, the material expert assessment questionnaire is given to the material expert to provide an assessment and input on the module in terms of material, including the feasibility of the content, linguistic, presentation, and guided findings. The media expert evaluation questionnaire was given to media experts to provide an assessment and input on the module in terms of media, which included several aspects, including the design aspects of appearance, fonts, layout, illustrations, graphics, images, and language. Whereas in the product trial, the student response assessment questionnaire was given to students after students studied the module. The data analysis technique used is the Likert scale presented in Table 1, which is as Table 1.

Table 1. Likert scale

Information	Score
Strongly agree (very good)	5
Agree (good)	4
Hesitation (enough)	3
Disagree (less suitable)	2
Strongly disagree (not suitable)	1

From the data collected, in Sukarjo (2006: 55), 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

Next, determine the average criteria in the guidelines for the ideal assessment criteria presented in Table 2.

Table 2. Criteria for Ideal Rating Categories

No	Range of scores (i) quantitative	Category
1.	$\bar{X} > (\bar{M}_i + 1,8 SB_i)$	Very good
2.	$(\bar{M}_i + 0,6 SB_i) < \bar{X} \leq (\bar{M}_i + 1,8 SB_i)$	Well
3.	$(\bar{M}_i - 0,6 SB_i) < \bar{X} \leq (\bar{M}_i + 0,6 SB_i)$	Enough
4.	$(\bar{M}_i - 1,8 SB_i) < \bar{X} \leq (\bar{M}_i - 0,6 SB_i)$	Less
5.	$\bar{X} > (\bar{M}_i - 1,8 SB_i)$	Very less

Information:

\bar{X} : Average score

M_i : Average ideal

SB_i : Ideal standard deviation

RESULTS AND DISCUSSION

The assessment of the eligibility questionnaire calculations results by material experts can be seen in Table 3.

Table 3. Results of the Questionnaire Calculation of Material Expertise

No	Material Expert	Score	Qualitative Data Criteria
1.	Dra. Widayati, M.Sc.	90	Very good
2.	Andreast Wahyu Sugiyarta, S.Pd.	83	Well
3.	Nurani, S.Pd.	96	Well
	Total	290	Very good
	Mean	89,67	Very good

From Table 3, it can be seen that the average score of the results of the material expert assessment is 89.67. These results indicate that the modules developed were viewed in terms of material included in the very good category. Based on the three material experts' assessments, all aspects of the module have very good criteria. However, the presentation aspects get the highest rating compared to other aspects, equal to 90.68%.

The assessment of the eligibility questionnaire calculations results by media experts can be seen in Table 4.

Table 4. Results of the Calculation of the Eligibility Questionnaire for Media Experts

No	Material Expert	Score	Qualitative Data Criteria
1.	Dra, Widayati M.Sc.	100	Very good
2.	Fita Adhi, S.Pd	108	Very good
3.	Afi Julantari, S.Pd	104	Very good
	Total	312	Very good
	Mean	104	Good

From Table 4, it can be seen that the average score of the results of the assessment of media experts is 69. The results indicate that the module developed is seen in terms of the media included in the good category. Based on the three media experts' assessment, all aspects of the module have very good criteria. However, the font aspect gets the highest rating compared to other aspects, which is 93.33%.

Tests The students' response to mathematical module products is known based on the questionnaire results given and filled out by students during the trial of product I for small classes and product tests for large classes. The results of the questionnaire calculation of student responses to the mathematics module can be seen in Table 5, namely,

Table 5. Results of Calculation of Student Response Questionnaire

No	Activity	Average score	Category
1	Product trials	78,60	Very good
2	Product test	74,57	Good
	Average score	76,58	Very good

From Table 5, it can be seen that students' responses to the very good module are shown with an average score of 78.60 in product trials and product tests with an average score of 74.57 included in either category. The mathematical modules developed in the very good category are shown with an average of 76.58. They are suitable for use in learning from the two tests conducted. Based on the assessment of students' responses to product trials and product tests, all aspects of the module have very good criteria. However, the graphics aspect gets the highest rating compared to other aspects, equal to 87.90%.

CONCLUSION

Based on the results of research on the development of a mathematical module of trigonometric material based on guided discoveries that have been made, the following conclusions are obtained:

1. The development of trigonometry based mathematical modules based on guided discoveries is carried out through several stages: potential and problems, data collection, product design, design validation, design revision, product trials, and product revisions.
2. Module eligibility
The guided discovery-based mathematics module that has been developed is suitable for use in learning based on the results of the assessment of material experts, media experts, and class X students' responses in SMA Muhammadiyah 3 Yogyakarta and SMA Muhammadiyah 7 Yogyakarta. The material experts' module assessment results obtained an average score of 89.67 with the criteria very good, the results of the module assessment by the media experts obtained an average score of 104 with the criteria of very good. In contrast, the module assessment results by the student's response obtained a score of an average of 76.58, included in the very good category.

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