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Mathematics Literacy of Grade 4 Elementary School Students in Solving HOTS Type Mathematics Problems

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A B S T R A C T

The purpose of this study was to determine the level of mathematical literacy possessed by students related to the completion of HOTS-type questions found in FPB and KPK content. Written exams, interviews, and documentation are the three data collection methods used in this study. The participants in this study were three children at Grade 4 Elementary School 001 Air Tiris. The level of the students' mathematical abilities ranged from high, medium, and low. The ability to solve problems and frame problems, the ability to apply mathematics, and the ability to communicate are the three components of mathematical literacy skills used in this study. The results of the study show that the use of HOTS-type math problems for learning mathematics improves problem solving, application of mathematics, and communication. According to the introduction to the section, There are still wrong answers, so each student's mathematical literacy is unique. Students have demonstrated the ability to understand and construct problems, particularly in the areas of problem solving and problem formulation. Students' conceptual and procedural problem-solving abilities in mathematics are limited, and this limits their ability to adequately apply mathematics to real-world situations. In terms of communicating, not all students are able to write responses in a logical way. In addition, they do not write down clear problem-solving strategies and do not include conclusions.

1. Introduction

Mathematics is important because it teaches children to think critically and gives them conceptual knowledge. Mathematics is taught from elementary school to university, methodically as well as being logical and creative regarding quantitative facts and problems related to space and form (Hudoyo, 2003;

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Suryapuspitarini et al., 2018). As James said, mathematics discusses the science of logic, which discusses shapes, arrangements, quantities, and concepts (Hasratuddin, 2021). Mathematics is also said to be a deductive science because every problem solving process uses a deductive method. (Hasratuddin, 2021; Marsigit, 2003). Students are expected to be able to memorize and add after studying mathematics because they can think critically and logically. The following are expected math skills for students (Hasyim & Andreina, 2019).

Connected math materials help students practice critical and creative thinking when solving problems. The 2013 curriculum stipulates that integrated thematic learning must employ a scientific methodology.This scientific approach helps students actively construct concepts, laws, and principles through observing, singing, reasoning, experimenting, and communicating. This means students can measure and approach problems (Armadi, 2016; Salsabilla & Hidayati, 2021). Problem-solving skills can be taught through tasks that require students to analyze, evaluate, and create. Therefore, it is possible to improve the assessment using Anderson and Kratwohl's cognitive levels from the revised Bloom's taxonomy. (Anwar, 2018) Thinking processes are broken down into two categories in the revised version of Bloom's Taxonomy: the first is low-level thinking, also known as Low-Level Thinking (LOTS), and the second is higher-order thinking, also known as Higher-Order Thinking. Skills (HOTS), which are divided into six domains, include remembering, understanding, applying, analyzing, evaluating, and creating. In the revised version, cognition is (Journal et al., 2010; Rahmawati & Mahdiansyah, 2014; Sani, 2019).

High Order Thinking Skills, commonly abbreviated as HOTS, is a thinking process at a higher level, where HOTS is developed through various cognitive concepts and methods as well as Bloom's taxonomy, learning, teaching, and assessment taxonomies (Dinni, 2018). This high-order thinking skill or high-order thinking ability is a way that requires students to be able to process existing information and then develop it in a certain way so as to provide a new idea or understanding (Fanani, 2018; R Nugroho, 2018). The BLOOMS ability described in this taxonomy is included in the C4-C6 cognitive domain thinking category. The aim of incorporating Bloom's taxonomy into the education system is to ensure that students not only acquire knowledge through the educational process but also acquire the skills necessary to apply that knowledge in real-world situations. To develop students' analytical, creative, and problem-solving analytical skills. The 2013 curriculum requires students to have high reasoning abilities to practice problem solving (Rapih & Sutaryadi, 2018).

The 2013 curriculum contains HOTS variety questions for mathematics. HOTS questions help students use high-level reasoning to develop critical, logical, reflective, metacognitive, and creative thinking skills and solve problems (Dinni, 2018). The characteristics of HOTS-type questions are the connection between a concept and another, renewal, looking for links from various sources, utilizing existing information to solve a problem, and critically examining ideas and information (Suryapuspitarini et al., 2018). To design HOTS-type questions, there are several steps that must be followed, namely, basic competency analysis,

making a list of question grids, formulating question indicators, making questions based on rules for writing questions, and determining benchmark scores and answer keys. When preparing questions for the HOTS test, it is the instructor's responsibility to pay attention to the cognitive level of the questions, ensuring that they are at the right level to analyze (C4), evaluate (C5), and create (Abduh, 2019; Widana, 2017). These three levels become the standard for determining which questions will be included in the 2013 curriculum. There are indicators that need to be measured at each of these different levels. For example, HOTS indicators for competency level 4 include distinguishing, organizing, and attributing; level 5 competency indicators include checking and criticizing; and level 6 competency indicators cover generation, design, planning, and manufacturing. (Lewy et al., 2013; Nafiati, 2021).

In addition to HOTS abilities, in the 2013 curriculum, mathematical literacy skills have also begun to be developed, with the aim being that students not only understand calculations but also help develop their analytical skills, reasoning abilities, and problem-solving abilities. One of the steps that can help develop students' mathematical literacy is non-routine questions of the HOTS type, which involve two or more formulas and are able to explore students' ideas or creativity (Suyitno, 2015). PISA defines mathematical literacy as "an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. Mathematically literate people can develop, apply, and interpret mathematics in a variety of settings.

This mathematical literacy includes concepts, principles, procedures, facts, and mathematical tools used to describe, explain, and predict phenomena. Mathematical understanding requires two things. First, basic mathematics. This leads to the basic conceptual and procedural knowledge used to solve everyday math problems. While procedural knowledge leads to knowledge about how to use mathematical procedures, language, symbols, interpretation, and draw tables and graphs, Second, competence is the ability of students to understand situations and apply knowledge and skills in everyday life. (Anwar, 2018).

Program for International Student Assessment (PISA) menempatkan Indonesia di peringkat 69 dari 76 negara yang menguji matematika pada tahun 2015. Kemampuan matematika siswa Indonesia tergolong rendah. Menurut PISA, kemampuan siswa untuk mengidentifikasi informasi, menalar, dan mengungkapkan pendapat dalam berbagai situasi matematika terkait dengan kemampuan literasi mereka. Bahkan pada tahun-tahun sebelumnya yakni tahun 2000, 2003, 2006, 2009, 2012 juga dilakukan survey di beberapa negara dan menunjukkan hasil bahwa skor rata-rata literasi matematika Indonesia itu masih dibawah Negara lainnya. Meskipun demikian pada tahun 2015 literasi matematika Indonesia mulai meningkat, perbandingannya tahun 2012 skor rata-ratanya adalah 375 sedangkan 2015 menjadi 386, hal ini menunjukkan bahwa Indonesia mengalami peningkatan 11 point dari skor sebelumnya. Namun, jika melihat hasil PISA, terlihat bahwa tingkat literasi matematika di Indonesia masih belum

memadai (Fathani, 2016), hal tersebut dikarenakan siswa hanya menghafal rumus namun tidak memahami konsep dengan baik. Sehingga saat menemukan soal yang membutuhkan tinggat nalar yang tinggi siswa merasakan kesulitan dalam menyelesaikannya (Luqmana Qoni'ah, 2017).

Students in Indonesia are still unable to apply basic algorithms or interpret the results of mathematical calculations in the context of the problems they face, as the results of research conducted by Stacey found that 76.7% of Indonesian students rank 2 at the level of mathematical literacy.Students in Indonesia are less able to apply basic algorithms or interpret mathematical calculations in the context of the problems they face. In addition, Indonesian students are not familiar with HOTS, TIMSS, and PISA math problems (Hertiandito, 2016).

Low math literacy has been learned and must be overcome. Irfani Salsabila found that students' problem-solving abilities varied (2021). Students can understand and solve challenges. Students have not fully utilized ideas and methods when developing and solving arithmetic problems. Students have not produced cohesive solutions or problem-solving strategies. Rima Melati Santoso and Nining Setyaningsing (2020) The five basic abilities of mathematical literacy—communication, mathematization, problem-solving strategies, using operations and symbolic language, formal language, technical language, and reasoning and giving reasons—can all be used by students who have mathematical abilities strong enough to solve HOTS. The low mathematical literacy of Indonesian students in the PISA survey and exam should be evaluated for teaching professionals, as Indonesia ranks second out of six PISA levels. Educators should pay more attention to the cognitive component, especially for C3–C6, by maximizing HOTS-type questions and activities for teaching and increasing mathematical literacy. This study aims to determine the mathematical literacy skills of high-order thinking skills (HOTS) in fourth-grade elementary school students.

2. Methodology

This research was conducted using a descriptive qualitative method. The research design is a form of content analysis. Content analysis is a scientific method for studying the contents of a text or document to draw conclusions from the text or document (Afrizal, 2014; Ahmad, 2018; Burhan Bugin, 2003). The research subjects in this study were three grade IV elementary school students. Two students are girls, and one is boys; all three come from the same school, 001 Air Tiris Public Elementary School. This study collected data through assessments, interviews, and student work. The interview used was semi-structured. Semi-structured interviews use open-ended questions to create subjects. These interviews also collect research data. This study included HOTS-type math questions made by teachers and student work. First, the researcher determines how to measure mathematical literacy. The next researcher gave a written test using HOTS type math questions and assessed student work. This is done as part of document analysis. HOTS-type mathematical problem grids and several

guidelines for evaluating students' mathematical literacy abilities were used as research instruments. The questions consist of a total of four questions that refer to mathematical literacy with NCTM as the assessment references used.

Table.1 Mathematical Problem Grid

No.	Basic competencies	Question Indicator	Cognitive Realm	Question Form	Question Number
3.6	Explain and choose the common factor, greatest common factor (FPB), common multiple and least common multiple (KPK) of two numbers related to everyday life.	Solve the factorization of three predetermined numbers.	C4	Essay Questions	1
			C4	Uraian	2
4.6	Solve problems related to the greatest common factor (FPB), the least common multiple (KPK) of two numbers related to everyday life.	Find and conclude the factorization of three numbers related to everyday life.	C4	Essay Questions	3
		Choose three numbers that are relevant to your life and analyze their factorization in relation to each other.	C5	Essay Questions	4

Table.2 Mathematical Problem Grid

No	Question
1.	Decorative lights in red, yellow, and green can be found in shopping centers. The red light flashes once every 14 seconds, then turns off. The yellow light flashes on and off every 16 seconds, then turns off completely. while the green light is on for a total of twenty seconds before going out. How many seconds will pass before all three lights flash simultaneously?
2	Mr. Ardi is a chicken trader at the Tuesday market. Mr. Ardi has 60 chickens and 70 ducks; the chickens and ducks will be put in the same number of cages. To accommodate all of his animals properly, Mr. Ardi needs approximately how many cages?
3	One Sunday morning Ria, Lina, Rina and Lilis played a traditional 'clap' game. Lilis guides the game. Lilis asked Ria to clap once every 35 seconds, Lina clapped once every 40 seconds, and Rina clapped once every 45 seconds. So, every how many minutes will all three clap simultaneously?
4	On the last day of the competition at school, there will be an announcement of the winners and the distribution of prizes. The school has prepared a gift package consisting of 60 pieces of sports equipment, 80 pieces of stationery, and 100 school bags. The prizes will be packaged in packages, and each package will contain the same amount of each of the three types of prizes. Then, a) how many packages can be provided? b) How many items of sports equipment, stationery, and school bags are there for each package?

In investigating this issue, a qualitative descriptive analysis approach was taken for the data collected. At this stage, the analysis begins with student responses that have been written down. After that, their mathematical literacy abilities were evaluated according to various aspects of mathematical literacy abilities, and their scores were determined using the following mathematical literacy rubric. The following is a betting table for scoring mathematical literacy skills.

Table 3. References for Scoring Mathematical Literacy

No.	Aspects of Mathematical Literacy Ability	Description	Score	Max Score
1	Problem solving and problem formulation	a. Able to identify and formulate problems appropriately.	3	3
		b. Able to identify and formulate problems but not yet precise.	2	
		c. Not able to identify and formulate problems.	1	
2	Using math	a. Able to use accurate formulas or arithmetic processes	4	4
		b. Can apply mathematical concepts and use arithmetic formulas or operations, even when they are imprecise.	3	
		c. Able to apply mathematical concepts or methods and perform arithmetic formulas or operations, but not with precision.	2	
		d. Unable to use problem-solving techniques, formulas, or math.	1	
3	Communicate	a. Explaining solutions and interpreting conclusions	3	3
		b. Can explain solutions and interpret results, but is not precise.	2	
		c. Unable to explain the resolution or conclusion.	3	
		Total Skor		10

Final score = (total score gain)/(maximum total score) x 100

3. Results and Discussion

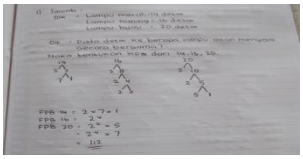
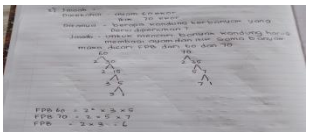
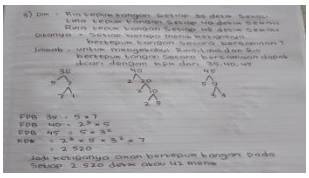
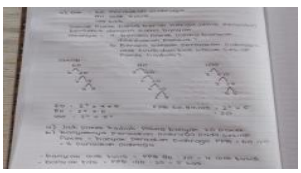
This study collected data from the work, interviews, and recordings of two female and one male students. Same-sex research subjects. This study analyzed students' responses to the NCTM math literacy portion. (NCTM, 2000). After that, the students' work was evaluated with reference to the scoring rules which were based on the characteristics of mathematical literacy skills which were abstracted from the rubric used to evaluate students' mathematical literacy abilities. The following information was collected from study participants that was used in this study:

Table 4. Research Subject Data

No.	Initial	Subject Code	Class
1	NFL	S1	IV
2	KM	S2	IV
3	KSY	S2	IV

Subject 1 (S1)

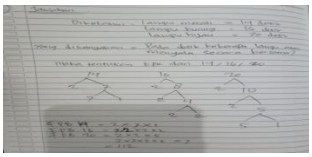
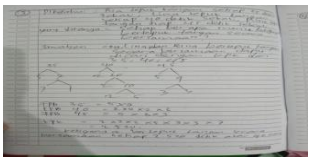
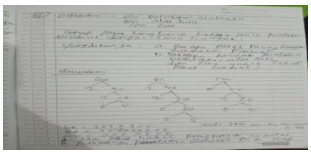
Table 5. Work Results of S1 Students

No Question	Subject Code	Student Work Results
1	S1	
2	S1	
3	S1	
4	S1	

Based on the results of the S1's work, it was found that the S1 completed the HOTS type questions correctly for questions 1-4. S1 is able to identify what is known and asked from the description. Then they can answer questions using steps and formulas. S1 can explain completion and interpret results, but it is not finished.S1 is able to answer questions sequentially from 1 to 4 based on interviews. S1 has difficulty understanding long texts, so they have to re-read.

Subject 2 (S2)

Table 6. Work Results of S2 Students

No Question	Subject Code	Student Work Results
1	S2	
2	S2	
3	S2	
4	S2	

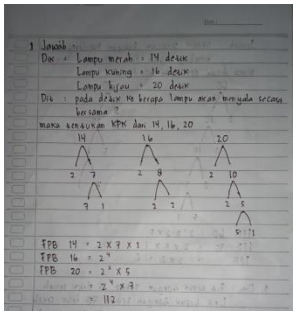
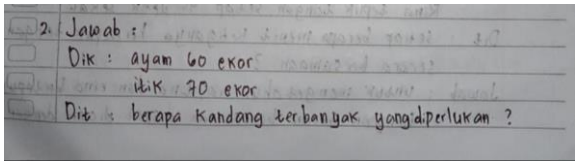
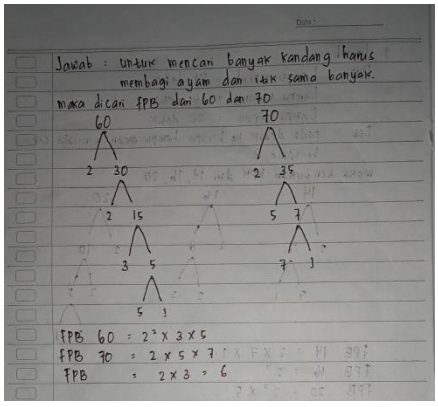
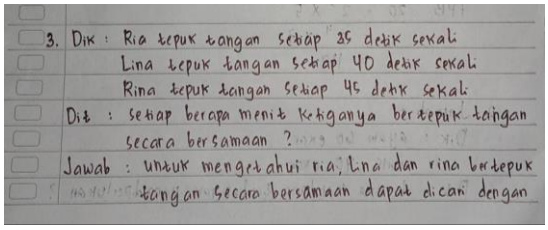
According to the master's explanation, the problem was correctly identified. S2 understands what is known about and asked for in the problem. In answering S2 questions correctly, S2 applies mathematical concepts and formulas. Then, in describing and providing an explanation for question number 4, namely cognitive domain C5, S2 has also been able to provide an explanation of completion and interpretation correctly.Based on the results of interviews conducted by researchers with S2, while working on the questions, S2 experienced a little confusion with long description questions. So that S2 requires quite a lot of time to solve 1 question.

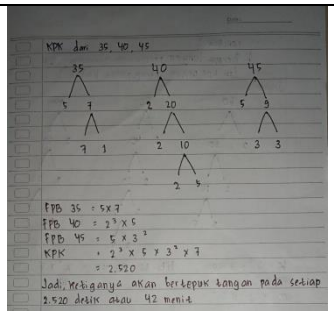
Based on the results of the S3's work, it can be seen that they correctly identified and formulated the problem, as well as what was known and what was asked. These doctors are able to use mathematics by applying mathematical concepts or procedures and using formulas or appropriate arithmetic operations. Furthermore, in providing an explanation of the answers that have been given, S3 has also been able to explain the solution, but it is still too short, so the explanation is still not solid and complete.Based on the results of the interviews conducted by the researcher with the S3, the S3 chose to solve the questions that he thought were easy first. The S3 subject saw which question text had a shorter description and fewer numbers, so that was the question he worked on first. This means that S3 chooses to work on questions starting with number 2 first, then continuing with number 1 and then number 3, where the three questions fall into the category of

HOTS questions in the cognitive domain C4 and the last question in C5 is question number 4.

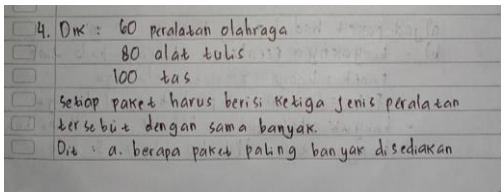
Subject 3 (S3)

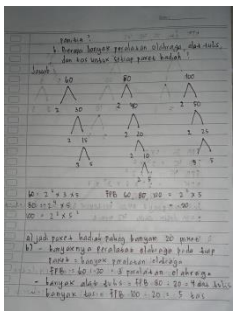
Table 7. Work Results of S3 Students

No Question	Subject Code	Student Work Results
1	S3	
2	S3	
		
3	S3	



4 S3





Aspects of Problem Solving and Formulating Problems

The results of the analysis carried out on Subjects 1, 2, and 3 showed that the three subjects had good abilities in solving and formulating problems. Subject 1 was able to identify and solve questions sequentially with appropriate explanations. Subject 2 can also solve and formulate problems, identify them, but it takes longer to understand long forms of descriptive text, so that in solving 1 question, it takes subject 2 longer than the others. Subject 3 also has the ability to solve problems and formulate problems well, as well as identify what is known and asked in the questions. Subject 3 is immediately focused on solving questions with less text description, so Subject 3 is not sequential in solving questions.

Aspects of Using Mathematics

The results of the analysis that can be seen from the worksheets of the three subjects show good mathematical abilities. The answers of the three subjects to the researcher's questions showed that they got it right.

Aspects of Communicating

Based on the results of the analysis carried out by the researcher on the worksheets for subjects 1, 2, and 3, all three of them were also able to explain the completion and interpret the conclusions from the answers given correctly and accordingly. However, if the re-analysis of the three still provides an explanation that is too brief, so that each of the answers presented has not been interpreted in more detail, After the answers have been obtained, each subject should be able to provide further information regarding the intent of the answer to answer what was asked in the question. So it's not just a number answer.According to the OECD, mathematical literacy skills include problem formulation, application, and interpretation. Some of the talents mentioned earlier are a kind of mathematical reasoning, making use of processes and functions to explain or describe a phenomenon. HOTS questions are well-known because they require students to think critically, rationally, metacognitively, artistically, and reflectively (Santoso & Setyaningsih, 2020).

4. Conclusion

Using HOTS-type questions to learn to count can help build problem solving, math, and communication skills. There are still incoherent answers, so that students' mathematical literacy skills vary. Students can solve and formulate problems. Students cannot fully use mathematical ideas and processes to solve problems. Students cannot make comprehensive responses, explanations, and conclusions using accurate and concise information.

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