



Validity analysis of the mathematical literacy test: implementation of the pancasila student profiles in instrument development

N A Sinaga ¹, Y Zahara ² and N J Saragih ^{2,*}

¹ Department of Mathematics Education, University of Malikussaleh, Indonesia; nurulsinaga@unimal.ac.id

² Department of Mathematics Education, University of Malikussaleh, Indonesia; nurulsinaga@unimal.ac.id

³ Department of Mathematics Education, University of Malikussaleh, Indonesia; nurulsinaga@unimal.ac.id

* Correspondence: nurulsinaga@unimal.ac.id ; Tel : -

Abstract: The background to this research is based on the need to improve students' mathematical literacy skills, which are integrated with character formation based on Pancasila values. This research aims to analyze the validity of the mathematics literacy test implemented with the Pancasila student profile in developing test instruments. This research uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model, with a focus on validation of the instruments developed. The instrument consists of 20 questions that were validated by media experts, material experts, and language experts. The research results show that media validation, material validation, and language validation are in the very valid category. Of the 20 questions, 1 question item was declared valid in the very high category, 2 questions were valid in the high category, 14 questions were valid in the medium category, and 3 questions were valid in the low category. The reliability of the instrument is classified as high with a value of 0.783. Apart from that, 7 questions have good differentiating power, while 13 questions have sufficient differentiating power. Based on the level of difficulty, 4 questions are in the difficult criteria, 14 questions are in the medium criteria, and 4 questions are in the easy criteria. These results indicate that the mathematical literacy test instrument developed generally has good validity and reliability and can be used as an effective measuring tool in evaluating students' mathematical literacy abilities, as well as integrating the values of the Pancasila student profile.

Keywords: Mathematical Literacy; Pancasila Student Profile; Instrument Test

1. Introduction

The rapid development of technology and information requires society not only to understand knowledge but also to utilize that knowledge intelligently and critically to process information and solve increasingly complex problems. The quality of society expected can be enhanced through the significant role of education. Education can provide sustainable improvements in human quality [1]. According to Ningtiyas and Sinaga [2], education, in its process, is capable of developing creative thinking, problem-solving, flexibility, collaboration, and innovation skills in individuals.

Mathematics, as a compulsory subject in education, is expected to contribute to meeting these demands. Mathematics is anticipated to enhance students' abilities in learning, not just limited to computation skills using formulas but also critical thinking, reasoning, problem-solving, and creativity during the process. The expected mathematical abilities can be achieved through mathematical literacy. Mathematical literacy is the knowledge and skills required to understand and use basic mathematics in everyday life [3]-[5]. The higher a person's literacy skills, the greater their problem-solving abilities, reasoning skills, and creativity will develop.



Based on a survey conducted by the Programme for International Student Assessment (PISA), the mathematical literacy skills of students in Indonesia remain very low. This is evidenced by Indonesia's position below the international average. Moreover, the majority of students can only solve problems at levels below Level 2 out of a total of 6 levels. Given this fact, it is clear that the mathematical literacy skills of students in Indonesia still need significant improvement. This situation has been exacerbated by the COVID-19 pandemic, which necessitated remote learning, leading to a decline in students' learning abilities (Learning Loss) [6].

The government has undertaken various efforts to address the need for improving mathematical literacy. One such initiative is the implementation of the Kurikulum Merdeka (Independent Curriculum). According to Feriyanto [7], the Merdeka Belajar policy is a concrete action to strengthen students' numeracy literacy. Assessments within the Merdeka curriculum are divided into three components: Minimum Competency Assessment (AKM), character surveys, and learning environment surveys [8]. The national assessment within the Merdeka curriculum focuses on understanding student literacy and character formation. Therefore, familiarizing students with solving problems in the form of mathematical literacy is expected to enhance their mathematical skills[9], [10].

In addition to improving mathematical abilities, character development is also a crucial focus within the substance of the Merdeka Belajar curriculum. One of the innovations in the Merdeka Belajar curriculum is the Project to Strengthen the Profile of Pancasila Students (P5). This initiative aims to shape a national character that upholds the values of Pancasila [11]. The Profile of Pancasila Students serves as an identity that helps students understand that national character formation significantly influences their success in facing global challenges. One way to meet the demands of the Merdeka Belajar curriculum is by developing a test instrument that encompasses mathematical literacy, wherein the test content reflects the formation of national character [12]-[14]. The mathematical literacy test instrument based on the Profile of Pancasila Students is expected to provide a solution for the education sector in fulfilling the national and state objectives of producing an intellectual and character-driven generation..

2. Research Methods

This research uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) [15]. development model to develop an integrated mathematical literacy test instrument for the Pancasila Student profile. This research was carried out at SMP N 2 Dewantara involving a sample of 110 students as participants. Samples were randomly selected to take part in trials of the test instruments that had been developed. Sampling was carried out by considering the diversity of student backgrounds so that the results obtained could represent the population.

1. Analysis; At this stage, a needs analysis is carried out to determine the competencies to be achieved through a mathematical literacy test. Surveys, interviews with mathematics teachers, and observations of the existing curriculum were used to identify deficiencies in existing test instruments and student needs.

2. Design; Based on the results of the analysis, the design of the mathematics literacy test instrument was carried out by formulating indicators and learning objectives that were by the Pancasila Student profile. The questions will be developed to cover various aspects of mathematical literacy.

3. Development; Instrument development was carried out by compiling a grid of questions by connecting them with mathematical literacy indicators and Pancasila student profile categories. Next, 20 questions were developed consisting of various levels of difficulty

and categories and equipped with problem-solving along with scoring guidelines. These questions were then validated by media experts, material experts, and language experts to ensure their validity and reliability.

4. Implementation; The validated instrument was tested on 110 students at SMP N 2 Dewantara. This trial aims to determine the readability and effectiveness of the instrument in measuring the integrated mathematical literacy of the Pancasila Student profile. Data obtained from trials is analyzed to determine the level of validity, reliability, distinguishing power, and level of difficulty of the questions.

5. Evaluation; Evaluation is carried out by analyzing test results to assess the effectiveness of the test instrument. The results of the analysis are used to improve and perfect the instrument to better suit student needs and learning objectives.

Data obtained from instrument testing will be analyzed using statistical methods, including analysis of validity, reliability, distinguishing power, and level of difficulty of questions, to evaluate the quality and effectiveness of the instrument being developed. The results of the analysis will be used as a basis for revising the instrument and improving aspects that are still inappropriate. With this approach, it is hoped that the integrated mathematics literacy test instrument for the Pancasila Student profile can be produced validly and reliably and can be used to evaluate students' mathematical literacy abilities effectively

3. Results and Discussion

Assessment of the validity of test instruments includes test instruments, image layout and illustrations, presentation and language, and ease and benefits of use.

Table 1 Aspects of Media Expert Assessment

Assessment Aspects	1 st Media Expert Score	2 nd Media Expert Score
test instrument	39	40
Image Layout and Illustrations	34	33
Language Presentation	29	30
Ease of Use	11	11
Benefits of Use	26	26
Amount	139	140
Mean	0,914473684	0,921052632
Percentage (%)	91,4	92,1
Category	Very Valid	Very Valid

Based on the table above, the percentage of integrated mathematical literacy test instruments for Pancasila student profiles in media expert validation 1 is 91.4% with the "Very Valid" category and the percentage of media expert validation 2 is 92.1% with the "Very Valid" category. Based on the validation test results of media expert 1 and media expert 2, the integrated mathematical literacy test instrument for the Pancasila student profile that was developed was very valid from the validation calculations.

Assessment of material validity includes suitability of questions to indicators, material content, material presentation, and learning strategies. The results of the material expert validation can be seen in the following table.

Table 2 Aspects of Material Expert Assessment

Assessment Aspects	1 st Material Expert Score	2 nd Material Expert Score
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suitability of questions to indicators	23	21
Contents of the material	66	68
Presentation of material	23	22
Learning strategies	15	14
Amount	127	125
Mean	0,933823529	0,91911765
Percentage (%)	93,82	91,91
Category	Very Valid	Very Valid

Based on the table above, the percentage of integrated mathematical literacy test instruments for Pancasila student profiles in material expert validation 1 is 93.82% with the "Very Valid" category and the percentage of material expert validation 2 is 91.91% with the "Very Valid" category. Based on the validation test results of material expert 1 and material expert 2, the integrated mathematical literacy test instrument for the Pancasila student profile that was developed was very valid from the validation calculations.

Language validity assessment includes linguistics. The results of the validation by language experts can be seen in the following table.

Table 3 Aspects of Language Expert Assessment

Assessment Aspects	1 st Language Expert Score	2 nd Language Expert Score
Language	47	51
Amount	47	51
Flat	0,839285714	0,91071429
Percentage (%)	83,92	91,07
Category	Very Valid	Very Valid

Based on the table above, the percentage of integrated mathematics literacy test instruments with Pancasila student profiles in language 1 expert validation is 83.92% with the "Very Valid" category and the percentage of language 2 expert validation is 91.07% with the "Very Valid" category. Based on the results of the validation test by Language Expert 1 and Language Expert 2, the integrated mathematical literacy test instrument for the Pancasila student profile that was developed was very valid from the validation calculations.

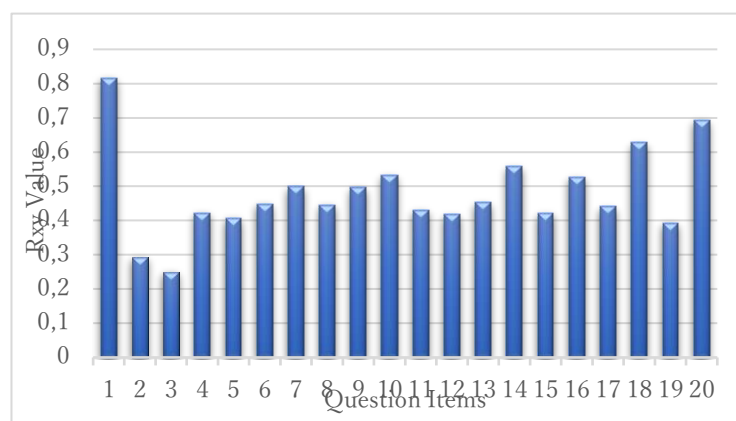
Next, a small class trial was carried out to see the readability of the media which was tested on 10 class VIII middle school students. The aspects assessed in this small-scale trial are aspects of appearance, ease of use, and product usefulness. Test results data can be seen in the following table.

Table 4. Small Class Trial Assessment Results

Assessment Aspects	Assessment Score (%)	Category
Product Display	86,42%	Very Valid
Ease of Use	89,16%	Very Valid
Product Usefulness	86,87%	Very Valid

The table above shows the validity results from small group trials. The product appearance aspect obtained very valid results, the ease of use of the product aspect obtained very valid results and the usability aspect of the media obtained very valid results. Through the results obtained from small-scale trials, it can be said that the product developed has a good readability and can be continued in the instrument feasibility stage in terms of content validity, reliability, distinguishing power, and level of difficulty.

This test instrument has gone through validity testing using the Pearson correlation value (r_{xy}). Based on the calculation results, all question items have a r_{xy} value that is greater than the table r value (0.187), which indicates that all question items are declared valid. This validity shows that the items in the questions can measure well the aspect that is intended to be evaluated in the questions, namely the integrated mathematical literacy of the Pancasila student profile. The r_{xy} value categories which vary from low to very high also show variations in the quality of the questions, but are still valid and suitable for use for this test instrument.



From the figure above, it is found that of the 20 tests developed, there is 1 valid question item in the very high category, 2 valid questions in the high category, 14 valid questions in the medium category, and 3 valid questions in the low category. These results show that overall the 20 questions developed in the integrated mathematical literacy test instrument product for mathematics student profiles are declared valid and can be used.

Reliability testing was carried out using Cronbach's Alpha method to determine the internal consistency of this survey instrument. The calculation results show a Cronbach's Alpha value of 0.783, which means this instrument has a high level of reliability. Values above 0.7 are generally considered reliable, which shows that this instrument is consistent and reliable in measuring the integrated mathematics literacy test of Pancasila student profiles repeatedly with consistent results. Thus, this instrument can be used effectively to evaluate students' mathematical literacy abilities.

The next thing to do is look for the differentiating value in the test being developed. Discriminating power measures how well each question item can differentiate between respondents who have different understandings or attitudes regarding the topic being measured. In this test instrument, the analysis results show that most of the items have sufficient differentiating power. This indicates that the questions prepared were able to differentiate respondents based on their level of ability in the integrated mathematics literacy test of the Pancasila student profile. Items with high discriminating power can be relied upon to identify variations in opinion between groups of respondents.

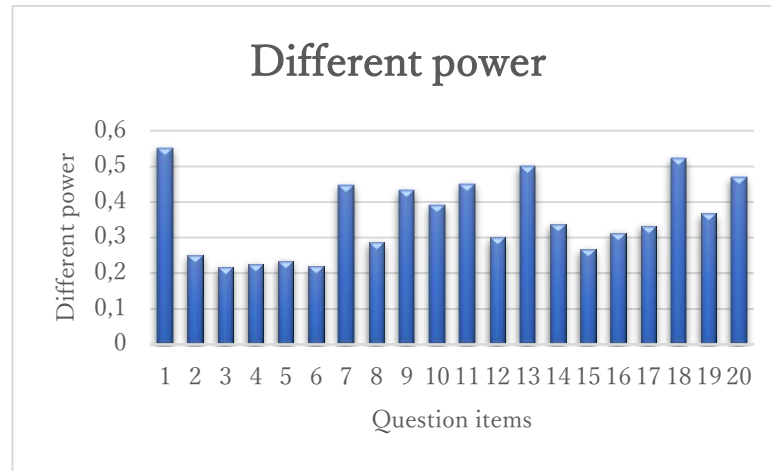


Figure 2. Results of Differentiating Power of Question Items

From the figure above, it is found that of the 20 tests developed, 7 questions have good discriminating power on the criteria and 13 questions have sufficient discriminating power on the criteria. This shows that all the questions developed can represent the differences in abilities of each student who works on the questions.

The level of difficulty shows how easy or difficult a question is to be answered by the respondent. Based on the analysis carried out, most of the items on this test instrument are at a moderate level of difficulty. This means that the questions prepared are not too easy or too difficult so that most respondents can answer them well. A balanced level of difficulty helps ensure that the instrument is inclusive for all respondents, regardless of their background or experience with the collaboration being evaluated.

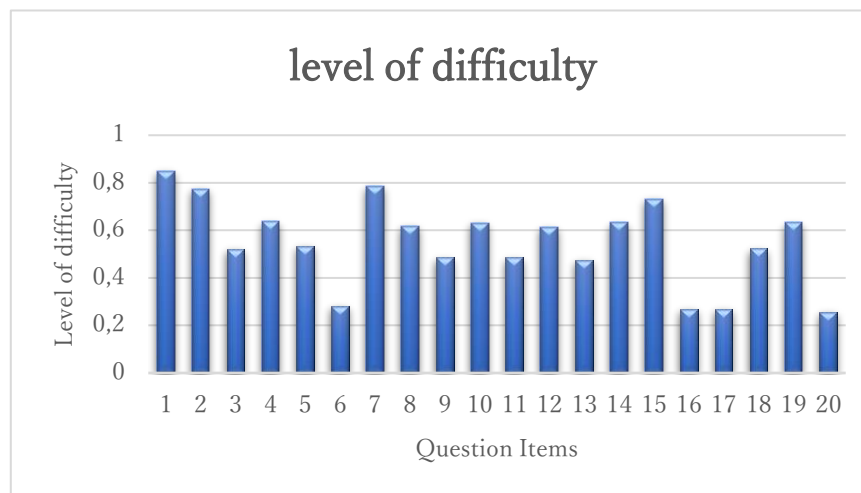


Figure 3. Results of Difficulty Level of Question Items

From the table above, it is found that of the 20 tests developed, 4 questions have a difficulty level on the Easy criteria, 12 questions have a difficulty level on the medium criteria and 4 questions have a difficulty level on the difficult criteria. This shows that all the questions developed have varying levels of difficulty and tend to have criteria for a medium level of difficulty.

Based on the research results, the integrated mathematical literacy test instrument for the Pancasila Student profile was declared very valid from various aspects. Validation by media experts shows that this instrument reached a percentage of 91.4% and 92.1%, with the category "Very Valid". This reflects that the instrument is good in terms of appearance, illustrations, language presentation, ease of use, and benefits. Material expert validation shows percentages of 93.82% and 91.91%, which are also categorized as "Very Valid". This shows that the questions developed are relevant to the indicators and the content of the material is well presented. In terms of language, the instrument achieved validation percentages of 83.92% and 91.07%, with the "Very Valid" category, which shows good readability and language clarity. Small-scale trials on 10 junior high school students also strengthened the validity of the product with very valid results in terms of appearance, ease of use, and product usefulness. Overall, this instrument is suitable for measuring mathematical literacy [16], [17].

The research results show that the integrated mathematical literacy test instrument for the Pancasila Student profile has gone through rigorous validity testing with a Pearson correlation (r_{xy}) value that is greater than the r table value, namely 0.187. All 20 questions were declared valid, with varying categories from low to very high. This indicates that this instrument can measure mathematical literacy effectively. The reliability test using Cronbach's Alpha method showed a value of 0.783, which shows the consistency and reliability of the instrument.

Discriminative power analysis shows that seven items have good discriminating power, while the other 13 items are sufficient. This confirms the ability of the instrument to differentiate the understanding of different students. The difficulty level of most of the questions is in the medium criteria, with varying proportions of questions, making this instrument inclusive and can be used to accurately measure students' mathematical literacy abilities. This instrument, overall, is feasible and effective for evaluating student abilities.

4. Conclusions

Based on the research results, the mathematical literacy test instrument developed was proven to have excellent validity from various aspects. In terms of construct validation, the results show that the 20 questions tested are very valid. Content validation also provides very good results, after going through assessments from several expert validators. Two media expert validators concluded that this instrument was very valid to use, as did two material expert validators who gave a very valid assessment of the test content. Apart from that, two linguist validators also stated that the questions used were very valid from a linguistic perspective. From the question validity category, there is 1 question that is categorized as very high, 2 questions are in the high category, 14 questions are in the medium category, and 3 questions are categorized as low. The reliability value of this instrument is also high, with an Alpha value of 0.781, which shows that this instrument is suitable for consistent use.

The results of the discriminating power analysis show that there are 7 questions with good discriminating power criteria and 13 questions with sufficient criteria. Meanwhile, the difficulty level of the questions is divided into three categories, namely 4 questions with difficult criteria, 12 questions with medium criteria, and 4 questions with easy criteria.

Overall, this mathematical literacy test instrument is considered very valid, and reliable, and can be used to measure mathematical literacy skills that are integrated with the Pancasila Student profile effectively

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