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DEVELOPMENT OF NUMERIC LITERACY QUESTIONS IN SPLTV SUB DOMAIN FOR HIGH SCHOOL STUDENTS

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ABSTRACT

This research aims to produce a numeracy literacy instrument in the three-variable linear equation system sub-domain for high school students that is valid, reliable, has distinguishing power and has a difficulty index. The research method used is the Research and Development (R&D) method with modifications to the Wilson Oriondo and Antonio models. The research results obtained a numeracy literacy question instrument that was valid and reliable in the high category. They had differentiating power for 1 question that was insufficient information, 1 question that was in good condition, and three questions that were in perfect description. Apart from that, the questions also have a difficulty index, with two questions being easy, two being medium, and 1 question being difficult. So, the resulting instrument is suitable for measuring students' numeracy literacy.

Tujuan dari penelitian ini untuk menghasilkan instrumen literasi numerasi pada sub domain sistem persamaan linear tiga variabel untuk siswa SMA yang valid, reliabel, memiliki daya pembeda dan memiliki indeks kesukaran. Metode penelitian yang digunakan adalah metode penelitian dan pengembangan atau Research and Development (R&D) dengan modifikasi model Wilson dan model Oriondo dan Antonio. Hasil penelitian memperoleh instrumen soal literasi numerasi yang valid, reliabel dengan katagori tinggi, memiliki daya pembeda untuk 1 soal berada pada keterangan cukup, 1 soal berada pada kerangan baik dan 3 soal berada pada keterangan sangat baik. Selain itu soal jua memiliki indeks kesukaran, dengan 2 soal berada pada keterangan mudah, 2 soal berada pada keterangan sedang, dan 1 soal berada pada keterangan sulit. Sehingga instrumen yang dihasilkan merupakan instrumen yang layak digunakan untuk mengukur literasi numerasi siswa.

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1. INTRODUCTION

Mathematics is a subject that involves calculations and can also be said to be a very important subject in education (Sandri et al., 2023). It is taught at all levels of education (Ningsih et al., 2022). Mathematics lessons are compulsory from elementary school to college (Purba et al., 2020).

The benefits of learning mathematics are significant in training students to think logically, solve problems, and communicate to convey ideas and mathematical skills (Widiastuti & Nindiasari, 2022). The purpose of learning mathematics in schools is that students can work on questions from teachers and are also able to solve problems related to mathematics (Amelia & Wardani, 2022). By learning mathematics, students acquire logical thinking skills, problem-solving, communication, and mathematical skills, and the purpose of learning mathematics is to train students to solve mathematical problems effectively.

The current curriculum is the Independent Curriculum. In this Independent Curriculum, the Minister of Education, Culture and Research Technology stated that the National Examination (UN) in 2021 was abolished and replaced with the National Assessment (AN) (Utari et al., 2023). The National Assessment consists of the Minimum Competency Assessment (AKM), Character Survey, and Learning Environment Survey (Sulingjar) (Berlianto & Pembangunan, 2023). The Minimum Competency Assessment (AKM) tests students on basic skills. It is designed to measure students' thinking skills when facing problems requiring reading, writing, and arithmetic skills requiring basic mathematics knowledge (Hidayah et al., 2021).

The ability of students to understand mathematical sentences and symbols and relate them to everyday life is known as numeracy skills (Saniah & Nindiasari, 2023). Mathematical literacy skills are students' basic mathematical abilities and applying mathematics in everyday life (Wahyuningtyas et al., 2020). Numeracy skills are the ability to think using mathematical concepts, procedures, facts and tools to solve everyday problems in various situations relevant to individuals as citizens of Indonesia and the world (Kemendikbud, 2020; Kedhi et al., 2024). Mathematical literacy skills are critical because they allow students to understand and apply mathematical concepts in various everyday life situations and help students make appropriate and relevant decisions based on a deep understanding of mathematics.

Algebra is a content that is often used in AKM questions at the high school level (Rachmawati et al., 2024). Story problems in the three-variable linear equation system (SPLTV) subdomain can be used to measure students' numeracy literacy abilities because they are complex, closely related to everyday life, involve more aspects of numeracy literacy, and have diversity in their stories(Jelita et al., 2024).

The results of interviews and observations conducted at SMAN 1 Jawilan showed that students were still not familiar with numeracy literacy questions and not many teachers used numeracy literacy-based questions during learning. In addition, based on research conducted by Ate & Lede, (2022) it shows that numeracy literacy skills are still in the poor category, especially in the skills of using various numbers and symbols related to basic mathematics to solve everyday problems. For this reason, students' numeracy literacy

skills need to be retrained by providing numeracy literacy-based practice questions (Mansur, 2018; Puspaningtyas & Ulfa, 2020).

Based on the description above, the purpose of this study is to develop a numeracy Based on the description above, the purpose of this study is to develop a numeracy literacy question instrument in the SPLTV subdomain for high school students that is valid, reliable, has differentiating power and has a difficulty index to produce an instrument that is suitable for measuring students' numeracy literacy.

2. METHODS

The research method used is the research and development method or Research and Development (R&D). The development of numeracy literacy questions in the SPLTV subdomain for high school students was carried out using the modified Wilson Model and the Oriondo and Antonio Model (Istiyono et al., 2014) which consists of three stages, namely the instrument design stage, instrument trial, and instrument assembly. Then the adaptation research stage from Apriatni et al., (2022) planning stages, namely: 1) formulating the objectives of developing question instruments; 2) curriculum analysis, including needs analysis and sustainable curriculum; 3) determining subject matter; 4) compiling instrument grids; 5) compiling assessment rubrics; 6) construct validation; and 7) instrument improvement. The next stage is the numeracy literacy question trial stage, namely: 1) determining subjects; 2) instrument trial; 3) analysis of instrument test results data (validity and reliability tests). The last stage is the instrument assembly stage, the revised question stage, which is written based on expert validity and analysis of numeracy literacy question trial data.

The study subjects were 33 students of class X-3 at SMAN 1 Jawilan who had studied the SPLTV material in the 2023-2024 academic year. The sample was selected using a purposive sampling technique, considering student characteristics. Data analysis includes interviews, needs analysis, expert validation, and numeracy literacy test instruments. Construct validation is carried out to find suggestions and input related to the instruments created. Three validators will validate the numeracy literacy instruments that have been developed.

Table 1. Validation Aspects

Aspect	Statement
Contents	1. Suitability of the question content to the domain 2. Suitability of the question content to the context 3. Suitability of question content with competency 4. Suitability of question content with cognitive 5. The questions represent all the material presented.
Construct	1. The questions are in accordance with the development of numeracy questions 2. Questions are appropriate for High School level
Language	1. The use of words does not have a double meaning 2. The language used is easy to understand 3. Effective use of language 4. Writing according to EYD

Expert validation data analysis was carried out by revising the input and suggestions provided by experts related to the numeracy literacy instrument with the

SPLTV subdomain. Analysis of the data from the trial of the numeracy literacy instrument to determine the instrument's validity and reliability test. The reliability test uses Alpha Cronbach. The provision of reliability categories in Table 2 (Wibowo & Retnowati, 2022):

Table 2. Instrument Reliability Categories

Mark	Katagori
$0{,}80 - 1{,}00$	Very high
$0{,}60 - 0{,}79$	High
$0{,}40 - 0{,}59$	Currently
$0{,}20 - 0{,}39$	Low
$0{,}00 - 0{,}19$	Very low

Next, a discriminatory power test will be carried out. For the criteria for the question discriminatory power index, there is table 3 (Magdalena et al., 2021):

Table 3. Discriminatory Power

Distinguishing Power (D)	Distinguishing Power Criteria
$D > 0{,}40$	Very good
$0{,}30 < D < 0{,}39$	Good
$0{,}20 < D < 0{,}29$	Enough
$0{,}19$	Not good
	Very bad

Question difficulty refers to the possibility of someone correctly answering a question instrument designed for a certain skill level. Usually, this difficulty is expressed in the form of an index that measures the level of complexity or challenge a question item possesses. The difficulty criteria in Table 4 (Magdalena et al., 2021):

Table 4. Level of Difficulty of Question Items

Criteria	Category
$< 0{,}25$	Difficult
$0{,}25 - 0{,}75$	Currently
$> 0{,}75$	Easy

3. RESULTS AND DISCUSSION

3.1. Results

The first stage is to formulate the development objectives. The objectives are to produce a valid, reliable, discriminatory, and difficulty-index numeracy literacy instrument.

After determining the development objectives, the next stage is curriculum analysis. The curriculum currently being used is the Merdeka Curriculum. In the Merdeka Curriculum, the National Examination (UN) is abolished and replaced with a National Assessment, which includes the Minimum Competency Assessment (AKM). The AKM is designed to measure students' reasoning abilities when faced with problems requiring basic mathematics knowledge.

After curriculum analysis, the next stage is needs analysis. In the needs analysis, interviews with teachers and observations were conducted. Based on interviews and observations, students are still not familiar with numeracy literacy questions, and there are still not many teachers who use numeracy literacy-based questions during learning. Therefore, it is necessary to develop valid and reliable numeracy literacy-based question instruments to help teachers provide these questions to students.

The next stage is determining the material. The numeracy literacy instrument material that will be developed is the SPLTV material. This material was chosen because it is one of the materials in the algebra domain. Then, the stage of compiling the grid. The grid of the question instrument is in Table 5.

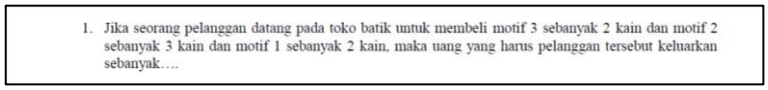
Table 5. The Grid Instrument

No	Domain	Sub Domain	Context	Cognitive Level	Types of Question	Indicator
1	Algebra	System of Linear Equations in Three Variables	Socio-cultural	Knowing	Essay	Provided stimulus/text in the form of images and a price list for Banten Batik cloth.
2	Algebra	System of Linear Equations in Three Variables	Socio-cultural	Reasoning	True False	Given a stimulus/text in the form of a picture and a price list for Banten Batik cloth, students are asked to determine whether the statements are true or false.
3	Algebra	System of Linear Equations in Three Variables	Socio-cultural	Applying	Essay	Given stimulus/text in the form of images and a price list for Banten Batik cloth, students are asked to provide reasons for the existing statements.
4	Algebra	System of Linear Equations in Three Variables	Personal	Applying	Essay	Stimulus/text is given in the form of images and a time table, the number of vehicles that have entered and the money collected.
5	Algebra	System of Linear Equations in Three Variables	Personal	Reasoning	True False	Stimulus/text is given in the form of images and a time table, the number of vehicles that have entered and the money collected.

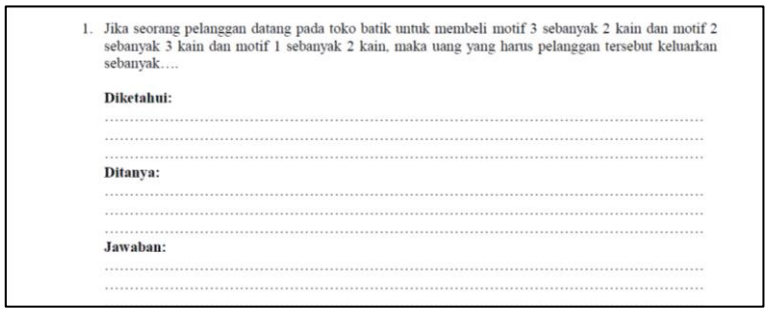
Then, after compiling the instrument grid, the assessment rubric is compiled. Numbers 1, 3, and 4 will be assessed based on the completion steps. The highest score for numbers 1, 3, and 4 is 10. Questions 2 and 5 will be assessed based on whether or not to choose the available statement, with the highest score given at 20. So, the maximum score that will be obtained for the whole is 70.

The next stage is construct validation. Validators are given a validation sheet to assess the suitability of the questions developed with indicators and then provide input and suggestions for improving the numeracy literacy questions.

Next is the instrument improvement stage. Instrument improvement is done after getting input from the validator. The following are the improvements that have been made.


1. Jika seorang pelanggan datang pada toko batik untuk membeli motif 3 sebanyak 2 kain dan motif 2 sebanyak 3 kain dan motif 1 sebanyak 2 kain, maka uang yang harus pelanggan tersebut keluarkan sebanyak….

Before revision


1. Jika seorang pelanggan datang pada toko batik untuk membeli motif 3 sebanyak 2 kain dan motif 2 sebanyak 3 kain dan motif 1 sebanyak 2 kain, maka uang yang harus pelanggan tersebut keluarkan sebanyak….

Diketahui:

Ditanya:

Jawaban:

After revision

Figure 1. Addition of Answer Section

Figure 1 above shows one of the validator's improvements: providing a separate section for students to answer. This is done to determine the steps students take in answering questions. Furthermore, the validator provides feedback again.


Kerjakanlah dengan teliti!

Kain batik merupakan warisan budaya Indonesia. Batik kerap diidentikkan dengan warisan budaya Kota Yogyakarta. Padahal, Indonesia memiliki batik dari daerah lain di Indonesia salah satunya Banten. Hingga saat ini terdapat 12 corak Batik Banten, yaitu dengan corak datulaya, mandalikan, kapurban, kawangsan, pamaranggen, pancaniti, pasepen, pasulaman, pejantren, sabakinking, srimanganti, dan surosowan. Sebuah toko di Kota Serang menjual 3 corak Batik Banten. Berikut ini adalah corak dan juga harga 1 kain batik.

Motif 1	Motif 2	Motif 3
Rp. 100.000	Rp. 150.000	Rp. 125.000

1. Jika seorang pelanggan datang pada toko batik untuk membeli motif 3 sebanyak 2 buah kain dan motif

Before revision


Kerjakanlah dengan teliti!

Untuk nomor 1-3.

KAIN BATIK BANTEN

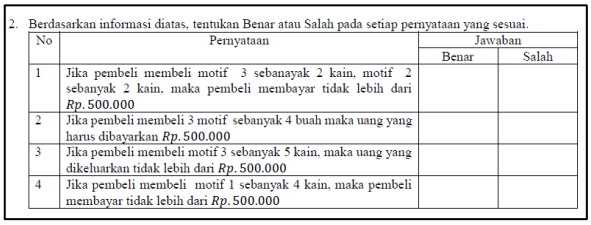
Kain batik merupakan warisan budaya Indonesia. Batik kerap diidentikkan dengan warisan budaya Kota Yogyakarta. Padahal, Indonesia memiliki batik dari daerah lain di Indonesia salah satunya Banten. Hingga saat ini terdapat 12 corak Batik Banten, yaitu dengan corak datulaya, mandalikan, kapurban, kawangsan, pamaranggen, pancaniti, pasepen, pasulaman, pejantren, sabakinking, srimanganti, dan surosowan. Sebuah toko di Kota Serang menjual 3 corak Batik Banten. Berikut ini adalah corak dan juga harga 1 kain batik.

Motif 1	Motif 2	Motif 3
Rp. 100.000	Rp. 150.000	Rp. 125.000

After revision

Figure 2. Correction Adding Discourse Title

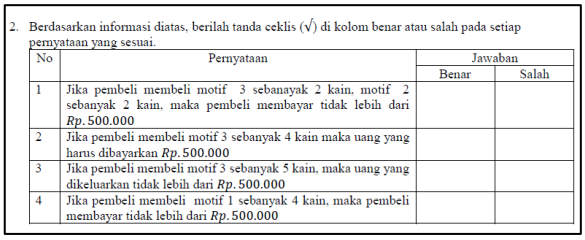
Figure 2 above is one of the improvements from the validator. The validator provides input to add a discourse title and also information related to the discourse for any number. In addition, the validator also provides other suggestions. The following are suggestions and input from the validator and the results of the improvements in Figure 3.



2. Berdasarkan informasi diatas, tentukan Benar atau Salah pada setiap pernyataan yang sesuai.

No	Pernyataan	Jawaban	
		Benar	Salah
1	Jika pembeli membeli motif 3 sebanayak 2 kain, motif 2 sebanyak 2 kain, maka pembeli membayar tidak lebih dari *Rp.* 500.000		
2	Jika pembeli membeli 3 motif sebanyak 4 buah maka uang yang harus dibayarkan *Rp.* 500.000		
3	Jika pembeli membeli motif 3 sebanyak 5 kain, maka uang yang dikeluarkan tidak lebih dari *Rp.* 500.000		
4	Jika pembeli membeli motif 1 sebanyak 4 kain, maka pembeli membayar tidak lebih dari *Rp.* 500.000		

Before revision



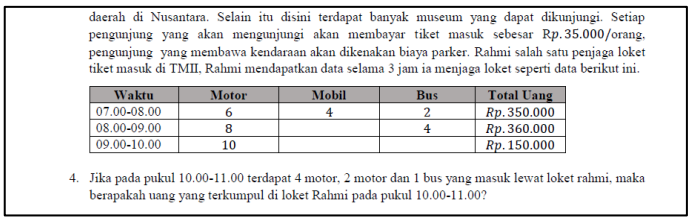
2. Berdasarkan informasi diatas, berilah tanda ceklis (√) di kolom benar atau salah pada setiap pernyataan yang sesuai.

No	Pernyataan	Jawaban	
		Benar	Salah
1	Jika pembeli membeli motif 3 sebanayak 2 kain, motif 2 sebanyak 2 kain, maka pembeli membayar tidak lebih dari *Rp.* 500.000		
2	Jika pembeli membeli motif 3 sebanyak 4 kain maka uang yang harus dibayarkan *Rp.* 500.000		
3	Jika pembeli membeli motif 3 sebanyak 5 kain, maka uang yang dikeluarkan tidak lebih dari *Rp.* 500.000		
4	Jika pembeli membeli motif 1 sebanyak 4 kain, maka pembeli membayar tidak lebih dari *Rp.* 500.000		

After revision

Figure 3. Correction of Adding Check Mark

Figure 3 above is a correction to add a checkmark to answer the statement that has been provided. In addition, the validator questions related to statement 2. Statement 2 can confuse students. Initially, "the buyer bought three motifs as many as four pieces" was corrected to "the buyer bought motif three as many as four fabrics". In addition, the validator provides feedback again.

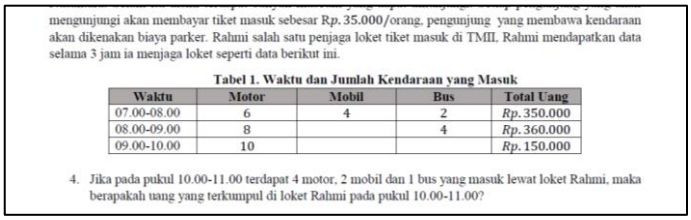


daerah di Nusantara. Selain itu disini terdapat banyak museum yang dapat dikunjungi. Setiap pengunjung yang akan mengunjungi akan membayar tiket masuk sebesar Rp. 35.000/orang, pengunjung yang membawa kendaraan akan dikenakan biaya parker. Rahmi salah satu penjaga loket tiket masuk di TMII, Rahmi mendapatkan data selama 3 jam ia menjaga loket seperti data berikut ini.

Waktu	Motor	Mobil	Bus	Total Uang
07.00-08.00	6	4	2	*Rp.* 350.000
08.00-09.00	8		4	*Rp.* 360.000
09.00-10.00	10			*Rp.* 150.000

4. Jika pada pukul 10.00-11.00 terdapat 4 motor, 2 motor dan 1 bus yang masuk lewat loket rahmi, maka berapakah uang yang terkumpul di loket Rahmi pada pukul 10.00-11.00?

Before revision



mengunjungi akan membayar tiket masuk sebesar Rp. 35.000/orang, pengunjung yang membawa kendaraan akan dikenakan biaya parker. Rahmi salah satu penjaga loket tiket masuk di TMII, Rahmi mendapatkan data selama 3 jam ia menjaga loket seperti data berikut ini.

Tabel 1. Waktu dan Jumlah Kendaraan yang Masuk

Waktu	Motor	Mobil	Bus	Total Uang
07.00-08.00	6	4	2	*Rp.* 350.000
08.00-09.00	8		4	*Rp.* 360.000
09.00-10.00	10			*Rp.* 150.000

4. Jika pada pukul 10.00-11.00 terdapat 4 motor, 2 mobil dan 1 bus yang masuk lewat loket Rahmi, maka berapakah uang yang terkumpul di loket Rahmi pada pukul 10.00-11.00?

After revision

Figure 4. Sentence Repetition Correction

Figure 4 above corrects the repetition of words in number 4. It can be written "6 motorbikes" directly. Because the researcher actually wanted "4 motorbikes, two cars and one bus," it was corrected in the two motorbike section. Finally, the validator gave feedback again.

The stage of determining the research subject is after the improvement of the numeracy literacy instrument based on suggestions and input from the validator. The subjects of this study were 33 students of class X-3 who had received SPLTV material.

The next stage is the instrument trial. This stage was conducted on 33 students of class X-3 SMAN 1 Jawilan. The test results were given a score following the assessment rubric that had been created. After the score was obtained, the validity and reliability test was next. The validity test was the number of respondents, namely 33 students, for the significant level—the results of the empirical validation test of the question items in Table 6.

Table 6. Results of the Validity Test of Question Items

No Question	r_{hitung}	Information
1	0,640	Valid
2	0,704	Valid
3	0,844	Valid
4	0,789	Valid
5	0,894	Valid

Based on the calculation results in table 4, 5 questions meet the criteria or can be interpreted as all valid questions. Next, a reliability test is carried out. The reliability value is obtained using *Cronbach Alpha.* The reliability of the numeracy literacy instrument is 0.649 which means it is included in the high category.

After the instrument is declared valid and reliable, the next step is to analyze the discriminating power. The following are the results of calculating the discriminating power and the difficulty index of the question instrument.

Table 7. Results of the Discriminatory Power Test and Results of the Difficulty Index

No	Results	Distinguishing Power Criteria	Difficulty Index	Category
1	0,244	Enough	0,818	Easy
2	0,416	Good	0,840	Easy
3	0,555	Very good	0390	Currently
4	0,711	Very good	0,224	Difficult
5	0,805	Very good	0,484	Currently

The numeracy literacy question instrument has differentiating power with the criteria of 1 sufficient question, 1 question with good information, and three questions with excellent details. Then, for the difficulty index, there are two questions in the easy category, two in the medium category, and 1 question in the problematic category. The final stage is assembling the questions. This assembly stage involves improving the questions and rearranging the question instruments that have been developed according to the results of the test data analysis of the question instruments.

3.2. Discussion

This study produces a numeracy literacy question instrument in the SPLTV subdomain for high school students that is valid and reliable, has discriminatory power, and has a difficulty index. The results of this study are by the research of Apriatni et al., (2022), which produces a numeracy literacy instrument on trigonometry material that is

valid, reliable, has quite good discriminatory power and has an easy, medium, and complex difficulty index. In addition, the study conducted by Yasin et al., (2023) produced a numeracy literacy instrument with a socio-cultural context at SMK Plus Pakuhaji, which is valid, reliable, has a moderate average level of difficulty and the discriminatory power of each question is mainly in the good category.

According to Tai et al., (2024) Tai et al., (2024) numeracy is the ability to apply number concepts and calculation skills in everyday life, such as at home, school, and society. Numeracy literacy skills are the application of mathematics in everyday life to make decisions in solving problems involving mathematical symbols, calculations, or numbers and figures (Salvia et al., 2022). Then, numeracy literacy skills can help students understand the role of mathematics in solving problems in everyday life (Pulungan, 2022). Numeracy literacy skills are understanding the role of mathematics and the application of mathematics to solve problems in everyday life. Students' numeracy literacy skills directly affect their learning outcomes; the better the numeracy skills are, the better their learning outcomes will be, and vice versa (Harefa et al., 2023).

4. CONCLUSION

Based on the results and discussion, it can be concluded that the development of the numeracy literacy question instrument in the SPLTV subdomain for high school students is a valid, reliable instrument with a high category, has a discriminatory power for 1 question in sufficient information, 1 question in good details and three questions in excellent information. In addition, the questions also have a difficulty index, with two questions with straightforward information, two with moderate details, and 1 question with complex information. So, the numeracy literacy questions in the SPLTV subdomain are suitable for measuring the numeracy literacy abilities of high school students.

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