AKSIOMA: Jurnal Program Studi Pendidikan Matematika
Volume 13, No. 4, 2024, 1202 – 1214

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

DEVELOPMENT OF A NUMERACY LITERACY BASED MATHEMATICS TEST ASSESSMENT ON INTEGERS IN PRIMARY SCHOOLS

Mohammad Yusuf Randy[1], Sukoriyanto[2], Sri Rahayuningsih[3*], Radeni Sukma Indra Dewi[4], Shirly Rizki Kusumaningrum[5]

[1,2,3,4,5] Universitas Negeri Malang, Malang, Indonesia
*Corresponding author. Jl. Semarang No.5, Malang, Jawa Timur, Indonesia
E-mail: yusufrandy123@gmail.com [1)]
sukoriyanto.fmipa@um.ac.id [2)]
srirahayuningsih.pasca@um.ac.id [3*)]
radenisukmaindradewi.pasca@um.ac.id [4)]
shirly.rizki.pasca@um.ac.id [5)]

Received 04 March 2024; Received in revised form 18 August 2024; Accepted 10 October 2024

Abstract

One of the mathematics materials considered difficult by students is integers, which affects the AKM Numeracy results that are not optimal, especially in the number domain. This study aimed to develop a valid and reliable numeracy literacy-based mathematics test instrument based on an integer of materials in grade V elementary school. This type of research is research and development with the Thiagarajan 4D model. The instruments developed include question grids as guidelines for making questions, questions and answer keys to test students' numeracy skills, and scoring guidelines for giving students scores. The number of questions developed was three multiple-choice questions and seven complex multiple-choice questions. This test instrument was validated by the principal and fifth-grade teacher and obtained very valid results. The instrument was tested on fifth-grade students of SDN Kasembon 3 in the even 2023/2024 school year and obtained the results of the item validity test getting a valid level on each item, the reliability test getting a high level, the differentiator test getting a sufficient and good level, and the difficulty test getting an easy and moderate level. So, this numeracy literacy-based mathematics test instrument on integer material is feasible and can measure numeracy skills very well.

Keywords: Instrument development; integers; numeracy literacy; primary school

Abstrak

Salah satu materi matematika yang dianggap sulit oleh siswa adalah bilangan bulat dan berpengaruh pada hasil AKM Numerasi belum optimal, khususnya pada domain bilangan. Tujuan penelitian ini untuk mengembangkan instrumen tes matematika berbasis literasi numerasi pada materi bilangan bulat yang valid dan reliabel di kelas V sekolah dasar. Jenis penelitian ini adalah Research & Development dengan tahapan pengembangan model Thiagarajan 4D. Instrumen yang dikembangkan meliputi kisi-kisi soal sebagai pedoman pembuatan soal, soal dan kunci jawaban sebagai alat untuk menguji kemampuan numerasi siswa, dan pedoman penskoran sebagai alat untuk memberikan nilai siswa. Jumlah soal yang dikembangkan berupa tiga soal pilihan ganda dan tujuh soal pilihan ganda kompleks. Instrumen tes ini divalidasi oleh kepala sekolah dan guru kelas V dan mendapatkan hasil sangat valid. Instrumen tersebut diujicobakan kepada siswa kelas V SDN Kasembon 3 pada tahun ajaran genap 2023/2024 dan mendapatkan hasil uji validitas butir soal mendapatkan tingkat valid pada setiap butir soal, uji reliabel mendapatkan tingkat tinggi, uji daya pembeda mendapatkan tingkat cukup dan baik, dan uji tingkat kesukaran mendapatkan tingkat mudah dan sedang. Jadi dapat disimpulkan, bahwa instrumen tes matematika berbasis literasi numerasi materi bilangan bulat ini layak dan dapat mengukur kemampuan numerasi dengan sangat baik.

***Kata kunci**: Bilangan bulat; literasi numerasi; pengembangan instrumen; sekolah dasar*

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

INTRODUCTION

Mathematics is one of the most important subjects for everyone to learn, from primary to higher education, because it supports or develops various other disciplines (Bennison & Geiger, 2020; Rezat, Fan, & Pepin, 2021). In mathematics, students must learn about numbers, shapes, and patterns and emphasize logical and rational thinking (Cresswell & Speelman, 2020; Zippert & Rittle-Johnson, 2020). Mathematics also has abstract concepts and requires concrete objects or real-life contexts to make it easier for students to understand the material (Kaminski & Sloutsky, 2020; Ulfah, Yerizon, & Arnawa, 2020). Assessment is an important and inseparable component in learning mathematics to measure a student's ability to achieve learning objectives.

Assessment encompasses various methods to evaluate students' progress toward learning goals, with tests precisely measuring cognitive understanding (Granberg, Palm, & Palmberg, 2021; İbili, Çat, Resnyansky, Şahin, & Billinghurst, 2020; Zainuddin, Shujahat, Haruna, & Chu, 2020). As education enters the 21st century and adapts to the Industrial Revolution 4.0, critical thinking, creativity, collaboration, and communication have become essential skills. In response, the Ministry of Education and Culture introduced the AKM program as a technology-based assessment to replace the national exam (Kemendikbudristek, 2020; Nahadi, 2022). Within the AKM framework, students must develop competencies in reading and numeracy literacy (Kemendikbudristek, 2020). Numeracy literacy involves applying mathematical concepts and procedures to solve real-life problems, which is crucial for calculating, processing, presenting, and analyzing information in various formats (Carroll, 2022; Chan & Scalise, 2022). This ability not only aids in making predictions and decisions but also helps students tackle various mathematical challenges in everyday life (Bennison & Geiger, 2020; Thomas et al., 2023).

In reality, In Indonesia, students' numeracy skills remain relatively low, as evidenced by the 2022 PISA test results, which ranked the country 69 out of 81, and the National Education Report Card, indicating an achievement level of only 46.67% (Kemendikbudristek, 2023; OECD, 2023). Observations at SDN 3 Kasembon reveal that the school's preparation for implementing AKM needs improvement, particularly in enhancing teachers' efforts to build students' literacy and numeracy skills, especially regarding integers. While teachers provide AKM-based problems, more than this approach is needed to ensure deep understanding, as students may only perform well due to familiarity with similar questions. Thus, there is a need for a more structured and effective literacy and numeracy-based assessment to evaluate students' understanding of integer concepts, which are often challenging due to the rules of arithmetic operations and their application in real-life contexts. Developing a numeracy literacy-based mathematics test assessment for primary school materials is essential.

This integer material has abstract concepts consisting of various rules, especially in integer counting operations, and requires creative and innovative challenges for teachers in teaching so that it can be understood by students (Bryant et al., 2020; Çankaya, Yıldız, & Cengiz, 2022; Muslimin, Putri, Zulkardi, & Aisyah, 2020). By linking the mathematics test on integers

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

material with numeracy literacy, it is hoped that students can practice working on numeracy problems and work on this integers problem contextually and more concretely because this numeracy literacy is related to students' daily lives (Bolstad, 2023; Maslihah, Waluya, Rochmad, & Suyitno, 2020).

In previous studies, the development of mathematics test assessments has been carried out several times, such as the development of HOTS-based mathematics tests, the development of problem solving-based mathematics tests, the development of ethnomatics-based mathematics tests, the development of reflective thinking-based mathematics tests, and the development of open-ended mathematics tests (Anggraini & Muntazhimah, 2021; Cahyadi, Darmayanti, Muhammad, Sugianto, & Choirudin, 2023; Rahayuningsih, Sirajuddin, & Ikram, 2021; Rahmawati, Komarudin, & Suherman, 2022; Suherman & Vidákovich, 2022). Based on the exposure of similar previous studies, researchers are interested in taking the title "Development of Numeracy-Literacy Based Mathematics Test Assessments on Integers Material in Primary Schools." The difference between previous research and this research is that it is focused on developing a mathematics test assessment on integers based on numeracy literacy, not developing a numeracy literacy AKM assessment. Therefore, this research aims to develop a valid and reliable numeracy literacy-based mathematics test instrument based on an integer of materials in grade V primary school.

METHODS

This study used a Research & Development approach to develop a numeracy literacy based mathematics test instrument on integer material. The development model used the 4D model from Thiagarajan through the development stages of define by analyzing the needs at school, design by designing numeracy literacy based questions by adjusting the provisions in the AKM, develop by conducting material expert validity, instrument trials, and item analysis, and disseminate by sharing the results of instrument development with the school (Reigeluth & An, 2020).

The instrument was tested on 19 students from Grade V of SDN 3 Kasembon during the even academic year 2023/2024. This location and subject were chosen because SDN 3 Kasembon represents primary schools in the region, allowing for insights into the specific challenges students face in developing numeracy literacy skills. Additionally, focusing on Grade V students is crucial, as this is a pivotal stage for mastering foundational mathematical concepts, particularly integers, which are essential for further mathematical learning.

The instruments developed include question grids as guidelines for making questions, questions and answer keys to test students' numeracy skills and scoring guidelines as a tool for giving student scores. The number of questions developed was three multiple-choice questions and seven complex multiple-choice questions.

The data analysis stage consists of a content validity test to test the level of validity through material experts, item validity test to test the level of validity through each item, reliability test to test the level of constancy of the instrument,

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

differentiating power test to test the instrument can distinguish student abilities. Difficulty test to test the level of difficulty of students in working on the instrument.

RESULT AND DISCUSSION

A. Define Stage

At this stage, researchers conducted interviews and observations at SDN 3 Kasembon to analyze the problems and needs of teachers and students, learning materials that students consider difficult, and student characters. Based on the results of interviews with teachers and the principal of SDN 3 Kasembon, it was found that they had not carefully prepared the minimum competency assessment that would be held in class V, and the results of students' numeracy literacy skills at the school could not be maximized. This happens because students' abilities are heterogeneous, and teachers rarely train students with numeracy literacy based questions because these questions still need to be improved. Teachers still need more time to develop numeracy literacy questions. One of the important things that make students' abilities in numeracy literacy not optimal because teachers rarely or never provide numeracy literacy based practice questions and make students not accustomed to working on these questions on AKM (Ijtahidah & Nisa', 2023; Kusuma & Nurmawanti, 2023; Oktiningrum & Rahayu, 2022).

The researcher determined that the subject of this study was grade V. In the previous AKM, their numeracy skills could still not be said to be maximized and needed to be trained further, especially to continue at the next level, namely junior high school, high school, and even college, because this numeracy skill must be trained at every level. The material considered difficult by grade V students is integer material because students not only learn about the concept of integers but must learn about the rules of integer counting operations and calculate integers associated with the context of everyday life. Integers material is considered difficult by most students because the material has abstract concepts that must be given concretely by the teacher either through learning media or the context of students' daily lives (Çankaya et al., 2022; Defa, 2022; Mustika, Soleh, & Supriatna, 2023).

During observations and interviews of students' characteristics when working on math problems, it was found that students tend to take a long time, especially questions that use descriptions and essays that must include methods or procedures. Then, students still need to get used to answering complex multiple-choice questions, and the portion of complex multiple-choice questions in AKM numeracy is more than other types of questions. Therefore, the researchers developed ten questions consisting of three multiple-choices and seven complex multiple-choices. Analyzing student characteristics is very important before developing question instruments because it determines the type of question and the number of questions used. If students take a long time to do the questions, then in developing questions, they must use multiple-choice or complex multiple-choice questions or develop description questions but with fewer questions (Anggraini & Muntazhimah, 2021; Purnamasari, Safitri, & Kurnia, 2023; Sutama, Prayitno, Narimo, Ishartono, & Sari, 2021).

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

B. Design Stage

At this stage, researchers make numeracy-based integer material test instruments consisting of question grids, numeracy literacy questions, answer keys, and scoring guidelines. In making numeracy literacy based mathematics, questions must adjust to the components of the questions in the AKM, from the types of questions used, the numeracy themes used, the cognitive levels measured in numeracy, the content used in numeracy questions, and the numeracy context used.

In making a test instrument, it must have a question grid as a guide in compiling questions, there are questions and answer keys as a tool to test students' abilities, and scoring guidelines as a tool to measure students' abilities and make the assessment more objective (Anggraini & Muntazhimah, 2021; Cahyadi et al., 2023; Rahmawati et al., 2022). In addition, according to Ijtahidah & Nisa' (2023) and Purnamasari et al. (2023) in making numeracy literacy questions, you must pay attention to the rules contained in the guidelines for making AKM questions made by the Ministry of Education and Culture, both from the types of questions used, the content used, the context used, and so on.

In making the question grids, researchers formulated five components contained in the question grids, namely: theme, context, question number, cognitive level, competency, and question type. Examples of question grids developed by researchers can be seen in Table 1.

Table 1. Question grid

Theme	Context	Question Number	Cognitive Level	Competences	Type of Question
"Makanan Sehat"	Personal	1	Understanding	Explaining negative integers	Multiple choice
		2	Reasoning	Comparing negative integers	Compelx multiple choice
		3	Application	Operating negative integers	Compelx multiple choice

In making questions and answer keys, researchers designed ten questions that would be used in the multiple-choice scoring guidelines; there are two aspects of assessment in measuring students' numeracy skills. If the student does not answer or is wrong in doing the problem, then the student gets a score of 0. Conversely, if the student is correct in doing the problem, then the student gets a score of 1. The development of this numeracy problem, namely, three multiple-choice questions and seven complex multiple-choice questions with a true-false model. Examples of questions and answer keys from numeracy literacy developed by researchers can be seen in Table 2.

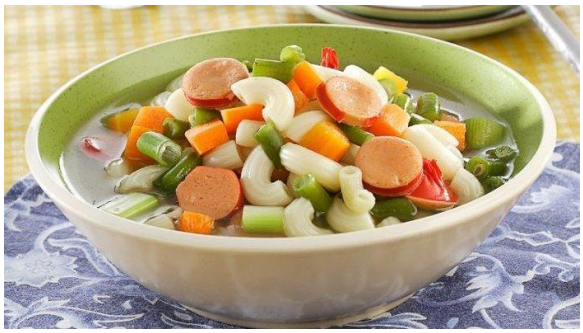
ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

Table 2. Questions and answer keys

Memasak Sayur Sop

Intan memiliki seorang ayah yang bekerja sebagai koki di restoran terkenal. Pada esok hari, ayahnya berencana untuk memasak sayur sop sebagai menu utama. Ayahnya menyuruh Intan untuk membeli bahan-bahan yang dibutuhkan untuk memasak. Setelah berbelanja, Intan membawa pulang 5 wortel, 3 kol, 4 sosis, dan 6 buncis. Intan menyimpan bahan-bahan tersebut di kulkas sebelum memasak. Sebelum memasak, Intan mengukur suhu masing-masing sayuran dengan termometer. Hasilnya, suhu wortel 10°C, kol -5°C, sosis -10°C, dan buncis 5°C. Intan dan ayahnya kemudian memasak sayur sop bersama-sama.



Pertanyaan 2.
Berdasarkan informasi yang ada pada teks tersebut, berilah tanda centang (✓) pada kolom **Benar** atau **Salah** pada setiap pernyataan yang sesuai.

Pernyataan	**Benar**	**Salah**
(1) Jumlah bahan pembuatan sayur sop terdingin adalah 4 buah.		
(2) Jumlah bahan pembuatan sayur sop terpanas adalah 5 buah.		
(3) Jumlah bahan pembuatan sayur sop terdingin urutan kedua adalah 2 buah.		
(4) Jumlah bahan pembuatan sayur sop terpanas urutan kedua adalah 5 buah.		

Kunci Jawaban:
Benar – Benar – Salah – Salah
Pembahasan:
Urutan bahan pembuatan sayur sop dari terdingin ke terpanas: Sosis – kol – buncis – wortel.

- Pernyataan 1 Benar, jumlah bahan pembuatan sayur sop terdingin (sosis) adalah 4 buah.
- Pernyataan 2 Benar, jumlah bahan pembuatan sayur sop terpanas (wortel) adalah 5 buah.
- Pernyataan 3 Salah, jumlah bahan pembuatan sayur sop terdingin urutan kedua (kol) adalah 3 buah bukan 2 buah.
- Pernyataan 4 Salah, jumlah bahan pembuatan sayur sop terpanas urutan kedua (buncis) adalah 6 buah bukan 5 buah.

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

The scoring guidelines researchers made special scoring guidelines for both multiple-choice questions and complex multiple-choice questions. Examples of scoring guidelines for multiple-choice questions developed by researchers can be seen in Table 3.

Table 3. Scoring guidelines for multiple-choice questions

Aspect	Score
No answer or wrong answer	0
Answered correctly	1

In the multiple-choice scoring guidelines in Table 3, there are two aspects of assessment in measuring students' numeracy skills. If the student does not answer or is wrong in doing the question, then the student gets a score of 0. Conversely, if the student is correct in doing the question, then the student gets a score of 1.

Table 4. Scoring guidelines for complex multiple-choice questions

Aspect	Score
No answer or all answer choices are wrong	0
Answer choice only correct 1	1
Correct answer choice 2	2
Correct answer choice 3	3
All answer choices are correct	4

In the complex multiple-choice scoring guidelines in Table 4, there are five aspects of assessment in measuring students' numeracy skills, namely:

1. Students will get a score of 0 when students do not answer all questions or all answer choices are wrong.
2. Students will score 1 when they only answer one question correctly.
3. Students will get a score of 2 when students answer two questions correctly.
4. Students will get a score of 3 when students answer three questions correctly.
5. Students will get a score of 4 when students answer four questions correctly.

The scoring guidelines for numeracy literacy questions combine multiple-choice question type scores with complex multiple-choice questions, namely three multiple-choice questions with a maximum score of 3 and seven complex multiple-choice questions with a maximum score of 28. When summed up, the maximum score that students can achieve is 31.

C. Develop Stage

At this stage, the researcher conducts a validity test to test the level of validity of the questions, a reliability test to test the level of reliability of the instrument, a differentiator test to test whether the instrument can differentiate student abilities, and a difficulty test to test the level of difficulty of students in working on the instrument. The first step taken by the researcher is to conduct a validity test of two kinds, namely, a content validity test for material experts and an item validity test using SPSS. In content validity, researchers' instruments are tested by two material experts, namely the principal and the grade V teacher. In content validity, the aspects assessed are content aspects, which contain 6 components; construct aspects, which contain 10 components; and language aspects, which contain 4 components. The results of content validation can be seen in Table 6.

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

Table 6. Content Validity Results

Aspect	V1	V2	Average	Max Score	Percentage
Content	24	24	24	24	100%
Construct	40	40	40	40	100%
Language	15	13	14	16	88%

Based on the results of content validity in Table 6, the percentage obtained in each aspect of validity, namely the content aspect gets a percentage score of 100%, the constructed aspect gets a percentage score of 100%, and the language aspect gets 88%, which means that all three get very valid results because they have a percentage value between 85% - 100% (Anggraini & Muntazhimah, 2021; Rahmawati et al., 2022). According to Apipah et al. (2023) and Rahmawati et al. (2022) validity is important before conducting research or product trials because when the instrument is invalid, the instrument cannot measure the student's ability to be measured. After the content validity results obtained valid results, the researchers tested the test instrument on 19 students in class V SDN 3 Kasembon.

Table 7. Question item validity results

Question Number	R_{Hitung}
1	0,531
2	0,731
3	0,733
4	0,710
5	0,774
6	0,637
7	0,600
8	0,511
9	0,651
10	0,552

Based on the results of the question item validity results in Table 7, the researcher conducted item validity using the SPSS 27.0 application with an R_{tabel} value of 0.456 and obtained the result that each item tested was said to be valid because it had a $R_{Hitung} > R_{Tabel}$ value with a significant level of 5% (Anggraini & Muntazhimah, 2021; Nasution, Fauzi, & Syahputra, 2020; Rahmawati et al., 2022) or had a value of 0.400 - 1.00 which could be said to be valid (Arikunto, 2022). So, it can be concluded that the instrument is valid and can be used. Item validity also needs to be done to ensure that the questions used can measure the ability of students to be measured using the results of the instrument trial to students by testing the validity of each item (Kusuma & Nurmawanti, 2023; Rahmawati et al., 2022).

Based on the results of the test instrument test on 19 students in class V SDN 3 Kasembon, the researcher conducted a reliability test using the SPSS 27.0 application and obtained a result of 0.819, which means it has a very high reliability because it has a value between 0.800 - 1.000 (Sugiyono, 2022). So, the instrument is reliable and can be used to measure students' numeracy literacy skills. The reliability test is important in developing a question instrument because it assesses the consistency or persistence of the instrument in measuring student abilities when several times tested on the same subject to get the same data results (Fatayah, Yuliana, & Muf'idah, 2022; Rahmawati et al., 2022).

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

Table 8. Differentiating power test results

Question Number	Value
1	0,491
2	0,606
3	0,597
4	0,667
5	0,680
6	0,481
7	0,598
8	0,358
9	0,551
10	0,460

Based on the results of differentiating power test in Table 8, the researcher conducted a differentiating power test using SPSS 27.0 and found that item number 8 received sufficient differentiating power criteria because it had a value between 0.21 - 0.40 (Arikunto, 2022). Meanwhile, questions 1, 2, 3, 4, 5, 6, 7, 9, and 10 have good differentiation criteria because they have values between 0.41 and 0.70 (Arikunto, 2022). So, the ten items can differentiate each student's high and low ability. The differentiating power test is one of the important things to prove whether the test instrument developed can distinguish between high student abilities and low student abilities to get a comparison (Rahmawati et al., 2022).

Table 9. Results of the level of difficulty test

Question Number	Value
1	0,842
2	0,593
3	0,553
4	0,737
5	0,750
6	0,473
7	0,737
8	0,895
9	0,580
10	0,528

Based on the results of the level of difficulty test in Table 9, the researchers tested the difficulty level using SPSS 27.0. They found that questions 1, 4, 5, 7, and 8 had an easy difficulty category because they had a value between 0.71 and 1.00 (Arikunto, 2022). Meanwhile, questions 2, 3, 6, 9, and 10 have a medium difficulty category because they have a value between 0.30 - 0.70 (Arikunto, 2022). The difficulty test is a test to prove and see the extent to which the test instrument developed by the researcher has a certain level of difficulty when done by students (Rahmawati et al., 2022). A good difficulty test usually has medium and easy categories (Nasution et al., 2020). Meanwhile, according to Rahmawati et al. (2022), it would be nice if the questions developed had simple or easy categories.

D. Disseminate Stage

At this stage, researchers disseminate the results of the revised instrument to the school to be used in the next class year in the hope that it can help students at SDN 3 Kasembon to improve numeracy literacy skills. Based on research by (Anggraini & Muntazhimah, 2021; Ijtahidah & Nisa', 2023; Purnamasari et al., 2023), the dissemination stage is the last stage of the 4D model, which aims to disseminate and provide the results of products that have been developed and revised, namely question instruments to schools as test locations or other schools so that the products developed can be useful.

The research results offer significant theoretical and applied implications for mathematics education. Theoretically, the study enhances knowledge by providing a structured framework for developing numeracy

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

literacy-based assessment instruments, highlighting the importance of systematic methodologies. It deepens the understanding of numeracy literacy in primary education, particularly regarding the challenges of mastering integer concepts, and sets a foundation for future research in effective assessment tools. Practically, the developed instrument provides educators with tools to assess and improve Grade V students' understanding of integers, addressing gaps in numeracy skills and potentially enhancing student outcomes in mathematics. The findings also inform policymakers about the state of numeracy skills and the effectiveness of current assessments, contributing to the development of improved educational policies. By sharing the results with SDN 3 Kasembon and other schools, the study promotes collaboration between researchers and educators, fostering a community-oriented approach to enhancing educational practices and student learning experiences.

CONCLUSION AND SUGGESTION

Based on the research results, this research has produced a numeracy literacy based mathematics test instrument on integer materials in primary schools. From the results of the trial of grade V students at SDN 3 Kasembon, it can be concluded that this math test instrument has a valid level of validity, a high level of reliability, a sufficient and good level of differentiating power, and an easy and moderate level of difficulty. Therefore, this numeracy literacy based mathematics test instrument on integers number material is feasible and can be used as a measure of students' numeracy skills in primary schools and as an instrument for further research.

Therefore, it is expected that teachers can develop numeracy literacy based mathematics test assessments to train students to get used to facing numeracy AKM in the following year. For future research, it is hoped that researchers can develop numeracy literacy based mathematics test assessments with broader material and various questions.

REFERENCES

Anggraini, A., & Muntazhimah, M. (2021). Pengembangan Instrumen Kemampuan Berpikir Reflektif Matematis Siswa Madrasah Aliyah. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(4), 2465–2476. https://doi.org/10.24127/ajpm.v10i4.4223

Apipah, I., Nindiasari, H., & Sukirwan, S. (2023). Pengembangan Instrumen Soal Literasi Numerasi pada Materi Bilangan untuk Meningkatkan Kemampuan Berpikir Tingkat Tinggi Siswa Kelas VIII MTs. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *7*(3), 3083–3092. https://doi.org/10.31004/cendekia.v7i3.2606

Arikunto, S. (2022). *Dasar-Dasar Evaluasi Pendidikan*. Jakarta: Bumi Aksara.

Bennison, A., & Geiger, V. (2020). Numeracy Across the Curriculum as a Model of Integrating Mathematics and Science. In J. Anderson & Y. Li (Eds.), *Integrated Approaches to STEM Education: An International Perspective* (pp. 117–136). Cham: Springer International Publishing.

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

https://doi.org/10.1007/978-3-030-52229-2_7

Bolstad, O. H. (2023). Lower secondary students' encounters with mathematical literacy. *Mathematics Education Research Journal*, *35*(1), 237–253. https://doi.org/10.1007/s13394-021-00386-7

Bryant, D. P., Bryant, B. R., Dougherty, B., Roberts, G., Pfannenstiel, K. H., & Lee, J. (2020). Mathematics performance on integers of students with mathematics difficulties. *The Journal of Mathematical Behavior*, *58*, 100776. https://doi.org/10.1016/j.jmathb.2020.100776

Cahyadi, M. R., Darmayanti, R., Muhammad, I., Sugianto, R., & Choirudin. (2023). Rubrik Penilaian Tes Esai dari Kemampuan Pemecahan Masalah Matematika. *Jurnal Sains dan Pembelajaran Matematika*, *1*(2), 37–43. https://doi.org/10.51806/jspm.v1i2.55

Çankaya, E. A., Yıldız, E., & Cengiz, C. (2022). Examining Integers-Based Math Game Created by A Fourth Grade Student. *Problems of Education in the 21st Century*, *80*(6), 750–764. https://doi.org/10.33225/pec/22.80.750

Cresswell, C., & Speelman, C. P. (2020). Does mathematics training lead to better logical thinking and reasoning? A cross-sectional assessment from students to professors. *PLOS ONE*, *15*(7), e0236153. https://doi.org/10.1371/journal.pone.0236153

Defa. (2022). Pengembangan Media Ular Tangga Bilangan Bulat pada Pelajaran Matematika di Sekolah Dasar. *Jurnal Didaktika Pendidikan Dasar*, *6*(2), 394–410. https://doi.org/10.26811/didaktika.v6i2.419

Fatayah, F., Yuliana, I. F., & Muf'idah, L. (2022). Analisis Validitas Dan Reliabilitas Dalam Mendukung Ketuntasan Belajar Model STEM. *Jurnal Buana Pendidikan*, *18*(1), 49–60. https://doi.org/10.36456/bp.vol18.no1.a5175

Granberg, C., Palm, T., & Palmberg, B. (2021). A case study of a formative assessment practice and the effects on students' self-regulated learning. *Studies in Educational Evaluation*, *68*, 100955. https://doi.org/10.1016/j.stueduc.2020.100955

İbili, E., Çat, M., Resnyansky, D., Şahin, S., & Billinghurst, M. (2020). An assessment of geometry teaching supported with augmented reality teaching materials to enhance students' 3D geometry thinking skills. *International Journal of Mathematical Education in Science and Technology*, *51*(2), 224–246. https://doi.org/10.1080/0020739X.2019.1583382

Ijtahidah, F. F., & Nisa', R. (2023). Pengembangan soal literasi numerasi SMP yang terintegrasi Islam. *Primatika: Jurnal Pendidikan Matematika*, *12*(1), 1–8. https://doi.org/10.30872/primatika.v12i1.1596

Kaminski, J. A., & Sloutsky, V. M. (2020). The use and effectiveness

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

of colorful, contextualized, student-made material for elementary mathematics instruction. *International Journal of STEM Education*, *7*(1), 6. https://doi.org/10.1186/s40594-019-0199-7

Kemendikbudristek. (2020). *Asesmen Kompetensi Minimum (AKM) dan Implikasinya pada Pembelajaran*. Jakarta: Pusat Asesmen dan Pembelajaran.

Kemendikbudristek. (2023). Rapor Pendidikan 2022. Retrieved February 15, 2024, from Pusat Standar & Kebijakan Pendidikan website: https://pskp.kemdikbud.go.id/rapor_pendidikan

Kusuma, A. S., & Nurmawanti, I. (2023). Pengembangan Soal-Soal Literasi dan Numerasi Berbasis High Order Thinking Skills (HOTS) untuk Siswa Sekolah Dasar (SD). *Jurnal Ilmiah Profesi Pendidikan*, *8*(1), 516–523. https://doi.org/10.29303/jipp.v8i1.1313

Maslihah, S., Waluya, S. B., Rochmad, & Suyitno, A. (2020). The Role Of Mathematical Literacy To Improve High Order Thinking Skills. *Journal of Physics: Conference Series*, *1539*(1), 012085. https://doi.org/10.1088/1742-6596/1539/1/012085

Muslimin, Putri, R. I. I., Zulkardi, & Aisyah, N. (2020). Learning Integers with Realistic Mathematics Education Approach Based on Islamic Values. *Journal on Mathematics Education*, *11*(3), 363–384. https://doi.org/10.22342/jme.11.3.11721.363-384

Mustika, D. L. O., Soleh, D. A., & Supriatna, A. R. (2023). Pengembangan Multimedia Interaktif Berbasis Android Materi Operasi Bilangan Bulat pada Kelas Tinggi di Sekolah Dasar. *Jurnal Pendidikan Tambusai*, *7*(1), 68–78. https://doi.org/10.31004/jptam.v7i1.5265

Nahadi, W. S. (2022). Development of Minimum Competency Assessment (AKM) on Chemical Materials. *Moroccan Journal of Chemistry*, *10*(3), J. Chem. 10 N°3 (2022) 452-463. https://doi.org/10.48317/IMIST.PRSM/morjchem-v10i3.33067

Nasution, R. S., Fauzi, Kms. M. A., & Syahputra, E. (2020). Pengembangan Soal Matematika Model PISA pada Konten Space and Shape untuk Mengukur Kemampuan Penalaran Matematis. *Paradikma: Jurnal Pendidikan Matematika*, *13*(1), 1–10. https://doi.org/10.24114/paradikma.v13i1.22942

OECD. (2023). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education*. Paris: OECD Publishing. Retrieved from https://www.oecd.org/publication/pisa-2022-results/

Oktiningrum, W., & Rahayu, L. I. (2022). Pengembangan Soal AKM Bermuatan Ethnomatematika dengan Media Canva untuk Mengukur Kemampuan Literasi Numerasi Siswa Sekolah Dasar. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(4), 3860–3871. http://dx.doi.org/10.24127/ajpm.v11i4.6241

ISSN 2089-8703 (Print)
ISSN 2442-5419 (Online)

DOI: https://doi.org/10.24127/ajpm.v13i4.9797

Purnamasari, R., Safitri, N., & Kurnia, D. (2023). Pengembangan Soal Asesmen Kompetensi Minimum (AKM) Literasi Numerasi Kelas 5 Sekolah Dasar. *Jurnal Basicedu*, *7*(1), 787–797. https://doi.org/10.31004/basicedu.v7i1.4591

Rahayuningsih, S., Sirajuddin, & Ikram, M. (2021). Using Open-ended Problem-solving Tests to Identify Students' Mathematical Creative Thinking Ability. *Participatory Educational Research*, *8*(3), 285–299. https://doi.org/10.17275/per.21.66.8.3

Rahmawati, N. D., Komarudin, K., & Suherman, S. (2022). Pengembangan Instrumen Penilaian Matematika berbasis HOTS pada Calon Guru Sekolah Dasar. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(2), 860–871. https://doi.org/10.24127/ajpm.v11i2.4893

Reigeluth, C. M., & An, Y. (2020). *Merging the Instructional Design Process with Learner-Centered Theory: The Holistic 4D Model*. New York: Routledge.

Rezat, S., Fan, L., & Pepin, B. (2021). Mathematics textbooks and curriculum resources as instruments for change. *ZDM – Mathematics Education*, *53*(6), 1189–1206. https://doi.org/10.1007/s11858-021-01309-3

Sugiyono. (2022). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Suherman, S., & Vidákovich, T. (2022). Tapis Patterns in the Context of Ethnomathematics to Assess Students' Creative Thinking in Mathematics: A Rasch Measurement. *Mathematics Teaching Research Journal*, *14*(4), 56–79.

Sutama, Prayitno, H. J., Narimo, S., Ishartono, N., & Sari, D. P. (2021). The development of student worksheets based on higher order thinking skill for mathematics learning in junior high school. *Journal of Physics: Conference Series*, *1776*(012032), 1–8. https://doi.org/10.1088/1742-6596/1776/1/012032

Ulfah, A. S., Yerizon, Y., & Arnawa, I. M. (2020). Preliminary Research of Mathematics Learning Device Development Based on Realistic Mathematics Education (RME). *Journal of Physics: Conference Series*, *1554*(1), 012027. https://doi.org/10.1088/1742-6596/1554/1/012027

Zainuddin, Z., Shujahat, M., Haruna, H., & Chu, S. K. W. (2020). The role of gamified e-quizzes on student learning and engagement: An interactive gamification solution for a formative assessment system. *Computers & Education*, *145*, 103729. https://doi.org/10.1016/j.compedu.2019.103729

Zippert, E. L., & Rittle-Johnson, B. (2020). The home math environment: More than numeracy. *Early Childhood Research Quarterly*, *50*, 4–15. https://doi.org/10.1016/j.ecresq.2018.07.009