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DEVELOPMENT OF NUMERACY LITERACY INSTRUMENTS IN ALGEBRA MATERIAL CLASS X VOCATIONAL SCHOOL

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Abstract

This research aims to produce a Mathematics numeracy literacy instrument on algebra liner material in vocational schools that is tested for validity and reliability, as well as through systematic analysis of instruments with differentiating power tests and difficulty indexes. This type of research is a development study with the Wilson model and the Oriondo and Antonio model. The data collection method uses interviews, expert validation sheets, questionnaires and numeracy literacy tests. The data were analyzed descriptively and quantitatively. The results of the research obtained are: 1) expert assessment states that this numeracy literacy instrument is an instrument that is suitable for use; 2) the readability test shows that this numeracy literacy instrument is categorized as "good", 3) the validity test shows that this instrument is valid; 4) this numeracy literacy instrument is a reliable instrument with a reliability value of ri>rtable; 5) it has a good interpretive power with the conclusion that it can be used without revision; 6) Medium average difficulty index of question items. So that the resulting instrument is an instrument that is suitable for measuring students' numeracy literacy.
Keywords: Development, Numeracy Literacy, Linear Algebra.

INTRODUCTION

Mathematics education plays an important role in the formation of critical thinking and problem-solving skills for students. One of the important aspects of mathematics education is numeracy literacy, which refers to the ability of individuals to understand, use, interpret, and communicate using numbers in a variety of contexts. Strong numeracy literacy skills are necessary to build a solid foundation in the further understanding of mathematical concepts, including algebraic material.

Algebra material is one of the important mathematical concepts and is widely applied in daily life and in academic contexts. However, students often face difficulties in understanding algebraic concepts, especially at the secondary education level, such as grade X SMK. For this reason, the development of effective numeracy literacy instruments in algebra materials is very important to help students gain a deep understanding and good skills in this regard.

Numeracy literacy can be defined as a person's ability to use reasoning. Reasoning involves analyzing and understanding statements by manipulating symbols or mathematical language that are often encountered in everyday life, and then expressing those statements in writing or verbally (Abidin, Tita, & Yunansah, 2017). In numeracy literacy, a person uses his or her thinking ability. This thinking ability includes the ability to analyze and interpret information through daily activities (Fadilah, 2022). In simple terms, numeracy literacy is shown by the ability

to fluent in using numbers and practical skills in applying mathematical skills to solve problems faced (Susetyawati & Kintoko, 2022). Since 2009, numeracy literacy has become one of the aspects of assessment conducted by the OECD through the Program for International Student Assessment (PISA) for 15-year-old students in 79 countries (Ministry of Education and Culture, 2019). According to the 2018 PISA report released by the Ministry of Education and Culture (2019), students in Indonesia tend to have lower mathematical skills compared to students in the previous seven rounds. In PISA 2018, the average mathematics score of Indonesian students reached 379, or 80 points below the OECD average, which shows that the mathematics ability of Indonesian students is still at level 1, which is the lowest level in the context of PISA. One of the factors causing the low scores of Indonesian students is the lack of effectiveness of the learning process in Indonesia (Dewi Fortuna, Yuhana, & Novaliyosi, 2021). PISA 2018 tests students' math competence, including their ability to use mathematical symbols, read data presented in the form of tables, figures, or graphs, and use problem-solving strategies.

Previous research has shown that the use of proper numeracy literacy instruments can help students improve their math problem-solving skills and improve their understanding of the material being taught. However, in the context of algebra material for class X of vocational schools, the availability of adequate numeracy literacy instruments is still limited.

Therefore, this article aims to describe the development of numeracy literacy instruments that can be used in algebra materials in grade X of vocational schools. This research is expected to make a significant contribution to mathematics education, especially in improving the quality of algebra learning at the vocational school level.

In this article, we will describe the steps taken in developing a numeracy literacy instrument, including the process of designing, validating, and testing the instrument. In addition, we will also discuss the benefits of using numeracy literacy instruments in algebra learning and its implications for teachers and students.

With the development of appropriate numeracy literacy instruments in algebra materials in grade X of vocational schools, it is hoped that students can improve their understanding of mathematical concepts, critical thinking skills, and problem-solving skills. In addition, it is hoped that the results of this research can make a valuable contribution to the development of mathematics education and motivate further research in the field of numeracy literacy at the secondary education level.

Based on interviews conducted by researchers with several mathematics teachers of state vocational high schools in the Serang – Banten district area, precisely at SMK NEGERI 1 TANARA, it was found that it is still difficult to develop their own numeracy literacy questions that will be used as learning materials for students in understanding mathematics problems in the form of numeracy literacy and because of these difficulties teachers at the school are still using the previous years and there has been no renewal and development. For this reason, the researcher plans to conduct research and development *(RnD)* which produces mathematical numeracy literacy instruments in linear algebra materials.

RESEARCH METHODS

The method used is research and development or *Research and Development* (R&D). Sugiyono (2016) states that research and development is an activity

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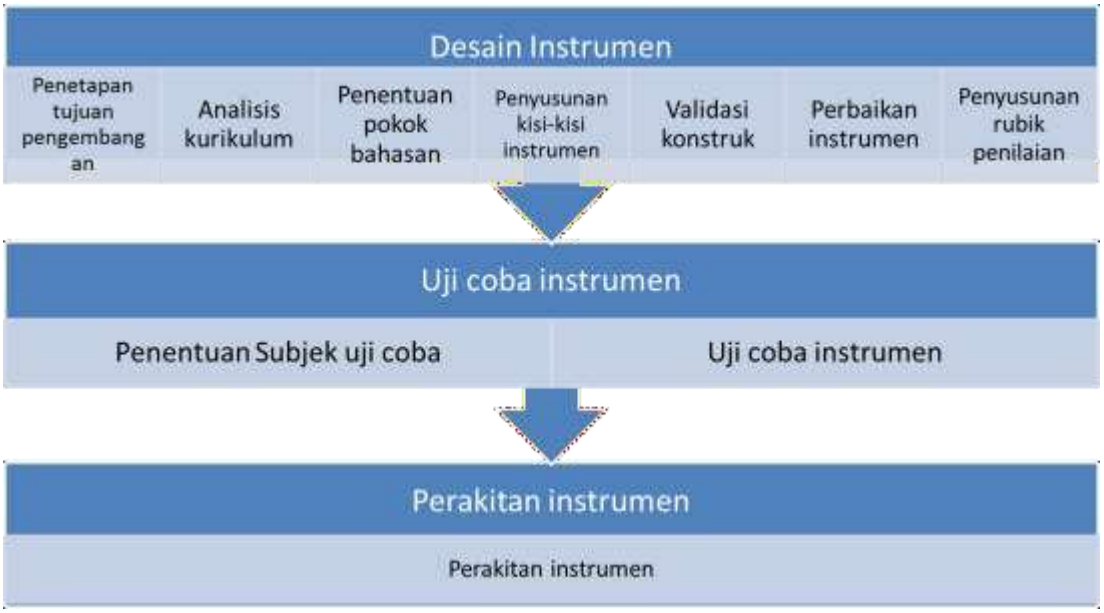
carried out to produce a certain product and test the effectiveness of the product. Meanwhile, according to Borg and Gall, it is a process used to develop and validate educational products.

The research model used is the Wilson model and the oriondo and Antonio model which consists of 3 stages, namely: instrument design, instrument trial, instrument assembly. As for the three stages above, it includes several implementation steps, which can be seen in the schematic of the stages in the image below:



The subjects of this study are class XII OTK Office students at SMK PLUS PAKUHAJI consisting of 20 randomly selected students. The data collection technique in this development was obtained through needs analysis interviews, self-study forms, expert review validation sheets directed at the validation of material content, construction and language suitability, and numeracy literacy test instruments.

RESULTS AND DISCUSSION

First, the development goal is set, namely to make a valid and reliable numeracy instrument and after that an analysis of differentiation and difficulty index is carried out.

Second, conducting a curriculum analysis and it was obtained from an interview with the deputy principal for curriculum that numeracy literacy is a form of question tested in the national assessment (AN) which includes AKM.

Third, determine the subject matter, namely in the form of material that will be applied to numeracy literacy questions and the researcher chooses linear algebra material

Fourth, namely the preparation of a grid of numeracy literacy instruments including domains, sub-domains, contexts, cognitive levels, indicators and question forms.

Table 1 Instrument grid

Yes	Domai	Sub	Context	Level	Indicator	Shape

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Question	n	Domain		Cognitive		question
1	Algebra	Program linear	Social	Applying	Students can create models to calculate the overall selling price of the fish and get the amount of profit the edge trader.	Multiple choice
2	Algebra	Program linear	Social	Applying	Students can re-present the data obtained from the stimulus and questions and then create a model to solve the problem.	Short Fill
3	Aljabar	Similarities and Inequality	Personal	Knowing	Stimulus/text was given in the form of images from the package menu of 3 different foods. Students can get information from the text	True/false
4	Aljabar	Similarities and Inequality	Personal	Applying	Stimulus/text was given in the form of images from the package menu of 3 different foods. Students can compile SPLTV	Multiple choice

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					based on the text.	
5	Aljabar	Similarities and Inequality	Personal	Applying	Stimulus/text was given in the form of images from the package menu of 3 different foods. Students can determine the price of one of the foods.	Isian
6	Aljabar	Similarities and Inequality	Personal	Reasoning	Stimulus/text was given in the form of images from the package menu of 3 different foods. Students can solve contextual problems related to SPLTV based on the text	Complex Multiple Choice
7	Aljabar	Similarities and Inequality	Personal	Reasoning	Stimulus/text was given in the form of images from the package menu of 3 different foods. Students can solve contextual problems related to SPLTV based on the text.	Matchmaking
8	Aljabar	Similaritie	Socio-	Reasonin	Stimulus/text	Complex

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		s and Inequality	Cultural	g	is given in the form of a composition table for uniform production. Students can solve problems related to linear programs based on the table data.	multiple options
9	Algebra	Program linier	Socio-Cultural	Applying	Stimulus/text is given in the form of a composition table for uniform production. Students can solve problems related to linear programs based on the table data.	Complex multiple options
10	Algebra	Program linier	Social	Applying	Students were given a stimulus of a table that was used to make the right mathematical model for Mr. Adi in buying fish with a certain amount of money that he had brought and	Complex multiple options

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					did not exceed the capacity of his motorbike	

Fifth, the construct validation carried out resulted in the following suggestions:

Table 1. Independent Study Results

ASPECTS STUDIED	**NO QUESTIONS**	**RESULTS OF SELF-STUDY**
Compatibility of the question with the indicator	1-4	The question has contained indicators that can be observed at: (1) A problem related to mathematical grades is given. With the hope that the participants will be able to analyze these problems. (2) It gives real problems related to the arrangement of tiles in a building. With the hope that the person will be able to determine the arrangement of the tiles (3) Given a real problem related to the travel route. Students are able to understand the travel route using the concept of numbers (4) Stimulus in the form of a picture of rice tumpeng analyzes the problem and determines the solution using
The questions have contained complete information consisting of aspects that are known and asked that lead to the expected answer	5-7 8-10	(5) spects known in the question include: drawings in the form of brick diagrams. Which is in the form of coffee exports from various countries. (6) iven a problem related to the type of batik in Indonesia in the hope that students will be able to apply problems with the SPLDV concept (7) roblems about Indonesian specialties are given with the hope that students will be able to answer with the concept of the association Aspects known in the question, include: the sale of fish from fishermen to edge traders and consumers.

After the construct validation is carried out, the numeracy literacy instrument is improved as the validation results are carried out. After that, scoring in each

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question depends on the cognitive level and complexity of each question. And after that, the Seventh is carried out, namely the determination of the research subject, namely 20 students of class X OTK Office, after which a trial is carried out which produces the following data:

Table 3. Field test results

QUESTION NUMBER	VALIDITY TEST	Reliability Test	DIFFICULTY LEVEL	DIFFERENTIATING POWER	KET
1	0,62		0,78	0,49	Used
2	0,61		0,75	0,47	Used
3	0,58		0,83	0,46	Used
4	0,70		0,71	0,59	Used
5	0,47	0,79	0,71	0,34	Used
6	0,70		0,75	0,64	Used
7	0,63		0,86	0,52	Used
8	0,55		0,56	0,44	Used
9	0,55		0,75	0,39	Used
10	0,60		0,66	0,46	Used

Based on the table above, it can be stated that the 10 numeracy literacy questions developed are categorized as valid because the validity value > 0.5 and for the reliability value because of the > rtables, it is stated that the numeracy literacy instrument developed is reliable.

Table 4. Difficulty index category
Difficulty Level Category 0.00 – 0.25 Difficult
0,26 – 0,75 Keep
0,76 – 1,00 Easy

Based on the table of difficulty categories above, the instruments developed in questions number 1, 3 and 7 are included in the easy category and in addition to that are included in the medium category.

Table 5. Power categories
Differentiating power Category
> 0.20 Must be revised

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0,20 - 0,29 Acceptable with revision
0.30 - 0.39 Acceptable without revision 0.40 – 1.00 Good

Based on the table of the differentiating power categories of numeracy literacy instruments question items 5 and 9

Included in the category is acceptable without revision and the rest are included in the good category.

After going through the development phase, the last step is to rearrange and improve trigonometric numeracy literacy instruments based on the results of test data analysis. This research succeeded in producing a valid numeracy literacy instrument that is valid, reliable, has a good separation rate, and a varying level of difficulty (easy, medium, and difficult). Thus, this numeracy literacy instrument is considered an effective tool and deserves to be used because it meets the criteria of validity and reliability as stated by Matondang (2014). These findings are in line with research conducted by Susetyawati & Kintoko (2022) which produced a valid and reliable numeracy literacy instrument for spatial building materials.

CONCLUSION

Based on the results of the research and development stages of the numeracy literacy instrument developed, several conclusions were obtained, namely: 1) the numeracy literacy instrument developed is suitable for use because it is valid and reliable, 2) the numeracy literacy instrument developed has a moderate average difficulty level for each question item, 3) the numeracy literacy instrument developed in testing the difference in the majority of question items is included in the good category. So that the instrument developed by the researcher is suitable to be used as an assessment to measure the numeracy literacy of students in vocational schools.

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