

# DEVELOPING MATHEMATICS MODULE WITH REALISTIC MATHEMATICS EDUCATION APPROACH ON THE STATISTIC MATERIAL

Desi Rubiyanti<sup>a</sup>, Suparman<sup>b</sup>

Program Studi Pendidikan Matematika Universitas Ahmad Dahlan  
Jalan Ring Road Selatan, Tamanan, Banguntapan, Bantul Yogyakarta

<sup>a</sup>[rubhy2lpyanthy@gmail.com](mailto:rubhy2lpyanthy@gmail.com), <sup>b</sup>[suparmancict@yahoo.co.id](mailto:suparmancict@yahoo.co.id)

## ABSTRACT

Limitations of teaching materials is a problem that affects the achievement of learning objectives. The existing teaching materials are still challenging to understand. One of the teaching materials that can help students learn actively and independently is the module. This study aims to develop, test the module's feasibility, and determine the student's response to the development of a mathematical module with the RME approach on the subject of statistics. The research design used Research and Development with potential and problem steps, data collection, product design, design validation, design revision, product trial, product revision, product trial, and revision trial. Research subjects are material experts, media experts, and student responses in Junior High School (SMP) Negeri 3 Pleret and SMP Muhammadiyah 4 Yogyakarta. This research object is a module of mathematics learning with an RME approach on the Statistic for Students class of SMP in the odd semester. Data collection techniques used questionnaires and interviews. Instrument test through lecturer validation and data analysis using quantitative descriptive analysis. The results showed that the material experts' scores obtained an average score of 83.333 with a good category. The media expert's judgment scored 111.667 with a very good category. The students' responses to the module received a score of 115.842 with the good category. Based on these calculations' results, the mathematics module developed possible use in learning mathematics.

**Keywords:** Mathematical Module, Realistic Mathematics Education (RME) Approach, R&D, Statistics.

## INTRODUCTION

Education is an important factor for preparing Human Resources (HR) for a Nation and State's progress. In line with the development of science and technology in this globalization era, the Indonesian people must have a quality education system to face global competence challenges. Education must be oriented so that students can develop the potential to live life well.

According to the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System that 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 spiritual, religious, self-control, personality, intelligence, noble morals, and the skills needed by himself, the community, the nation, and the State.

The success in achieving national education goals is an increase in the quality of education. To improve the quality of education, it is done by improving the quality of learning. One of the improvements in the quality of learning is the learning process. The learning process that is the core of the education process needs to be designed in such a way as to be able to achieve an expected learning goal. Learning mathematics in schools, teachers should choose to use strategies, approaches, methods, and media that involve students in learning, both mentally, physically, and socially. To create active and creative, and independent mathematics learning. Related to creating active and creative, and independent mathematics learning, learning tools are essential as a supporter of the learning process. A good learning tool will help teachers and students to achieve learning goals coherently and systematically.

Efforts to develop students who are active and able to explore their potential require supporting facilities. One of them is a learning resource that can be utilized as much as possible by students.

According to Sanjaya (2013), learning resources are all things that can be used by students to learn teaching materials and learning experiences by the objectives to be achieved.

According to the Association for Educational Communication and Technology (AECT, 1997) and Banks (1990) in the quote (Komalasari, 2010: 108), Learning resources are all things that can be used by teachers, both separately and in a combined form, for the benefit of teaching and learning to increase the effectiveness and efficiency of learning objectives. According to the Ministry of National Education (2008: 6), teaching materials are All forms of material compiled systematically that can be used to help teachers/instructors in carrying out learning activities. Teaching materials can be written or unwritten.

The preparation of modules is designed to make it easier for students to understand the learning material. Modules must also be equipped with instructions and information that are easier for students to use the module. The module can involve students in finding the mathematical concept itself. Therefore, an approach is needed to produce modules that are appropriate to the needs of students. The realistic Mathematics Education Approach is one approach that can support students in finding their concepts independently.

RME is a theory of mathematics learning in which one learning approach uses the real-world context. RME was first introduced by mathematicians from the Freudenthal Institute at Utrecht University in the Netherlands over thirty years ago, precisely in 1973. RME is an approach to learning mathematics that uses real-world situations or real contexts and student experience to start learning mathematics ( Fathurrohman:2015).

Based on researchers' interviews on November 26, 2016, with Mr. Afandi S.Pd, a mathematics teacher at Muhammadiyah 4 Junior High School Yogyakarta. Information is obtained that teachers often use lecture methods in learning. The teaching materials used are textbooks, worksheets, and modules. The use of modules in SMP Muhammadiyah 4 Yogyakarta is still minimal. Existing modules have not made students play an active and independent role in every learning activity undertaken. Also, existing modules, worksheets, and textbooks do not use the RME approach, even though a lot of mathematics material that is interesting to discuss uses the RME approach, for example, in statistics.

Researchers were also interviewed on December 10, 2016, with mathematics teachers at Pleret 3 Middle School. Information is obtained that teachers often use the lecture and group methods in teaching. Teaching materials that are often used in schools are textbooks accompanied by worksheets. Researchers also conducted interviews with several students from each of these schools. The interview results obtained information that mathematics is difficult to understand, such as statistical material in the data presentation section in the form of diagrams. Students prefer to be explained by the teacher because students' textbooks and worksheets are challenging to understand.

Statistics material is one of the materials that some IX grade students often have difficulty understanding and completing practice questions. For example, in calculating the mean, mode, and presentation of data in the form of diagrams. This should be a concern for mathematics teachers to find solutions; if these difficulties can be overcome, students can more easily understand the next material, especially statistics.

The study considers that statistical material is indeed important to be well understood based on the description above. Students can understand statistical material well by developing a mathematical module using the RME approach on statistics for grade IX junior high school students. The module compiled contains instructions for use, learning objectives, presentation of material in a coherent, concise, and clear manner by the RME approach's steps. Fathurrohman (2015: 193) states there are four steps to the RME approach, which include:

1. By contextual problems, learning must start from problems taken from the real world. The problem used as a starting point for learning must be real for students to be directly involved in their experiences.
2. Using a Model or a Bridge with a Vertical Instrument, a model must be by the abstraction that students must learn. Models can be real situations or situations in student life.

3. Using Student Contributions, Students have the freedom to express their work in solving real problems given by the teacher. Students have the freedom to develop problem-solving strategies so that various variants of problem-solving are expected to be obtained.
4. Interactivity, the learning process must be interactive. The interaction between teachers and students and students and students is an important element in learning mathematics. Students can discuss and cooperate with other students, ask questions, and respond to questions and evaluate their work.

Modules are also developed with students' real-world problems in everyday life and use simple and easy-to-understand language; there are examples of questions, discussions, and practice questions.

This study's problem can be formulated as follows: 1) How to arrange and develop a mathematical module with the RME approach on the subject matter of statistics for grade IX junior high school? 2) What is the mathematics module's feasibility with the RME approach on the subject matter of statistics for grade IX junior high school? 3) How do students respond to the mathematics module with the RME approach on the subject matter of statistics for grade IX junior high school?

The purpose of developing teaching materials in the form of modules is as follows: 1) Develop modules as mathematics teaching materials with the RME approach to statistical material for grade IX junior high school students. 2) Knowing the quality of the mathematics module with the RME approach to statistical material in terms of content worthiness, language feasibility, the feasibility of presentation, the feasibility of graphics, and suitability to the characteristics and assessment of the RME approach. 2) Knowing students' responses to the quality of mathematics modules with the RME approach to statistical material in terms of content worthiness, language worthiness, presentation worthiness, graphic worthiness, and suitability to the characteristics and assessment of the RME approach.

## **METHODS**

This research is a research and development R&D (Research and Development) with development steps, namely potential and problems, data collection, product design, design validation, design revision, product testing, product revision, trial use, product revision, and production mass. R&D methods are research methods used to produce specific products and test their effectiveness (Sugiyono, 2016: 407). This research is product-oriented, a mathematical module with the RME approach on statistics for grade IX junior high school. Research subjects are:

1. Material Expert. The material experts in this study were Ahmad Dahlan University mathematics lecturer and mathematics teacher in class IX of Muhammadiyah 3 Yogyakarta Junior High School and mathematics teacher in class IX of SMP Negeri 3 Pleret. Product assessment experts will provide an assessment of the product development modules that have been made. Assessment is not limited to material aspects but includes several other aspects through researchers' instruments to create quality modules.
2. Media Expert. The media expert in question is Ahmad Dahlan University mathematics lecturer, who is an expert in the field of instructional media. Media experts assess the modules developed in terms of the language used, the writing format, the module's color display, and its presentation. Media experts are also expected to provide suggestions to make modules more interesting, so students are motivated to learn them.
3. Students. The subjects in the mathematics module tryout with the RME approach on statistics were the IX grade junior high school students. Testing is done in small classes and large classes. In testing this product, students are asked to use the statistics module. After using the product, students are given a questionnaire to provide assessments and positive inputs to the module. In small class trials, a sample of 5 students was taken. At the same time, the large class trial was conducted on 27 students.

Data collection techniques using non-test instruments in the form of interviews and questionnaires. The questionnaire assessment technique was carried out by giving a product validation sheet containing a set of statements to the material expert lecturers and media experts, teachers, and

students. Score calculation is done by looking for averages that refer to the guideline of the ideal evaluation criteria, according to Sukarjo (2006: 55). Eligibility in terms of scores obtained is feasible if included in a very good, suitable, or good category.

## RESULTS AND DISCUSSION

After research by the method of R&D (Research and Development) with development steps, namely:

1. Potential and problems. Potentials and problems can be identified in various ways, through interviews, before conducting interviews with teachers and students from SMP Negeri 3 Pleret and SMP 4 Muhammadiyah. Researchers enter the observation letter to the school. Schools used for product trials have potential teaching material. However, there are no teaching materials in the form of mathematics modules with the RME approach. In both schools for product trials, problems that exist in both schools were obtained from interviews with teachers and some students from each of these schools. The results obtained from the interview are that there is no mathematical module with the RME approach, teaching materials used by students are still challenging to understand, and learning activities using a realistic approach are still relatively low.
2. Data collection. Data collection was carried out by analyzing SK and KD, gathering references about statistical material, and determining the scope of material presented in the mathematics module with the RME approach by SK and KD in KTSP 2006.
3. Product design. The initial framework of the learning module is:
  - a. The initial section contains, among others:
    - 1) Cover
    - 2) Title Page
    - 3) Module Identity
    - 4) Preface
    - 5) Table of Contents
    - 6) Concept Maps
    - 7) Introduction: Basic Competency and Compensation Standards, Description, and Instructions for using the module
  - b. Section Contents. The contents / core section contains:
    - 1) Learning Activities
    - 2) Example
    - 3) Summary
    - 4) Exercise
    - 5) The final part
  - c. The final section contains:
    - 1) Competency Test
    - 2) Glossary
    - 3) Bibliography
4. Design validation. Material experts and media experts carry out design validation by filling in validated instruments.
5. Design revisions. Design revisions were made on the results of input and comments from material experts and media experts.
6. Product trials. The first product trial is a small class trial by taking a sample of 5 students.
7. Product revision. Product revisions are made from small class trial results to follow-up to students' input and comments.
8. Trial usage. The second class trial is a large class trial by taking 27 students.
9. Product revision. Product revision at this stage is carried out on the results of input and comments from student response questionnaires in large class trials.

The results of product evaluation by the validator are based on the ideal evaluation criteria, according to Sukarjo (2006: 55), which is presented in Table 1.

**Table 1.** Ideal Assessment Criteria

Score Range	Qualitative Criteria
$X > \bar{X}_i + 1,8 SB_i$	Very good
$(\bar{X}_i + 0,6 SB_i) < X \leq (\bar{X}_i + 1,8 SB_i)$	Well
$(\bar{X}_i - 0,6 SB_i) < X \leq (\bar{X}_i + 0,6 SB_i)$	Pretty good
$(\bar{X}_i - 1,8 SB_i) < X \leq (\bar{X}_i - 0,6 SB_i)$	less
$X \leq (\bar{X}_i - 1,8 SB_i)$	Very less

Material expert assessment is done by filling in the mathematics module assessment sheet with the RME approach on statistics for grade IX junior high school. This stage is carried out by submitting a product for later validation using a product validation sheet instrument consisting of several assessment components, including content eligibility, presentation eligibility, and RME learning approach.

The assessment instruments used previously were examined by non-test items by the instrument validation lecturer. The material was validated by three material experts, namely one material expert lecturer and two mathematics teachers in the school concerned. The results of the eligibility questionnaire calculations by material experts can be seen in Table 2.

**Table 2.** Results of the Eligibility Questionnaire Calculation by Material Expert

No.	Material Expert	Score	Qualitative Data Criteria
1.	Drs. H. Edi Prajitno, M.Pd	85	Very good
2.	Affandi S.Pd	81	Good
3.	Wista Indriyani S.Pd	84	Good
	Total number	250	
	Average	83,33	Good

Table 2 shows that the average results of the assessment by material experts is 83.33 and shows that the modules developed are in the excellent category.

The media experts' assessment was carried out by filling in the mathematics module assessment sheet with the RME approach on statistics for the ninth grade junior high school. This stage is done by submitting the product to be validated with the product validation sheet instrument, which consists of several assessment components, including the feasibility of the language, the feasibility of presentation, and the feasibility of graphics arranged based on the grid. The instrument used previously had been examined by non-test items by the instrument validation lecturer. Module validation for media was validated by three media experts, namely one media expert lecturer and two mathematics teachers in the school concerned. The results of the eligibility questionnaire calculations by media experts can be seen in Table 3.

**Table 3.** Results of Feasibility Questionnaire Calculation by Media Experts

No.	Material Expert	Score	Qualitative Data Criteria
1.	Drs. H. Edi Prajitno, M.Pd	108	Very good
2.	Irkam Sudaryana S.Pd	117	Very good
3.	Wista Indriyani S.Pd	110	Very good
	Total number	331	
	Average	111,667	Very good

Table 3 shows that the average result of the assessment by media experts is 111,667 and shows that the modules developed fall into the very good category. The students' responses were conducted by testing a small class by taking a sample of 5 students for SMP Negeri 3 Pleret and SMP Muhammadiyah 4 Yogyakarta. Whereas in the large class trial, the module was tested on 27 students for each school.

Testing small classes and large classes are done by giving students modules and questionnaires to determine their responses. The results of calculating student response questionnaires can be seen in Table 4.

**Table 4.** Results of Calculation of Student Response Questionnaire

No.	Student Response	Total score	Criteria
1.	Trial small classes in SMP N 3 Pleret and SMP Muhammadiyah 4 Yogyakarta	115,536	Good
2.	Large Class Trial at SMP N 3 Pleret Muhammadiyah 4 Middle School Yogyakarta	116,151	Good
Total number		231,685	
Average		115,842	Good

Based on Table 4, it can be seen that the results of students' responses to the module in the small class trials in the two Pleret State Junior High Schools 3 and Muhammadiyah 4 Junior High Schools in Yogyakarta are good, with an average score of 115,536. In the large class trials conducted at the same school, the students' responses to the modules with the right criteria were 116.15. These results indicate that the module developed is suitable for use in the learning process.

## CONCLUSION

Based on the results of research on the development of mathematical modules on algebraic material that has been done, the following conclusions are obtained:

1. Development of mathematical modules in statistical material carried out through the following stages:
  - a. Potential and Problems. At this stage, interviews were conducted with mathematics teachers at Pleret State Junior High School and Muhammadiyah 4 Junior High School Yogyakarta about mathematics potential and problems. An outline of the results of the interview is as follows:
    - 1) The module teaching materials are still limited.
    - 2) The existing modules can not make students play an active and independent role.
    - 3) The student learning outcomes are still low.
  - b. Data collection. Data collection is done by analyzing SK and KD, gathering references about statistical material, and determining the material scope presented in the module.
  - c. Preparation of Mathematics Modules. At this stage, SK, KD, and indicators of competency achievement are determined in the mathematics module with algebraic material developed, then making module designs and instruments for assessment in the module trials.
  - d. Product Validation. Material experts and media experts carry out product validation. The material experts consisted of one UAD lecturer and two mathematics teachers from Pleret State Middle School and SMP Muhammadiyah 4 Yogyakarta. At this stage, researchers submit the developed products and assessment instruments to material experts and media experts. Based on validation by material experts and media experts, input and suggestions are obtained, which are then corrected at the product revision stage. After the revision, material experts and media experts evaluate the module using the assessment instruments that have been made previously.
  - e. Product Trial. Product trials were conducted twice, namely small class trials, by taking a sample of 5 students and large class trials of 27 students from each school. Based on the results of small class trials, I obtained an average score of 115.536. The small classes' results also obtained input and suggestions from students, who then become materials for improvement in the module. Large class trials are conducted using modules that have been improved from the results of small class trials. In large class trials obtained an average score of 116,151. In this large class trial, researchers also get input and suggestions from students. After being followed up, the mathematics module has become the final product.

2. Feasibility of mathematical modules. The mathematics module on the subject of statistics developed is suitable for learning based on material experts and media experts' assessment and student responses. In contrast, the mathematics module research results by the material experts obtained a score of 88.333 with the category Good, and media experts obtained a score of 111,667 in the category Very Good.
3. Student responses to the Mathematics Module. Mathematical modules on the statistical material developed have received good responses from students known from trials conducted in small classes and large classes. Based on the assessment of grade IX students at Pleret 3 Middle School and Yogyakarta Muhammadiyah 4 Middle School, the average score was 115,842 with the Good category. Students gave positive comments and provided constructive input to the module.

## **REFERENCES**

- Fathurrohman, M (2015) *Model-model Pembelajaran Inovatif*. Yogyakarta: Ar-Ruzz Media.
- Komalasari (2010). *Teori belajar dan pembelajaran di sekolah Dasar*. Jakarta: kencana Prenada Media Group.
- Sanjaya, W (2013). *Strategi Pembelajaran: Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana Prenada Media Group.
- Sukarjo (2006). *Kumpulan materi evaluasi pembelajaran*. Yogyakarta: pasca Sarjana UNY.