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DEVELOPMENT OF INSTRUMENTS TESTING STUDENTS' MATHEMATICAL CRITICAL THINKING SKILLS ONE-VARIABLE LINEAR EQUATION MATERIAL

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Abstract

Therefore, critical thinking skills need to be possessed by students. This is in line with what was stated variable linear equation (PLSV) material. The research method used in this study is development research with the ADDIE model. The subjects of this research were grade VIII G students at MTsN 3 Sukabumi with a total of 22 respondents. The object used is the instrument of critical thinking ability. The data collection technique in this study used feasibility tests from experts or validators as many as 3 experts and students as respondents. The results showed that the instruments developed were in the valid category with t_hitung>t_tabel, had a reliability index of 0.467 with the medium category, and the distinguishing power of each question item was in the index of 0.40<DP<0.70 with a good category and for the level of difficulty there were two instrument items in the range of 0.30<TK≤0.70 with the medium category and one question item in the difficult category with a value range of 0.00<TK≤0.30. Based on the feasibility test from experts and the results of the validity test of each question item, reliability, differentiating power and level of difficulty, the instrument is good and can be used.
Keywords: Test Instruments, Critical Thinking Skills, One Variable Linear Equations

Abstrak

Kemampuan berpikir kritis perlu dimiliki oleh siswa. Hal ini sejalan dengan apa yang dinyatakan sebagai materi persamaan linear variabel (PLSV). Metode penelitian yang digunakan dalam penelitian ini adalah penelitian pengembangan dengan model ADDIE. Subjek penelitian ini adalah siswa kelas VIII G MTsN 3 Sukabumi dengan jumlah responden sebanyak 22 orang. Objek yang digunakan adalah instrumen kemampuan berpikir kritis. Teknik pengumpulan data dalam penelitian ini menggunakan uji kelayakan dari pakar atau validator sebanyak 3 pakar dan mahasiswa sebagai responden. Hasil penelitian menunjukkan bahwa instrumen yang dikembangkan berada pada kategori valid dengan t_hitung>t_tabel, memiliki indeks reliabilitas sebesar 0,467 dengan kategori sedang, dan daya pembeda setiap item soal berada pada indeks 0,40<DP<0,70 dengan kategori baik dan untuk tingkat kesulitan terdapat dua item instrumen pada rentang 0,30<TK≤0,70 dengan kategori sedang dan satu soal item dalam kategori sulit dengan kisaran nilai 0,00<TK≤0,30. Berdasarkan uji kelayakan dari para ahli dan hasil uji validitas setiap item soal, reliabilitas, daya pembeda dan tingkat kesulitan, instrumen tersebut baik dan dapat digunakan.
Kata kunci: Instrumen Uji, Kemampuan Berpikir Kritis, Persamaan Linear Satu Variabel

INTRODUCTION

21st century skills in the field of education focus on developing 4C skills, namely critical thinking, creativity, collaboration, and communication (Widana et al., 2019). One field of science that can improve this ability is mathematics learning (Febriano et al., 2021). This is in line with what was stated by Novianti et al.,(2020) which states that the ability to think critically is one of the levels of thinking needed to learn mathematics. The ability to think critically is the ability to think by using reflective reasoning and responsibly in solving

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problems that can be applied in everyday life (Sakinah & Nasution, 2023). Therefore, critical thinking skills need to be possessed by students. This is in line with what was stated Novianti et al., (2020) which states that by thinking, learners will have the habit of thinking deeply and living life with an intelligent, balanced and responsible approach. In addition, critical thinking skills are important for students in solving problems that occur in everyday life and in the face of very rapid technological developments(Nugroho et al., 2023).

There are several indicators that can be used to measure critical thinking skills. According to Ennis, (1996) There are six indicators used to determine critical thinking skills, namely Focus, Reason, Inference, Situationon, Clarivity, and Overview. Meanwhile, according to facione (Karim & Normaya, 2015) There are four main critical thinking skills involved in the critical thinking process: interpretation, analysis, evaluation and inference.

Despite the fact that critical thinking skills are very important, the facts in the field state that the critical thinking skills of these students are still classified as low (Anggraini et al., 2022; Bakri et al., 2021; Lestari & Roesdiana, 2021; Novianti et al., 2020; Nuryanti et al., 2018). Based on research conducted by PISA (2018) shows that Indonesian students have an average mathematics score that is far below the international average. The score obtained by Indonesia is 379 from the international average score of 489 ranked 72 out of 78 countries (OECD, 2019). This is in line with what was stated (Tresnawati et al., 2017) The low critical thinking ability of students is caused because students are not used to solving non-routine problems, which in solving it requires students to think deeply. Based on the results of PISA, the test instrument must be in the form of story questions, where learners must understand the questions, present them systematically and relate them to the material that has been learned (Ratnamutia & Pujiastuti, 2020).

The material of one-variable linear equations (PLSV) is one of the mathematical materials that requires a strategy to solve it (Agustiani et al., 2022). However, according to (Ni'mah & Sutopo, 2018) It was found that mastery of the material and understanding of the concept of one-variable linear equations were still low, the learning outcomes were far from the minimum value that had been set.

Therefore, a critical thinking ability test instrument is needed in accordance with the indicators that have been set on the one-variable linear equation (PLSV) material. In order to find out the extent of the quality of the instrument developed, the test instrument should

need to be analyzed first. With the possession of the test instruments developed can be used to improve students' abilities.

METHODS

Development research using the ADDIE model. According to (Agustiani et al., 2022) ADDIE's development model consists of five stages including: Analysis, Design, Development, Implementation, and Evaluation. The subjects in this study were grade VIII G students at MTsN 3 Sukabumi with a total of 22 respondents. This study used validation sheets and tests of students' mathematical critical thinking skills. The validation sheet is used to verify the instrument tests students' mathematical critical thinking skills. Data analysis in this study was obtained based on the results of validation and the results of student answers. The analysis of test result data obtained based on student answers is a validity test, a reliability test of discriminating power, and the level of difficulty.

RESULTS AND DISCUSSION

The following are the stages and results of instrument development of students' mathematical critical thinking skills in one-variable linear equation material

1) Analysis

In this stage, researchers carry out observations and conduct interviews with mathematics teachers in MTsN 3Sukabumi with the results as presented in the following table.

Table 1. Table Analysis results

Analysis stage	Retrieved	Analysis results
Needs analysis	MTsN 3 Sukabumi math teacher	Existing instruments are package books and other sources
Characteristic analysis		Student responses to mathematics learning vary and overall, student responses to the material provided by the teacher are quite good. However, due to students'

	lack of comprehension skills, students have difficulty in solving the questions given.

2) Design

The design stage of the mathematical critical thinking ability test instrument includes:

a. Determining the purpose of the test

The purpose of developing this test instrument is to create an instrument that can improve students' mathematical critical thinking skills. In addition, the instruments made can be used to measure students' mathematical critical thinking skills.

b. Compilation of grids

Then after setting goals, researchers compile a grid in the form of a table that includes indicators, material, indicators of critical thinking skills.

c. Question preparation

Next, compile question items in the form of description questions that are arranged based on the grids that have been made and the material that has been studied. Researchers made three description questions according to indicators of critical thinking ability and answer keys. The examples of problems at the design stage are as follows.

Intan always buys seblak near campus, with the price list of seblak at the dining place as follows.

Menu	Price
Seblak fried rice	19.000
Seblak grilled chili sauce	25.000
Seblak milk sauce	23.000

When intan wants to buy seblak with fani, there is a new menu, namely seblak bakso malang. Intan was curious about the taste of the new menu and decided to order 1 seblak nasi goreng and 2 seblak bakso malang. when paying bills, Intan must spend Rp. 74,000.00. Fani also bought 2 seblak bakso malang to take home. If fani pays with Rp.100.000,00., how much change does fani receive?

3) Development

When the student's mathematical critical thinking ability instrument is completed, then the instrument is validated to the validator, namely to experts in their fields to be evaluated so that deficiencies are known. The validators in this study are mathematics education lecturers and mathematics teachers. Validators not only provide assessments, but provide advice related to students' mathematical critical thinking skills. Some of the suggestions given are as follows.

Suggestion: Validator 1 "Equipped with pictures to make it look more attractive and can help students sharpen concentration on the objects discussed in the problem".

Initial design :

Menu	Price
Seblak fried rice	19.000
Seblak grilled chili sauce	25.000
Seblak milk sauce	23.000

Design Revision:

4) Implementation

At the implementation stage, researchers gave test instruments to grade VIII G MTsN 3 Sukabumi students. The focus of this study is to determine the quality of instruments that have been developed in collecting data such as validity, reliability, level of difficulty, differentiation. After the instrument is tested, students' answers are used as a basis for

assessing students' mathematical critical thinking skills. The following are the results of the test instrument trial analysis:

1) Test validity

The test instrument is said to be valid if the results in the validation test have a degree of validity with a valid category. Where is the question said to be valid If $t_{hitung} > t_{tabel}$ (Nurullita et al., 2022). The results obtained are as follows.

Table 2. Table Question item validation results

No.	t_{hitung}	t_{tabel}	Decision
1	4,463		
2	4,971	1,725	Valid
3	3,229		

Based on the table above, it is known that the three questions obtained valid results because the calculation results $t_{hitung} > t_{tabel}$ so that the instrument is said to be valid.

2) Reliability

The results obtained from the overall average of each question item showed that the student's mathematical critical thinking ability instrument had a reliability score of 0.467 with the medium category. According to Putri & Warmi, (2022) states that a value that has moderate reliability means that it is able to provide fairly stable results.

3) Differentiating Power

According to Arikonto, (2013) An instrument can be categorized as good if it has a distinguishing power with an index of $0.40 < DP \leq 0.70$. The results of the distinguishing power of each test instrument item are as follows

Table 3. Table Differentiating Power Results

Question number	Distinguishing Power	Category
1	0,694	
2	0,666	Good
3	0,444	

Based on the table above, it can be seen that the three test instruments have a differentiating power with the same range of values, namely in the range of $0.40 < DP \leq 0.70$, which is in the good category.

4) Difficulty Level

As for the difficulty level of the question items, there are two instrument items in the range of $0.30 < TK \leq 0.70$ values with the medium category and one instrument item in the range of $0.00 < TK \leq 0.30$ values, with difficult categories. According to (Bagiyono, 2017) item with difficulty levels in the difficult category can be used by having differentiating power in the medium and low categories and can distinguish upper and lower groups.

CONCLUSION

Based on the results and discussion, it can be concluded that the test instrument developed with the results of the validity analysis of each question item, reliability test, distinguishing power and level of difficulty is obtained that the instrument is good and can be used.

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