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DEVELOPMENT OF NUMERACY QUESTIONS BASED ON LOCAL WISDOM OF SOUTH MINAHASA

Abstrak

Penelitian ini bertujuan untuk menghasilkan soal numerasi berbasis kearifan lokal Minahasa selatan yang valid dan praktis, serta mengetahui efek potensialnya yang dikembangkan terhadap kemampuan numerasi siswa SMP Negeri 2 Tareran. Penelitian ini merupakan penelitian pengembangan dengan pendekatan kualitatif. Subjek penelitian ini ada 3 orang yang terdiri dari masing-masing 1 siswa berkemampuan matematika tinggi, sedang, dan rendah pada tahap *one to one*; 6 orang yang terdiri dari masing-masing 2 siswa berkemampuan tinggi, sedang, dan rendah pada tahap *small group*; 11 siswa pada tahap *field test*. Teknik analisis data meliputi analisis dokumen, *walk trough* dan tes. Dari hasil analisis diperoleh 1). Soal numerasi yang dikembangkan telah praktis berdasarkan jawaban siswa serta komentar siswa dan respons positif siswa pada tahap *one to one* dan *small group*, dan telah valid berdasarkan hasil validasi atau uji pakar dari para ahli. 2). Soal numerasi yang dikembangkan efektif sesuai hasil jawaban dari 11 siswa mampu menjawab soal yang diberikan dengan perolehan nilai rata-rata 71,9 dan memenuhi KBM yang telah ditentukan yaitu 70. Dengan demikian soal numerasi yang dikembangkan memiliki efek potensial untuk meningkatkan kemampuan numerasi siswa

Kata Kunci: Numerasi, Kearifan Lokal, Minahasa Selatan, Literasi Matematis

Abstract

This research aims to produce numeracy questions based on local wisdom of South Minahasa that are valid and practical, as well as determine the potential effects they have developed on the numeracy abilities of students at SMP Negeri 2 Tareran. This research is development research with a qualitative approach. The subjects of this research were 3 people, consisting of 1 student, each with high, medium, and low mathematics abilities at the one-to-one stage; 6 people consisting of 2 students, each with high, medium, and low abilities at the small group stage; 11 students in the field test stage. Data analysis techniques include document analysis, walk-through, and tests. From the analysis, results obtained: 1). The numeracy questions developed are practical based on student answers, student comments, and positive student responses at the one-to-one and small group stages and are valid based on the results of validation or expert tests from experts. 2). The developed numeracy questions were effective according to the results of the answers from 11 students who were able to answer the questions given with an average score of 71.9 and met the predetermined KBM, namely 70. Thus, the developed numeracy questions had the potential effect of improving students' numeracy skills.

Keywords: Numeracy, Local Wisdom, South Minahasa, Mathematical Literacy

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INTRODUCTION

The world of education is currently experiencing very rapid progress. Education has become one of the community's priorities (Anas et al., 2015; Tho'in, 2017; Syaifulloh, 2020). Getting a higher education is the dream of every individual (Mustofa & Mollah, 2019). People believe higher education can improve their quality of life (Hair, 2018). Education is an effort to prepare students to be able to live well in their society, to be able to improve and develop their quality of life, and contribute to improving the quality of life of the community (Raharjo, 2010; Tohari, 2019; Husna et al., 2021). Education can change individual mindsets to become more critical and moral and able to live side by side in society according to prevailing norms (Mini, 2017; Asiyah et al., 2021). In addition, education is a human endeavor to foster personality according to society's values and needs (Ginanjari, 2017; Yuristia, 2018). Based on the above opinion, education is an effort to change the mindset of society to become more developed. In its implementation, it must follow the values and culture that develop in society.

Learning mathematics in the latest revision of the 2013 Curriculum is not integrated into the theme. Mathematics learning has stood alone and is separated from other subjects (Izzati, 2015; Basari, 2021). The 2013 curriculum requires schools to develop academic skills and teach cultural values that exist in society (Widyaningrom, 2018; Tarihoran, 2019). Besides that, character education learning can be taught about cultural values to train students when they are in society.

These cultural values are included in local wisdom. Local wisdom is a concept that lives and develops in society, grows continuously in public awareness, and regulates people's lives from its nature related to sacred and profane life (Istiawati, 2016; Berdame & Lombogia, 2020). However, in its application in schools, local wisdom has yet to be integrated into the learning process or test questions (Indrawan & Mahendra, 2021). Even though using local wisdom can help students solve math problems (Manggali, 2018). The lack of application of local wisdom affects student achievement in mathematics, which tends to be lower than other subjects. This is because some students consider mathematics one of the most challenging subjects (Hayati, 2014). The presumption that mathematics is a difficult lesson makes students often experience difficulties in solving problems. In addition, the presentation of math problems is generally only centered on books, both textbooks and worksheets provided by the school.

In the International Assessment that uses numeracy questions such as PISA (Program for International Student Assessment), the results of Indonesian students' abilities could be better. 2000, Indonesia was at level 39 of 41 countries (Mangelep, 2013). 2003, it was ranked 38th out of 40 countries (Mangelep, 2013). 2006, it was at level 53 out of 57 countries (Mangelep, 2013). Meanwhile, 2009 it was ranked 61st out of 65 countries (Mangelep, 2013). In 2012, Indonesian students were ranked 64th out of 65 countries (OECD, 2013). The latest results, namely in 2015, Indonesia was ranked 62nd out of 71 countries (Mangelep, 2017). From the results of the PISA, data was obtained that in 2003-2009, 80% of Indonesian students could only reach below level 2 of the 6 levels of questions tested (Kemendikbud, 2012). More specifically, in PISA 2009, 90% of students could only solve questions at levels 1, 2, and 3, while only 0.1% of students could solve questions at levels 5 and 6 (Stacey, 2011).

The development of PISA-type numeracy questions can be used as a solution to the problem above. This is because the PISA model questions use an innovative approach. In addition, based on previous studies on PISA, such as Mangelep (2013), who developed math questions on the PISA connection and reflection process competencies, Ahyani (2013), who developed PISA model questions on change and relationship content to find out mathematical reasoning for junior high schools, showed that the questions PISA model mathematics has a potential (effective) effect in improving learning outcomes.

METHOD

This study pertains to the field of development research. The objective of this study is to create mathematical problems that align with the PISA framework, specifically focusing on numeration issues. These questions will be developed by using the local wisdom of the South

Minahasa region. This study has two distinct phases: the preparatory stage and the prototype stage, also known as formative assessment. These stages encompass many methods such as self-evaluation, expert reviews, one-to-one evaluations with low resistance to revision, as well as small group and field testing with high resistance to revision (Tessmer, 1993; Mangelep, 2013).

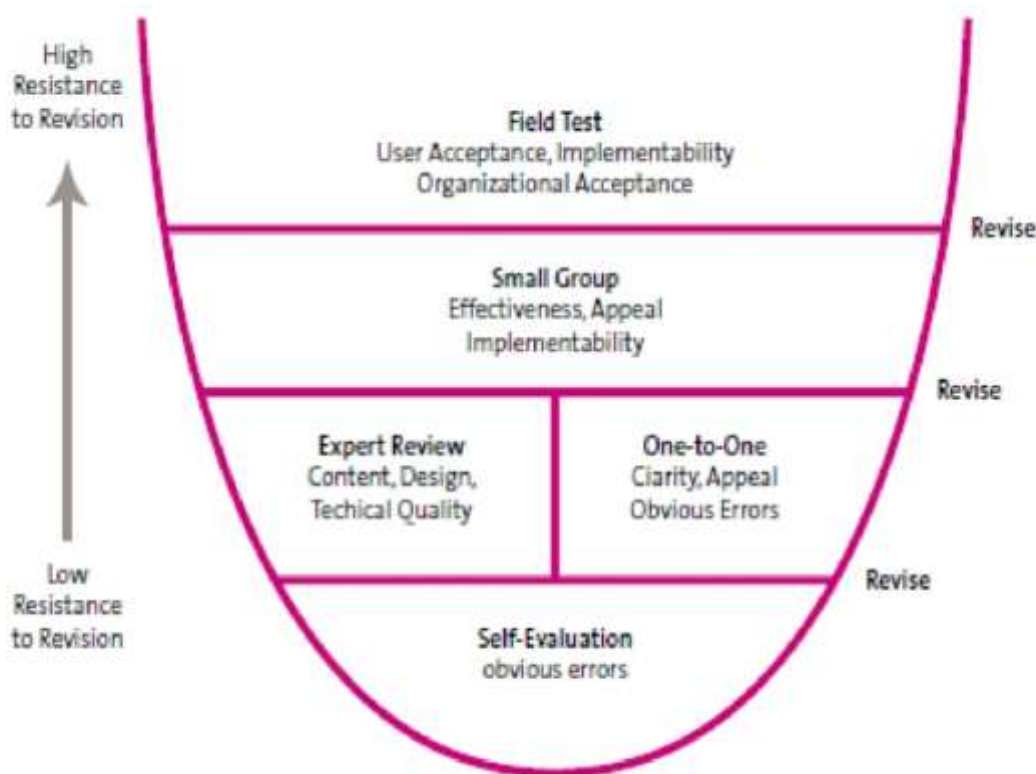


Figure 1. Formative Evaluation design flow (Tessmer, 1993)

The design flow in the formative evaluation stage, as depicted in Figure 1, will be implemented in this research endeavor. The purpose of this stage is to assess the quality of the question products that have been generated during the preliminary stage.

The present study was conducted during the Even semester of the 2021/2022 academic year, spanning from August to November. The research focused on SMP Negeri 2 Tareran as the subject of investigation. The Formative Evaluation stage encompasses multiple phases, namely self-evaluation, expert review, one-to-one evaluation, small group evaluation, and field testing. The data gathering procedures employed in this study encompass documentation, walk-throughs, testing, interviews, and questionnaires. In the realm of data analysis, several approaches are employed, such as document analysis, walk-through analysis, test analysis, interview analysis, and questionnaire analysis.

The anticipated success criteria in this study encompass criteria that are both valid and practical, as well as criteria that demonstrate prospective effectiveness. The validity of the questions is established through qualitative expert validation, which encompasses the evaluation of content, concept, and language. In addition to this, it is evident through quantitative validation, specifically through the examination of the question items. In the context of practicality, the questions under development are considered practical when they satisfy two criteria: (1) experts and practitioners affirm the applicability of the developed questions, and (2) empirical evidence demonstrates the feasibility of applying the produced questions. In essence, during the small

group phase, the questions formulated are designed to be user-friendly and accessible to all students for effective dissemination and utilization.

The effectiveness of the mathematics questions in developing PISA Type Numeracy Questions Using South Minahasa Local Wisdom can be indicated from students' written and verbal answers during the field test. It can also be seen from the results of interviews with students after they have worked on the questions. These questions can support students' understanding of concepts, demonstrate or help develop students' mathematical reasoning and communication abilities, capture or describe students' interests and curiosity, and show/determine the level of students' problem-solving abilities.

RESULT AND DISCUSSION

A. Results

1. Analysis Phase

At this stage, the researcher made preparations for the implementation of the research by contacting the school that had been invited to work together, namely Tareran 2 Public Middle School, for conducting the research. Apart from asking permission from the school, the researchers also carried out curriculum, student, and learning environment analyses. This curriculum analysis identified junior high school mathematics learning materials as a reference in developing questions. In the curriculum analysis, it was found that SMP Negeri 2 Tareran used the 2013 curriculum. Student analysis was carried out to determine the ability level of students who had become the subject of student research. At this stage, the researcher worked with the mathematics teacher to determine which students were the research subjects by looking at their ability to solve math problems (high, medium, and low). In the analysis of the learning environment, the researcher made observations of the student learning environment to ensure that the context used followed the students' circumstances and environment. It was also found that the context used used local wisdom or culture.

2. Design Stage

At this stage, the researcher designs numeration questions or problems based on curriculum analysis, student analysis, and analysis of the learning environment that has been carried out. The aim is to adapt the design of developing numeracy questions to the needs of students and to see whether the use of local wisdom or local cultural contexts fits into the curriculum. In this case, the context is used to utilize local wisdom or culture. This design was carried out to make it easier for students to understand and analyze each question that has been tried out.

3. Formative Evaluation Stage

a. Formative Self

At this stage, the researcher conducts his evaluation of the design that has been developed by looking at the suitability of the item design with the curriculum, grid, and assessment rubric that has been developed. The results of this evaluation produced prototype I, which experts or experts in the field of learning have reviewed.

b. Expert Reviews

At this stage, experts validated the prototype qualitatively regarding content, construction, and language. In this stage, validation is carried out with experts. Based on the validation results by the experts mentioned above, several suggestions or comments were obtained from the experts. Based on comments and suggestions from experts regarding the numeracy problems developed by researchers, it can be continued and implemented through changes and suggestions given by experts.

c. One to one

At this stage, the prototype I was tested on 3 students with high, medium, and low abilities. This one-to-one implementation focuses on practicality, readability, and student interpretation of the questions. Following the results obtained at the expert review and one-to-one stages and based on revision decisions, the development of prototype I numeration questions was revised into prototype II.

d. Small Group

This small group stage was attended by 6 students based on the abilities of students who had high, medium, and low abilities. This stage was carried out to see the practicality of numeration problems in prototype II. Based on the results of the answers, students and researchers conducted questions and answers regarding the questions given. The researcher can conclude that the developed numeracy problems can be appropriately used to help students understand and understand the application of mathematics in everyday life.

e. FieldTest

In this field test stage, the results of the development of the numeration problem were tested on research subjects, namely class IX students of Tareran 2 Public Middle School, which were attended by 11 students out of a total of 15 students. Field tests will be carried out on November 26, 2022. Field tests will be carried out to see if the product being developed has a potential impact. Researchers also made observations and communicated with students to discover their obstacles and opinions regarding the questions.

B. Discussion

A qualitatively valid prototype has been produced based on the results of the development of numeracy questions. Qualitative validity was fulfilled based on the validator's assessment at the expert review stage, where it was stated that the prototype that had been developed fulfilled and was following the curriculum and local wisdom, both constructively, conceptually, and well in a language that was easy for students to understand.

Furthermore, the problem prototypes that were developed not only demonstrated qualitative validity, but also fulfilled practical criteria. This phenomenon is seen in both the one-to-one and small group settings, when all students demonstrate proficiency in addressing the assigned questions, albeit with certain individuals requiring more assistance or guidance. During the course of the procedure. Students possess knowledge and comprehension regarding the goals and objectives of the questions, and they adhere to the contextual framework of local wisdom that is prevalent in their daily lives.

Subsequently, the researcher conducted a field experiment to assess the efficacy of the inquiries and the students' aptitude in addressing them. The method employed to acquire the outcomes of the student evaluation is as follows:

Table 1. Student results on the field test

Nomor	Inisial	Nilai
1.	RM	63
2.	FS	73
3.	WR	68
4.	SR	76
5.	FR	85
6.	FK	72
7.	HW	71
8.	SK	75
9.	VW	88
10.	PU	59
11.	MK	52

Based on the table above, the average student score is 71.09, which is in the excellent category. In these results, it was also found that 2 students, or 18.18% of students, answered with a perfect score or the highest score, then 5 students, or 45.45% of students, answered in the excellent category (passed with a score above Minimum Learning Completeness), then 4 students or 36.36% of students in the pretty good category. The following displays students with excellent, sound, and quite good answers.

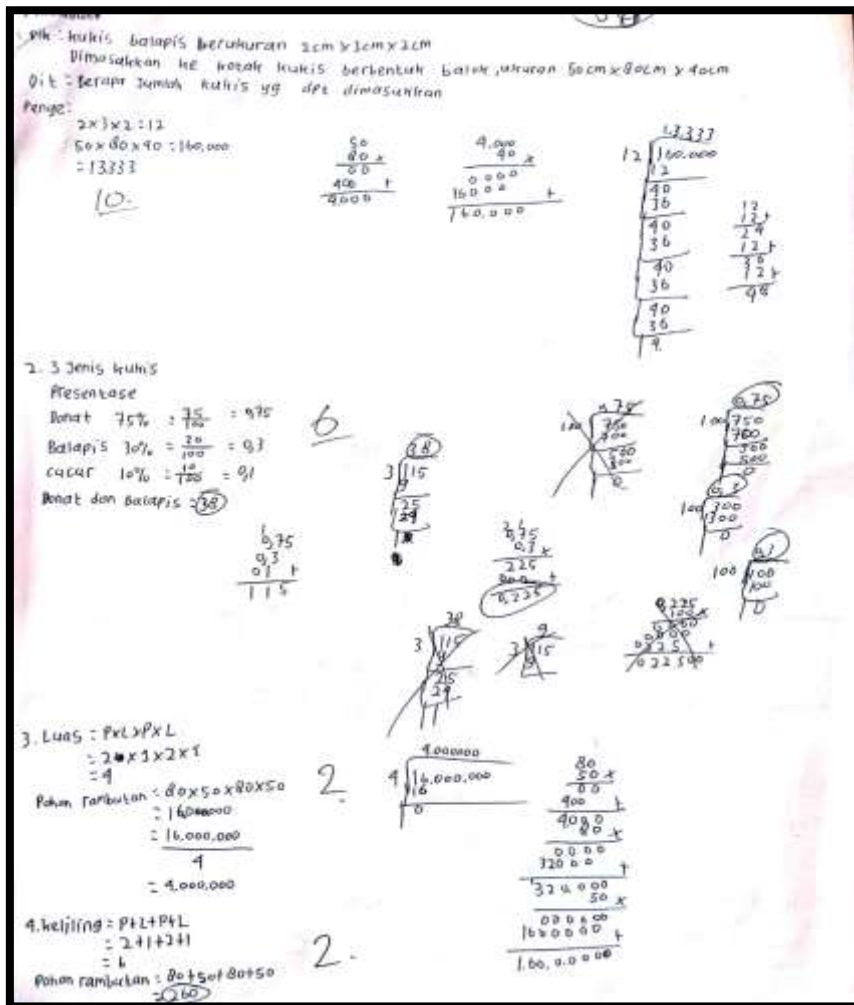


Figure 2. Student answers in the perfect category

From the results of the answers above, students have understood and comprehended the contents of the questions given. Students have solved them using appropriate methods to get the desired results. It is just that students need to be more careful in the calculations, which results in some wrong final results. The obtained does not match the desired results. Based on the results of students' answers, students can understand the concepts given. Thus, the numeracy questions using the local wisdom of South Minahasa have a potential effect.

dit. ibu mariane membuat kotak balapis berukuran 2 cm x 3 cm x 2 cm ke dalam kotak kutis berbentuk balok yg berukuran 50 cm x 80 cm x 90 cm

dit: berapa jumlah kutis?

Penye
 $= 2 \text{ cm} \times 3 \text{ cm} \times 2 \text{ cm}$
 $= 12 \text{ cm}$
 $= 50 \text{ cm} \times 80 \text{ cm} \times 90 \text{ cm}$
 $= 160.000 \text{ cm}$
 $= \frac{160.000}{12} = 1333 \text{ cm}$

2. dit. A: 3 Jenis kutis
 D: 75 %
 B: 30 %
 C: 10 %

dit: Menyukai kutis D dan B

peny
 $= 75$
 $= 30$
 $= 10$
 $= 75 + 30 + 10$
 $= 115$
 $= \frac{115}{3} = 38\% \text{ (circled)}$

3. $P \times L \times P \times L$
 $= 2 \times 1 \times 2 \times 1$
 $= 4$
 pohan Pembutan = $50 \times 80 \times 50 \times 80 = 1600000$
 $= \frac{1600000}{4} = 400000$

4. keding = $P + L + P + L$
 $= 50 + 80 + 50 + 100$
 $= 280$

Handwritten calculations and diagrams are visible on the right side of the page, including a vertical multiplication of 50 by 80 to get 4000, a vertical multiplication of 75 by 30 to get 2250, a vertical multiplication of 30 by 10 to get 300, a vertical multiplication of 3 by 115 to get 345, and a vertical multiplication of 4 by 160000 to get 640000.

Figure 3. Student answers in the excellent category

From the results of the students' answers, the answers produced are almost the same as those from students with perfect grades. The way of solving and understanding the questions is not as good as that of students with grades in the perfect category. Like the categories of students who are very good and sound, the results of the students' answers above represent the results of students who are categorized as quite reasonable. It is just that students need help to work on and solve the questions given by researchers. Based on what has been discussed above, the effective aspects (having potential effects) of developing numeracy questions using the local wisdom of South Minahasa provided can be said to be valid, practical and have potential effects in numeracy problems in line with Akker's (1999) effectiveness criteria, namely: Expert and practitioners based on their experience stated that the question set met the requirements for effectiveness. Operationally in the field, the prototype developed provided results that met expectations.

CONCLUSION

Based on the study's results, the researchers can conclude as follows.

1. A set of numeration problems that are both valid and practical has been produced. The validity and practicality of numeracy issues developed during the design phase are determined during the analysis stage, which involves expert validation and gathering student comments. Expert review and one-to-one consultations are conducted to assess the validity of the problems. The validity of the literacy difficulties/questions is supported by the results of expert tests conducted by professionals, who have indicated that the numeracy problems can be applicable. The efficacy of the numeracy problems or questions under development can be ascertained by the analysis of observations made during students' engagement with the questions provided during the small group phase. Based on the outcomes derived from the students' responses, it is evident that the students were able to successfully address all of the questions, indicating their comprehension of the question prompts. However, it should be noted that several students did exhibit errors in their calculations. Based on the provided information, pupils possess the ability to comprehend the concepts delineated within the questions. The questions have been deemed valid and practical by expert validation, student feedback, ideas, observations, and student responses.
2. Based on the findings obtained from the field test, it is evident that the utilization of South Minahasa's local wisdom in the formulation of numeracy issues yields a promising and effective impact. This is observed in terms of enhanced conceptual understanding and the successful application of students' problem-solving strategies in response to the presented questions. Hence, the utilization of indigenous knowledge from South Minahasa in the creation of numeracy questions holds promising implications.

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