

Development of Numeric Literacy Instruments in Socio-Cultural Context in Banten for Junior High School Students

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Abstract

Hasil *Program for International Student Assessment* (PISA) menunjukkan literasi numerasi siswa di Indonesia terbilang rendah. Ini menunjukkan bahwa Indonesia masih jauh di belakang negara-negara lain. Salah satu penyebab siswa Indonesia memiliki nilai yang rendah adalah sistem pembelajaran yang tidak efektif di Indonesia. Penelitian ini bertujuan untuk menghasilkan instrumen literasi numerasi konteks sosial budaya di Banten untuk siswa SMP. Metode yang digunakan adalah penelitian dan pengembangan atau *Research and Development* (R&D). Menggunakan model Wilson, Oriondo dan Antonio. Hasil penelitian yang diperoleh adalah :1) instrumen literasi numerasi yang dikembangkan valid dan dapat reliabel, 2) memiliki tingkat kesulitan rata-rata sedang untuk setiap jenis pertanyaan, dan 3) instrumen literasi numerasi yang dikembangkan masuk dalam kategori baik dalam pengujian daya beda. Jadi, alat yang dikembangkan oleh peneliti layak digunakan sebagai instrumen penilaian untuk mengukur literasi numerasi dalam konteks budaya Banten.

Abstract

The results of the Program for International Student Assessment (PISA) show that the literacy of students in Indonesia is low. This shows that Indonesia is still far behind other countries. One of the reasons Indonesian students have low grades is the ineffective learning system in Indonesia. This investigation aims to produce a numeration liaison instrument of the social and cultural context in Banten for high school students. The methods used are research and development or Research and Development. (R&D). Using the Wilson, Oriondo and Antonio models. The results obtained were: 1) a numerical literacy instrument developed that is valid and reliable, 2) has an average difficulty level for each type of question, and 3) a numerical literacy instrument developed falls into the category of both in different power tests. So, the tool developed by the researchers deserves to be used as an assessment to measure numerical literacy in the Banten cultural context.

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Introduction

Technology and science are the main focus of scientific development in the 21st century. According to the Ministry of Education and Culture (Sani, 2021) , Indonesian students must understand six basic literacies to improve the quality of education in Indonesia. These basic literacies include language literacy, science literacy, digital literacy, financial literacy, numeracy literacy, cultural literacy, and civic literacy. According to (Perdana & Suswandari, 2021), students are asked to be creative and reason. Reasoning means that students can find and analyze problems through daily activities and communicate these problems through writing or expression.

Students can develop their reasoning skills and learn on their own by studying mathematics. Students can also easily carry out daily activities if they are proficient in mathematics. In addition, it is expected that students who study mathematics gain the ability to understand and solve problems critically, logically, methodically, attentively, successfully, creatively, and efficiently (Fitriatien, 2022 ; Yolanda & Wahyuni, 2020) (Fitriatien, 2019; Yolanda & Wahyuni, 2020).

Students must acquire various literacy skills. According to Genc et al. (2019) adequate mathematical literacy skills enable students to use mathematics in real situations, solve problems, assess results, analyze situations, and provide explanations for conclusions. One of the abilities that is directly related to their ability to find, understand, and use information wisely is numeracy literacy skills (Putri et al., 2021 ; Rezky et al., 2022) . To find out the abilities expected of students, *an Assessment of Minimum Competencies* (AKM) is carried out to measure basic skills such as reading literacy and mathematical literacy (numeracy). Sani (2021) defines numeracy literacy as the use of facts, procedures, concepts, and mathematical tools to solve contextual problems in various contexts related to individuals as Indonesian citizens and citizens of the world.

Ekowati et al. (2019) saw that numeracy skills are very important for many aspects of life, such as the workplace, household, community, and having the ability to interpret quantitative data around them. Fadilah et al. (2022) a person's ability to use their thinking skills is known as numeracy literacy. Thinking skills that mean analyzing and interpreting interpretations through daily activities. According to Mahmud & Pratiwi (2019) this ability also refers to the appreciation and understanding of information expressed mathematically, in the form of graphs, pictures, and tables.

According to UNESCO (2006) (Putri et al., 2021) said that one way to measure the growth of a country is to have good numeracy literacy skills. Numeracy literacy skills are very important to develop in the world of education, especially in Indonesia, but the numeracy literacy of Indonesian students is still low. According to the Ministry of Education and Culture (2019) Since 2009, PISA has been used to assess the numeracy literacy of 15-year-old students in 79 countries, and is one of the assessments conducted by the OECD.

According to the PISA 2018 report released by the Ministry of Education and Culture (2019) for the last seven rounds, Indonesian students appear to be weaker in mathematics. In PISA 2018, Indonesian students had mathematics skills at level 1, the lowest in PISA. Indonesia's average mathematics score was 379 points, 80 points below the OECD average. In line with the OECD (2019) Students in Indonesia have lower scores than the OECD average in reading, mathematics, and science. As many as 30% of students in Indonesia have reading proficiency at level 2, compared to the OECD average of 77%. Around 28% of students in Indonesia have mathematics proficiency at level 2 or higher, compared to the OECD average of 76%. In addition, 40% of students in Indonesia have science proficiency at level 2 or higher, with the OECD average of 78%. This shows that, compared to the

OECD average, a small proportion of Indonesian students achieve the highest proficiency, namely level 5 or 6, in at least one subject. On the other hand, a small proportion of students achieve the lowest proficiency, namely level 2 or higher, in at least one subject. This shows that Indonesia is still far behind other countries. One of the reasons why Indonesian students have low scores is the ineffective learning system in Indonesia (Dewi Fortuna et al., 2021) .

According to the Ministry of Education and Culture (2021) in line with the implementation of the *Program for International Student Assessment* (PISA), in Indonesia, numeracy literacy skills are tested in the National Assessment (AN) which uses the Minimum Competency Assessment (AKM) to evaluate reading and numeracy skills. The contextualization of numeracy literacy in AKM includes various contexts relevant to students, including social, cultural, environmental, scientific, and mathematical aspects. The Ministry of Education and Culture (2020) states that context greatly influences the choice of strategies, concepts, procedures, facts, explanations of events, problem solving, or decision making using mathematical tools. There are three contexts: scientific, socio-cultural, and personal. Voting systems, public transportation, government, public policy, population, advertising, statistics, and national economy are some of the socio-cultural contexts. Scientific contexts also include the application of mathematics to the universe and topics related to science and technology. According to Liswati et al. (2021) socio-cultural contexts include weather and climate, ecology, medicine (pharmacy), space science, genetics, measurement, and mathematics itself.

When viewed from a socio-cultural context, the context that is in accordance with one of the learning in Banten is the history of heritage and local wisdom in Banten. Banten Province is a region of Indonesia that has cultural potential that must be maintained and preserved by the next generation because it has extraordinary religiosity, dance arts, and cultural traditions. The scope of Banten folk art performing arts usually comes from generation to generation. Banten folk crafts that have developed from time to time are very diverse (Hakiki, 2017) . One of the historical relics in Banten is the Great Mosque of Banten according to Indriastuty et al. (2020) the tower of this mosque has distinctive characteristics, namely based on the roof of the main building which is stacked five, like a Chinese pagoda. Apart from the Tower , there is also an octagonal wall construction known as istiwa, bencet, or mizwalah.

According to Shufa (2018) local wisdom is all the potential of a region, as well as the products of human thought and work that contain wise and wise values that are passed down from generation to generation and become the characteristics of the region. Maintaining feelings, mutual cooperation culture, and mutual respect are some small examples of local wisdom (Kennedy et al., 2019 ; Martawijaya & Hasyim, 2019) . Things related to the development of the times become more important for society. Society has changed a lot due to modernization along with the development of the times in the era of globalization. Conflicts of religion, race and ethnicity have the potential to occur if people do not understand local wisdom (Anjani, 2020 ; Syahrul & Djaha, 2021 ; Syahrul, 2020) .

According to Riza (2022), the socio-cultural life system of Indonesian society is increasingly colored by the influx of Western culture. In addition, the situation is getting worse with the tendency of some young generations in this country to focus on this culture. The lack of understanding of students about local history and cultural traditions in society. So it would be more useful to find ways to maintain and preserve the diversity of existing cultures. According to Suarningsih (2019), local wisdom-based education helps teachers, students, and schools preserve the potential of each region and produce learning that respects local cultural diversity. In line with the research of Maharani & Muhtar (2022) that character education that teaches students to be confident, rational, logical, critical, analytical, creative, and independent, can be combined with local wisdom-based education.

Educators are encouraged to use *Program for International Student Assessment* (PISA) questions to improve students' mathematical literacy skills. These questions have indicators of mathematical literacy, so that students can understand mathematics in various contexts and solve mathematical problems constructively (Riyatuljannah et al., 2021 ; Kholid et al., 2022) . According to the research results of Aprilia et al. (2023) the development of numeracy test instruments in the Minimum Competency Assessment (AKM) with local cultural values produced 20 valid questions that could be used to improve students' mathematical literacy (numeracy) skills.

Based on interviews conducted by researchers with several junior high school mathematics teachers in the Serang City area, Banten, precisely at SMPIT Al-Izzah, the results show that there are still challenges in creating their own numeracy literacy questions that will be used as learning resources for students in understanding mathematics problems in the form of numeracy literacy. As a result of this problem, teachers at the school continue to use questions from previous years and do not make changes or developments.

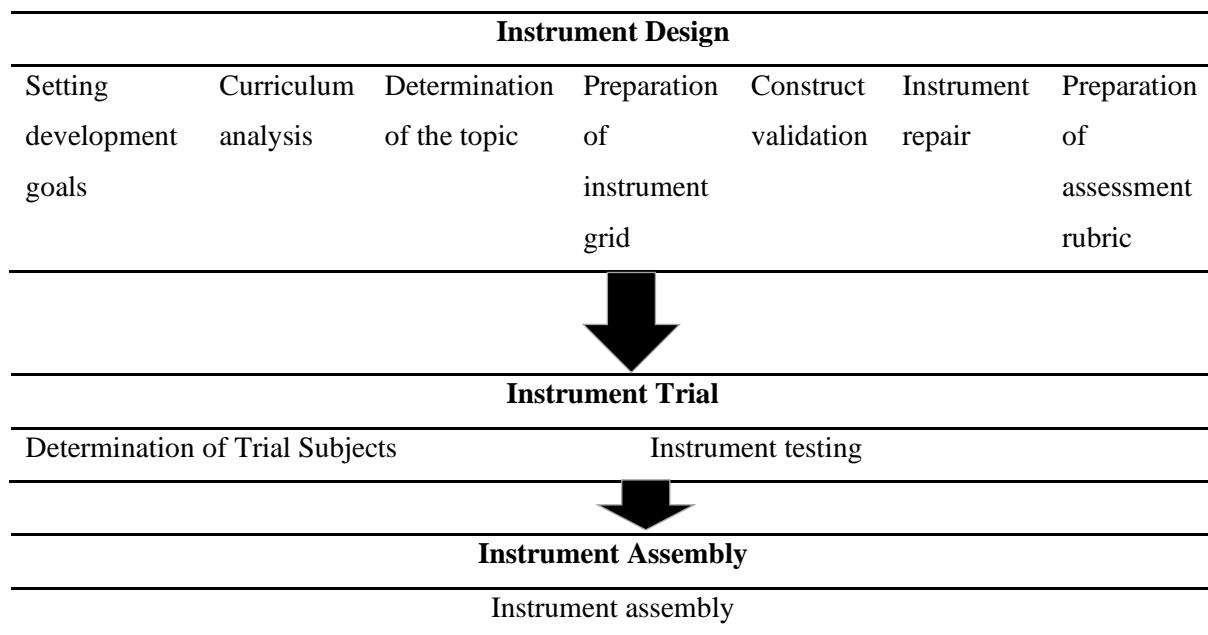
Based on the explanation, this research was conducted to produce a numeracy literacy instrument in the socio-cultural context in Banten that is suitable for use by junior high school students. Therefore, a research was conducted entitled "Development of Numeracy Literacy Instruments in the Socio-Cultural Context in Banten for Junior High School Students".

Method

The method used is research and development or *Research and Development* (R&D).This section provides a detailed and clear description of the research design, data sources, data collection techniques, and data analysis techniques. According to Okpatrioka (2023) research and development is a type of research that aims to produce a particular product. Research on educational problems can help develop and implement more innovative education.The subjects of this study were 30 students of class VIII at SMPIT Al-Izzah Serang.

The research model used is the Wilson, Oriondo and Antonio (1998) model, this research method is the same as that carried out by (Asbupel et al., 2018 ; Alfarisa et al., 2021 ; Habib et al., 2023)

which consists of 3 stages, namely: instrument design, instrument testing, instrument assembly. The three stages above include several implementation steps, which can be seen in the stage scheme in the image below.



Research Results and Discussion

The results of this study went through several stages according to the model explained above. The model used in this study is the Wilson, Oriondo and Antonio models. This model uses 3 stages. The stages in this study are instrument design, instrument testing, instrument assembly. The following explains each stage.

Research result

The results of this development research are in the form of a socio-cultural context numeracy literacy instrument in Banten. To ensure that the product has been theoretically tested and is ready to be tested, the examiners, consisting of material/content experts, construct experts, and language experts, must validate several elements of the test instrument that has been prepared.

Table 1. Instrument grid

Question Number	Domain	Sub domain	Context	Cognitive level	Indicator	Question form
1	Algebra	Equations and Inequalities	Socio-cultural	Reasoning (Aspect: Analyzing)	Students are given stimulus a discourse of “Irrigation Lake Tasikardi” which is used to measure the amount of money	Essay

2	Geometry	Building and Geometry	Socio-cultural	Reasoning (Aspect: Combining)	to be paid and the profit from the sale of rice and pepper right. Students are given stimulus a discourse of "Grand Mosque of Banten" which is used to measure the size of the floor appropriate.	PG
3	Geometry	Building and Geometry	Socio-cultural	Reasoning (Aspect: Combining)	Students are given stimulus a discourse of "Grand Mosque of Banten" which is used to measure the minimum cost to properly install room wall panels.	PG
4	Geometry	Building and Geometry	Socio-cultural	Knowing (Aspect: Calculating)	Students are given stimulus a discourse on "Traditional Houses of the Baduy Community" which is used to measure the area ratio of a rectangle accurately.	Essay
5	Geometry	Building and Geometry	Socio-cultural	Knowing (Aspect: Calculating)	Students are given stimulus a discourse on "Traditional Houses of the Baduy Community" which is used to measure an area that is still empty and the length is known.	Essay

The construct validation conducted resulted in the following suggestions:

Table 2. Expert Validation

Aspects reviewed	Question Number	Validation Results
Content Conformity	1-10	The question contains indicators that can be observed in: (1) Suitability of the question content to the domain

Language Used	1-10	<ul style="list-style-type: none"> (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. <p>The question contains indicators that can be observed in:</p> <ul style="list-style-type: none"> (1) The words used do not have double meaning (2) The language used is easy to understand (3) The language used is effective (4) Writing according to EYD
Construct	1-10	<p>The question contains indicators that can be observed in:</p> <ul style="list-style-type: none"> (1) The questions are in accordance with the development of numeracy questions (2) Questions are appropriate for Junior High School level

After the construct validation was completed, the numeracy literacy instrument was updated based on the validation results. Then a trial was conducted which produced the following results:

Table 3. Validity Test Results

Question Number	Pearson Validity Test Taking Basis	Information
1	0.545>0.361	Valid
2	0.328<0.361	Invalid
3	0.435>0.361	Valid
4	0.583>0.361	Valid
5	0.560>0.361	Valid

The Cronbach alpha reliability test aims to see whether the questionnaire has consistency if the measurement is carried out with the questionnaire repeatedly. According to V, Wiratna (2014) a questionnaire is said to be reliable if the Cronbach alpha value is >0.6.

Table 4. Reliability Test Results

Cronbach's Alpha	N of Items
0.207	5

The difficulty level test aims to find out whether the questions are easy or difficult, pay attention to the following difficulty levels.

Table 5. Item Difficulty

Question Number	Statistics Table	Category
1	$\frac{3,02}{4} = 0,755$	Currently
2	$\frac{3,00}{4} = 0,75$	Currently

3	$\frac{3,23}{4} = 0,8075$	Easy
4	$\frac{3,03}{4} = 0,7575$	Currently
5	$\frac{3,10}{4} = 0,775$	Easy

The test of the item discrimination power aims at item effectiveness, namely distinguishing test participants who obtain high scores from test participants who obtain low scores as follows.

Table 6. Distinguishing Power

Question Number	Corrected Item-Toal Correlation	Category
1	0.390	Good
2	0.380	Good
3	0.318	Good
4	0.342	Good
5	0.333	Good

Discussion

The first instrument design, namely the development objective is determined, namely to create a valid and reliable numeracy instrument and then an analysis of the discriminatory power and difficulty index is carried out. Second, conducting a curriculum analysis and it was obtained from interviews with school representatives in the curriculum field that numeracy literacy is one type of question tested in the National Assessment (AN) which also includes *the Assessment of Minimum Competencies* (AKM). Third, determining the subject matter, namely the material that will be applied to the numeracy literacy questions and the researcher chose junior high school material with a socio-cultural context in Banten. Fourth, namely the preparation of the numeracy literacy instrument grid including domains, sub-domains, contexts, cognitive levels, indicators and question forms. The context taken is socio-culture in Banten so that students can work on numeracy literacy questions that are associated with socio-cultural diversity and can preserve or recognize ancestral heritage from generation to generation.

The fifth and sixth are construct validation and instrument improvement experiencing changes or improvements from several questions so that revisions are needed and 2 validation stages with conclusions that are field-worthy without revision. The results and recommendations from the validator team regarding the products developed are then used by researchers to create better products. Seventh, namely the preparation of assessment rubrics according to the questions.

The first instrument trial, namely the determination of the trial subjects, namely grade VIII students at SMPIT Al-Izzah Serang consisting of 30 students . The second is the instrument trial where the validity test, the validity test is useful for determining the validity or suitability of the questionnaire used by researchers in measuring and obtaining assessment data from respondents. If the rcount value > rtable = valid, while if the rcount value < rtable = invalid. Where the rtable value is 0.361 at a significance of 5%. For questions 1 , 3, 4 , and 5 are said to be valid and reliable using the *Cronbach alpha reliability test* where the Cronbach alpha value > 0.6 is 0.207. This is in line with the results of

the study by Mawaddah et al., (2022) that the results of the validation of the AKM numeracy instrument related to socio-culture meet the valid criteria. According to Perdana & Suswandari (2021) to encourage students to understand the problems they face, teachers are expected to be better able to create variations of questions that prioritize numeracy literacy skills. In addition, they are expected to be able to provide relevant and contextual problems so that numeracy literacy skills increase and are optimal. Based on the results of the difficulty level test on questions 1, 2, and 4, they are in the moderate category, while questions 3 and 5 are in the easy category. Maulidina & Hartatik (2019) stated that high-ability students have good numeracy skills. The differentiating power of the 5 instrument questions all have a good category in the development of numeracy literacy instrument questions for cultural contexts in Banten. By using differentiating powers, teachers can identify students who have understood the material from students who have not (Kurniasi et al., 2020). Teachers can help improve students' numeracy skills by providing more word problem practice that is linked to the socio-cultural context. This will improve students' understanding, application, and mathematical reasoning.

Conclusion

Based on the stages of research and development of the numeracy literacy instrument developed, several conclusions were made: 1) the numeracy literacy instrument developed is valid and can be... reliable, 2) has a moderate average level of difficulty for each type of question, and 3) the numeracy literacy instrument developed is in the good category in the differential power test. So, the tool developed by researchers is suitable for use as an assessment to measure numeracy literacy in the Banten cultural context.

Recommendation

This study shows that the questions on the socio-cultural context numeracy literacy instrument used should be more numerous and the level of difficulty of the questions should be increased again. So that in the future, it is hoped that there will be more variations in the questions on the socio-cultural context numeracy literacy instrument in Banten.

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