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Development of Mathematics Teaching Materials on Tri-N-Based Variable Linear Equations and Inequalities

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ABSTRACT

This study aims to determine the validity and response of students to the development of mathematics teaching materials using Tri N teachings on the subject of One Variable Linear Equations and Inequalities. This type of research is Research and Development (R&D) which aims to produce and test product quality. This research refers to the 4D development model, namely Define, Design, Develop, and Disseminate. However, this research only reached the develop stage. Data collection was carried out using documentation techniques, validation sheets and student response questionnaires. The test subjects were class VII students of MTs Al Hidayah Sadeng. The data analysis technique used is descriptive analysis. This research produced mathematics teaching material products with an average percentage of 85.6% which were included in the very valid category. Student responses to teaching materials are in the very good category with an average percentage of 82.22%. This shows that teaching materials are appropriate for use in learning at school.
***Keywords**: teaching materials, realistic mathematics education, tri n.*

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INTRODUCTION

Learning mathematics in this modern era still uses conventional learning models. According to Apiati (2017) conventional learning places more emphasis on students remembering or memorizing and less emphasis on students reasoning, problem solving, or understanding. So that in conventional learning, students are not given the opportunity to associate ideas in learning. This results in teacher-centered mathematics learning.

While data from the National Council of Teacher of Mathematics/NCTM Ratnaningsih there are five standards for students in acquiring and using mathematical knowledge, namely: problem solving, reasoning and proof, communication, connection, and representation (Efuansyah & Wahyuni, 2018). By paying attention to this, it is necessary for students to develop problem-solving processes in learning mathematics. In addition, so that mathematics learning can be achieved optimally, quality teaching materials are needed.

Teaching materials are needed by teachers and students in the learning process. According to I. Lestari (2018) Teaching materials are a set of materials that are systematically arranged, both written and unwritten, so as to create an environment or atmosphere that allows students to learn. In the context of education, teaching materials are components that must exist in learning. This is because teaching materials are guidelines in understanding a subject matter. Teaching materials have various criteria and forms. Examples of teaching materials applied in schools are books, student worksheets, and modules. As a support for learning, some teachers use teaching materials in the form of modules. The use of modules can make it easier for teachers and students in learning.

With the emergence of the Covid-19 pandemic, teaching and learning activities that were originally carried out at schools are now being studied at home via online. These conditions require students to study independently because they have the flexibility of study time, can study anywhere and anytime. Online learning is an educational innovation to answer the challenge of the availability of various teaching materials. While the reality is that at school, teachers have not developed teaching materials that can meet the needs of students during online learning.

Haji in Efuansyah & Wahyuni (2018) emphasized that the presentation of the material contained in the mathematics books currently used is structured as follows: (1) Definitions, (2) Example questions, and (3) Practice questions. Presentation of material that contains only questions, results in students getting bored learning mathematics because the material given seems monotonous. Teaching materials that are designed according to needs can help students understand learning well. Seeing the problems that arise, it is necessary to develop teaching materials that can help students to improve their abilities.

There are various kinds of strategies that can be used to develop students' creativity. One of the new innovations that can be applied in developing creativity is the teachings of Ki Hajar Dewantara. All of his teachings are very good and should be applied and used as a guide in learning. The development of teaching materials with the wisdom that Indonesia has has not been found much. One of the teachings of Ki Hajar Dewantara that can be used to develop teaching materials is the Tri N teaching (niteni, nirokke, nambahi).

Based on the description above, the formulation of the problem of this study is (1) How is the development of teaching materials based on Tri N on the material of One Variable Linear Equations and Inequalities which are valid? and (2) How is the student's response to Tri N-based teaching materials on the material of One Variable Linear Equations and Inequalities?

METHOD

This type of research is research and development or Research and Development (R&D) which is used to produce products (prototypes) and test the quality of these products (Efuansyah & Wahyuni, 2018). The development research model used is the 4D model which consists of 4 stages, namely Define, Design, Develop, and Disseminate which was developed by Thiagarajan. The subjects of this study were 9 students of class VII MTs Al Hidayah Sadeng who represented high, medium and low academic ability.

The data collection techniques used were documentation, validation sheets, and student response questionnaires. Data analysis used in the define stage is descriptive qualitative analysis, in the design stage is descriptive analysis, while in the develop stage is a quantitative descriptive analysis with a Likert scale.

RESULTS AND DISCUSSION

This research produced a teaching material product in the form of a Tri N-based math module. The content of the material is Linear Equations and Inequalities One Variable. This research was carried out according to the development procedure, namely define, design, develop, and disseminate. However, this research only reached the develop stage.

Define

At the define stage, information is collected related to the product to be developed. It aims to define and identify learning requirements. At this stage what is done is curriculum analysis, material analysis, and formulating learning objectives. Based on the results of the analysis, the applicable curriculum, namely the 2013 Curriculum and the material on Linear One Variable Equations and Inequalities, is studied for basic competencies and their indicators. The results of the study are used as guidelines in the development of mathematics teaching materials. Based on the material, basic competencies and indicators that have been determined, they can be used in formulating learning

objectives. The learning objectives of the material system of linear equations can be seen in the following table.

Table 1. Learning Objectives

Learning Objectives
1. Determine open sentences and closed sentences
2. Get to know the linear equation of one variable in several variable forms.
3. Solving one-variable linear equations using addition and subtraction.
4. Solving one-variable linear equations using multiplication and division.
5. Make a mathematical model of problems related to one-variable linear equations.
6. Solve contextual problems related to one-variable linear equations.
7. Finding the concept of one-variable linear inequalities.
8. Make a mathematical model of problems related to one-variable linear inequalities.
9. Solve contextual problems related to one-variable linear inequalities.

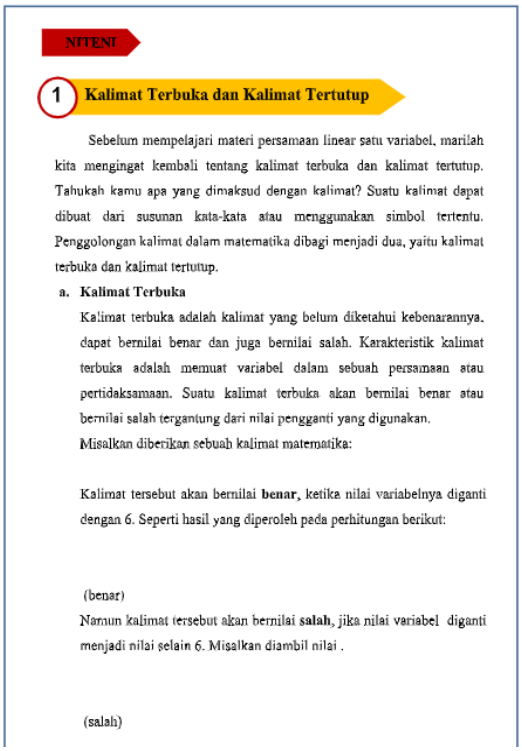
Design

The design stage aims to design prototypes of teaching materials using Tri N teachings based on the basic competencies, indicators, and predetermined learning objectives. The components of teaching materials are front cover, preface, table of contents, module descriptions, instructions for using modules, core competencies, basic competencies, indicators, learning objectives, concept maps, mathematical figures, material, sample questions, practice questions, summary, competency test, glossary, bibliography, author bio, and back cover.

Teaching materials are made with the help of CorelDraw on the front cover, back cover, and image illustrations. This is done to produce good and interesting illustrations. So that students don't feel bored when learning, while the material part is made with the help of Microsoft word. Each sheet of teaching material is equipped with a page number to make it easier for students to find the material being studied. The paper size used for teaching materials is A4 which consists of 50 pages.

After the teaching materials are made, the next step is to change the file format to Portable Document Format. This is done to facilitate the use and deployment. Because the pdf format can be opened with any media and by anyone. This teaching material can be used by students in online and offline learning. When learning online, students can open teaching materials using a laptop or cellphone. Meanwhile, when learning is offline, students can use math modules that are recorded or printed.

The cover design for mathematics teaching materials is made by combining the colors orange, yellow, blue, white and black with the aim of attracting students' interest. The design of the ninteni section is made by presenting material and examples of problems related to everyday life and how to solve them. Students can solve sample questions by following the appropriate instructions.



NITENI

1 Kalimat Terbuka dan Kalimat Tertutup

Sebelum mempelajari materi persamaan linear satu variabel, marilah kita mengingat kembali tentang kalimat terbuka dan kalimat tertutup. Tahukah kamu apa yang dimaksud dengan kalimat? Suatu kalimat dapat dibuat dari susunan kata-kata atau menggunakan simbol tertentu. Penggolongan kalimat dalam matematika dibagi menjadi dua, yaitu kalimat terbuka dan kalimat tertutup.

a. **Kalimat Terbuka**

Kalimat terbuka adalah kalimat yang belum diketahui kebenarannya, dapat bernilai benar dan juga bernilai salah. Karakteristik kalimat terbuka adalah memuat variabel dalam sebuah persamaan atau pertidaksamaan. Suatu kalimat terbuka akan bernilai benar atau bernilai salah tergantung dari nilai pengganti yang digunakan.

Misalkan diberikan sebuah kalimat matematika:

Kalimat tersebut akan bernilai **benar**, ketika nilai variabelnya diganti dengan 6. Seperti hasil yang diperoleh pada perhitungan berikut:

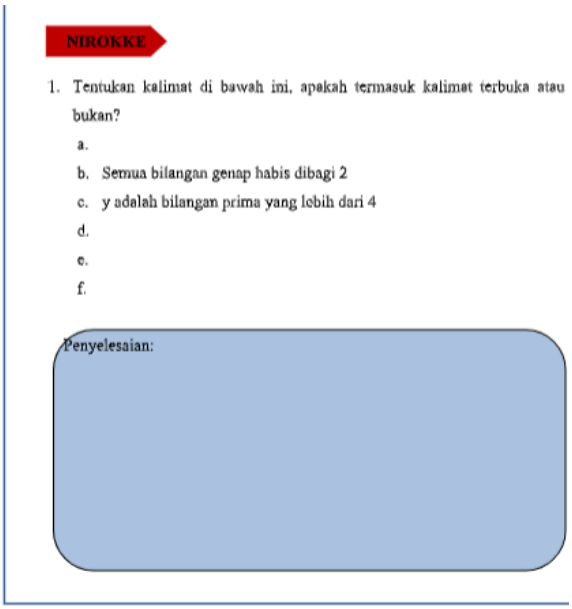
(benar)

Namun kalimat tersebut akan bernilai **salah**, jika nilai variabel diganti menjadi nilai selain 6. Misalkan diambil nilai .

(salah)

Figure 2. "Niteni" Section Design

The design of the nirokke section is made by presenting a problem that is similar to the niteni section and an empty shape to solve the problem.



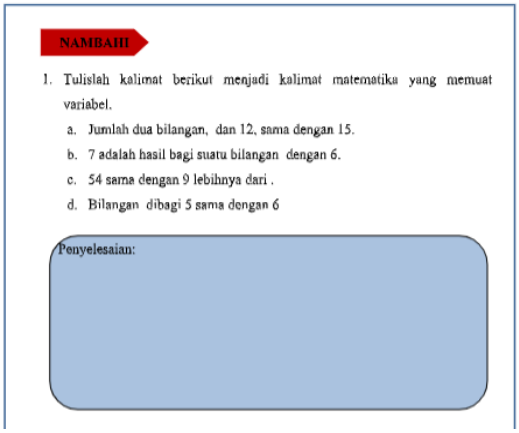
NIROKKE

1. Tentukan kalimat di bawah ini, apakah termasuk kalimat terbuka atau bukan?
   a.
   b. Semua bilangan genap habis dibagi 2
   c. y adalah bilangan prima yang lebih dari 4
   d.
   e.
   f.

Penyelesaian:

Figure 3. "Nirokke" Section Design

While the design of the nambahi section is made by presenting questions with a higher level of difficulty than the nirokke section which requires students to think creatively and there is an empty shape as a place to solve the problem.



NAMBAHI

1. Tulislah kalimat berikut menjadi kalimat matematika yang memuat variabel.
   a. Jumlah dua bilangan, dan 12, sama dengan 15.
   b. 7 adalah hasil bagi suatu bilangan dengan 6.
   c. 54 sama dengan 9 lebihnya dari .
   d. Bilangan dibagi 5 sama dengan 6

Penyelesaian:

Figure 4. Add Section Design

Develop

At the develop stage the teaching materials that have been made are then validated and tested on students to obtain an assessment related to product feasibility.

Expert Validation

Mathematics teaching materials that have been made are then validated by experts. Validation aims to obtain an assessment related to the validity of the material, presentation, and language. The validators consisted of 8 people including 4 experts in the field of mathematics education and 4 experts in mathematics education practitioners. From the validation of teaching materials obtained quantitative and qualitative assessments. The assessment is then used to improve mathematics teaching materials. Quantitative assessment obtained the validation score of each item. The results of validation

calculations can be seen in the following table.

Table 2. Expert validation results

No. Item	Percentage	Category
1.	82,5%	Highly Valid
2.	85%	Highly Valid
3.	95%	Highly Valid
4.	87,5%	Highly Valid
5.	80%	Valid
6.	90%	Highly Valid
7.	82,5%	Highly Valid
8.	92,5%	Highly Valid
9.	90%	Highly Valid
10.	87,5%	Highly Valid
11.	80%	Valid
12.	80%	Valid
13.	90%	Highly Valid
14.	82,5%	Highly Valid
15.	75%	Valid
16.	90%	Highly Valid
17.	82,5%	Highly Valid
18.	87,5%	Highly Valid
Average	**85,6%**	Highly Valid

Based on table 2, it is obtained that the average percentage of validity is 85.6%, so it is in the very valid category. In addition to these assessments, the validator also provides a qualitative assessment in the form of comments and suggestions for improving teaching materials.

First, with regard to the eligibility of the content, the validator conveys that the material is presented in a complete, accurate and appropriate manner with the learning objectives to be achieved and uses relevant illustrations. However, there are definitions of some concepts that need to be improved. Among them the definition of linear equations needs to be explained in detail. In addition, teaching materials do not accommodate the personal skills of students. So that at the adding stage, questions are given that raise new ideas so that students can think more critically and ask questions about how students write down answers.

Second, related to the presentation of the validator said that the tri N teachings in mathematics teaching materials have been presented consistently. So that the completion of the sample questions in the ninten section is added to the step of comparing answers between students and concluding the solutions obtained.

Third, with regard to language, mathematicians say that teaching materials use language that is in accordance with the Enhanced Spelling rules and can be well understood by junior high school students. However there is inconsistent use of pronouns. then there is the use of the equation which is still incomplete. Therefore the use of pronouns and equations in the mathematics module is corrected. Based on the results of the validation stated that mathematics teaching materials are valid with improvements.

rials

After the teaching material is declared valid and revisions have been implemented, it can be tried out on students. Trials were carried out to determine students' responses to teaching materials that had been developed. The trial was carried out on a limited basis, where students filled out a questionnaire. Implementation of trials at MTs Al Hidayah Sadeng with a total of 9 students. From the completed questionnaire, qualitative data will be obtained and then converted into

quantitative data. The results of the calculation of the student response questionnaire can be seen in the following table.

Table 3. Results of the Student Response Questionnaire

No. Item	Percentage	Category
1.	88,89%	Very good
2.	77,78%	Good
3.	75,56%	Good
4.	80%	Good
5.	82,22%	Very good
6.	93,33%	Very good
7.	91,11%	Very good
8.	93,33%	Very good
9.	82,22%	Very good
10.	73,33%	Good
11.	75,56%	Good
12.	82,22%	Very good
13.	93,33%	Very good
14.	91,11%	Very good
15.	75,56%	Good
16.	75,56%	Good
17.	77,78%	Good
18.	71,11%	Good
19.	75,56%	Good
20.	88,89%	Very good
Average	**82,22%**	**Very good**

Based on table 3 it is known that the average percentage of student response questionnaires is 82.22%, so it is in the very good category. Then students provide comments and suggestions that the use of mathematics teaching materials in learning is very interesting, because it contains examples of problems in everyday life that are easy to understand. In addition, mathematics teaching materials are equipped with pictures related to the material so that it attracts the attention of students to learn. Mr / Mrs teacher has never used teaching materials in the form of modules during learning so that students have new experiences in learning. The existence of Tri N teachings in mathematics teaching materials is very unique, because students have never encountered Tri N based teaching materials.

CONCLUSION

Based on the research conducted, the product is Trin-Based Mathematics teaching material in the Material of One-Variable Linear Equations and Inequalities with the stages of define, design, and develop. The validity of mathematics teaching materials according to 8 validators with an average percentage of 85.6% in the very valid category. Meanwhile, students' responses to mathematics teaching materials were in the very good category with an average percentage of 82.22%. So that mathematics teaching materials are suitable for use in the learning process in schools both online and offline. The research procedure carried out only reached the develop stage. Thus, this mathematics teaching material can be used for the next stage, namely disseminate.

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