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# Evaluating the Numeracy Cognitive Level of Indonesian Elementary School Students using the Minimum Competency Assessment

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**Abstract:** This study aims to describe the achievement of the numeracy cognitive level of elementary school students on a minimum competency assessment. The population of this study were fifth grade students at C-accredited elementary school in Lampung province. The sample of this study selected using stratified random sampling. Data were collected using a level 2 numeracy test instrument developed by the Center for Evaluation and Learning of the Ministry of Education and Culture of the Republic of Indonesia. Data were analyzed descriptively and inferentially using the Mann-Whitney test. It was concluded that: a) students' category of numeracy ability was "competent" (mean score 43.04); b) there is no significant difference between the numeracy abilities of male and female students; c) the highest percentage of correct answers was matching type questions (62.9%); and d) the lowest cognitive level was achieved is in the measurement concept which was only 28.6.

**Keywords:** elementary school students, minimum competency assessment, numeracy cognitive level.

***Abstrak:*** *Penelitian ini bertujuan untuk mendeskripsikan pencapaian level kognitif numerasi siswa sekolah dasar pada asessmen kompetensi minimum. Populasi penelitian ini adalah siswa kelas V sekolah dasar dengan akreditasi C di provinsi Lampung. Sampel penelitian dipilih dengan teknik stratified random sampling. Data kemampuan numerasi siswa dikumpulkan dengan menggunakan instrumen tes numerasi level 2 yang dikembangkan oleh pusat evaluasi dan pembelajaran Kementerian Pendidikan dan Kebudayaan Republik Indonesia. Data dianalisis secara deskriptif dan inferensial dengan menggunakan uji Mann-Whitney. Berdasarkan hasil penelitian disimpulkan bahwa: a) kemampuan numerasi siswa berada pada kategori "cakap" (rata-rata 43,04); b) tidak terdapat perbedaan yang signifikan antara kemampuan numerasi siswa laki-laki dan perempuan; c) bentuk soal menjodohkan merupakan bentuk soal dengan persentase jawaban benar tertinggi (62,9%); dan d) level kognitif terendah dicapai pada konsep pengukuran yaitu hanya sebesar 28,6.*

***Kata kunci:*** *asesmen kompetensi minimum, level kognitif numerasi, siswa sekolah dasar.*

## ▪ INTRODUCTION

Minimum competency assessment is part of a national assessment that has been implemented consistently since 2021. At the elementary school level, minimum competency assessment participants are grade 5th students whose literacy and numeracy skills are measured. The measurement of students' numeracy skills at the minimum competency assessment is one form of the government's seriousness in improving

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literacy skills which has been widely promoted since the existence of the National Literacy Movement Program.

The adaptation of the numeracy measurement paradigm is carried out to accommodate the need for international measurements of mathematics related to mathematical literacy which are routinely held periodically through PISA and TIMSS. As regularly reported by OECD and quoted by the Ministry of Education and culture as well as national researchers, the mathematical literacy results of Indonesian students on average are always at level 1 and are far below the international average since Indonesia first participated in international measurement. This condition has not met the standards set by the United Nation as described by the OECD in its report, that secondary school students must have at least level 2 of mathematical literacy attainment. Literacy and numeracy skills of students in Indonesia through national-scale flagship programs that involve contributions from the education office, universities, and educational quality assurance institutions.

Numeration is not only related to knowledge and skills to use numbers and mathematical symbols to solve practical problems in everyday life but also relates to a person's ability to use reasoning, analyzed information, interpret analysis results, manipulate symbols or mathematical language found in everyday life, and represent through writing and orally to predict and make decisions (Kemdikbud, 2017; Mahmud & Pratiwi, 2019; Ekowati et al., 2019). Alberta (2018) mentioned that numeracy ability as one of ability to succeed today's data-driven interconnected world which is relate to the willingness to engage quantitative or spatial information to make informed decisions in all aspect of daily living. There is a lot of evidence that shows the low achievement in learning numeracy in elementary school. Yustitia, Siswono, and Abadi (2020) reported that (1) students had difficulty in formulating and using information about numbers to solve mathematical problems in context; (2) students have difficulty analyzing various information presented in the form of frequency distribution tables and graphs; (3) students have not been able to interpret the results of their analysis related to numeracy problems to predict and make decisions. Numeracy for adult well measured in US as reported by Goodman (2013) which assest the cognitive and workplace skills necessary for successful participation in 21st-century society and the global economy. Many researchers also focus on the stimulation to enhance numeracy ability such as Nelson & McMaster (2019) reported that model predicted larger treatment effects for numeracy interventions were 8 weeks or shorter in duration and on average, interventions were more effective for students with lower levels of risk for MD according to screening criteria compared to typically achieving students; interventions were less effective for students with higher levels of risk for MD according to screening criteria and risk according to low socioeconomic status compared to typically achieving students. Another research conducted by Rohendi, Sumarna, & Sutarno (2017) found that multimedia can improve students' numeracy skill which is quit medium and the student response by using multimedia in numeracy learning are good.

Since many researchers pay attention about the development of numeracy skills including the Indonesian government, further studies are needed to measure the development of students' numeracy skills, especially in schools with accreditation level C. For this reason, research aimed at describing the achievement of the numeracy cognitive level of elementary school students on a minimum competency assessment.

## ▪ METHOD

This research is a quantitative descriptive study with a population of this study were fifth grade students at C-accredited elementary school in Lampung province. The sample of this study selected using stratified random sampling. Based on sampling technic, the research subject were all 5$^{th}$ grade students at SDN 1 Sumberbandung Pringsewu, SDN 2 Kupang Tebak Bandar Lampung, SDN K Siring Babara South Lampung, and SD Islam Terpadu Tri Bhakti Al Falah Central Lampung who were participated in minimum competency assessment in academic year 2021/2022. Data on students' numeracy skills were collected using 40 items of level 2 (measured grade 3rd and 4th content) numeracy test instrument developed by the Center for Evaluation and Learning of the Ministry of Education and Culture of the Republic of Indonesia. This research adopted the numeracy instrument on a minimum competency assessment which is valid and have high reliability. Data were analyzed using statistic descriptive then tested inferentially using the Mann-Whitney test at a 5% significance level.

## ▪ RESULT AND DISCUSSION

The results of the study based on descriptive analysis of students' numeracy ability are presented in Table 1.

**Table 1.** Descriptive statistics of students' numeracy ability from minimum competency assessment

| | **Total** | **Male** | **Female** |
|---|---|---|---|
| Mean | 43.04 | 40.71 | 45.36 |
| Range | 35 | 35 | 27.5 |
| St.Dev | 11.36 | 13.13 | 9.73 |

The information from Table 1, confirm that in average, students' numeracy ability in Competent category (> 40.00) and female students' average score was higher than male students. It is also known that female students have a lower range and standard deviation of scores than male students, which indicates that male students' numeracy scores are more diverse than female students' numeracy scores. This finding lead to the next descriptive analysis of the average score of numeracy abilities both in total and students' gender differences were assessed from the mathematical content of the cognitive level. Information as presented in Figure 1 show that male students outperform the numeracy skills of female students on a cognitive level related to relation-function and geometric figure. Meanwhile, female students surpass the mean score of numeracy of male students for more than 50% of mathematical content of the cognitive level in the minimum competency assessment.

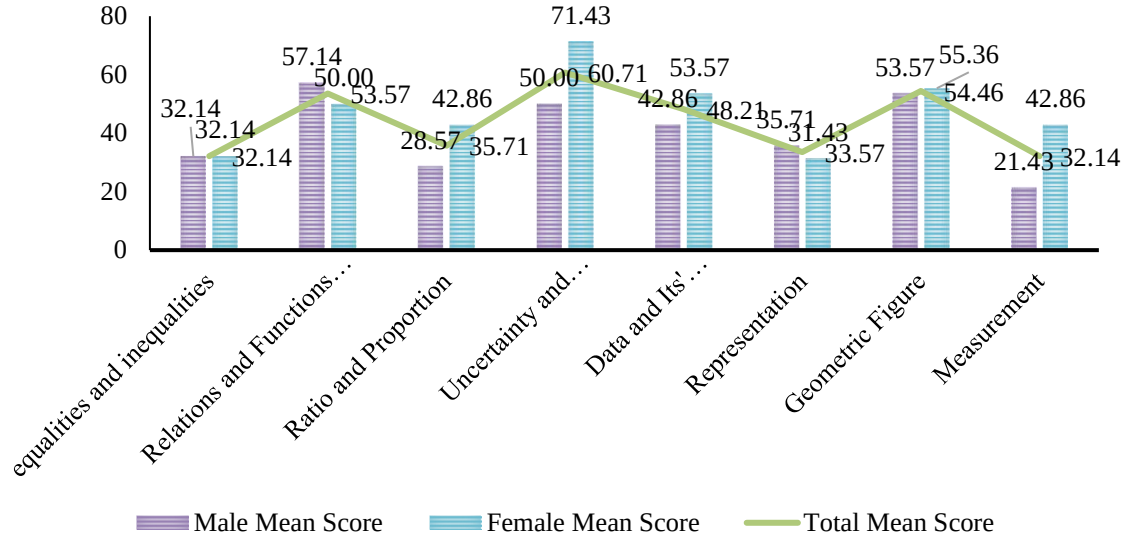


**Figure 1.** Male, female, and total mean score of students' numeracy abilities assessed from the mathematical content of the cognitive level

The results of the minimum competency assessment are designed to provide information about the level of student competence and indicate the students' learning progression. Students' minimum competency assessment results are then categorized into four groups that describe different levels of competence in order of competency levels: a) Need Special Interventions-students only have limited mathematical knowledge and demonstrate partial mastery of concepts and limited computational skills; b) Basic-students have basic mathematical skills, basic computing in the form of direct equations, basic concepts related to geometry and statistics, and solve simple routine math problems; c) Competent-students are able to apply their mathematical knowledge in more diverse contexts; and d) Proficient-students are able to reason, to solve complex and non-routine problems based on their mathematical concepts (Pusmenjar, 2020). Based on Pusmenjar (2020), student category in their numeracy shown in Table 2.

**Table 2.** Students' Numeracy Category

| Numeracy Category | Total | Male | Female |
|---|---|---|---|
| Proficient | 0 | 0 | 0 |
| Competent | 57.14 | 42.86 | 71.43 |
| Basic | 42.86 | 57.14 | 28.57 |
| Need Intervention | 0 | 0 | 0 |

Based on Table 2, in total, most elementary school students are in the competent category which means they are able to apply their mathematical knowledge in more diverse contexts. When we dig deeper into gender deference, more female students in competent category than male students. This reveals valid information that male students more inclined to basic mathematical skills, basic computing in the form of direct equations, basic concepts related to geometry and statistics, and solve simple routine math problems while female students more adequate in applying wider contexts of mathematical knowledge. These findings imply that there are differences in numeracy skills between female and male students. To confirm these indications, the

Mann Whitney test was carried out at a 5% significance level. Result of Mann-Whitney Test Statistics shows that Asymp. Sig. (2-tailed) = 0.561 > $\alpha$ = 0.05 which means retain $H_0$. So, it can be concluded that there is no significant difference between the numeracy abilities of female students and male students in primary schools, obtaining from minimum competency assessment results. In minimum competency assessment, the content of numeracy questions is divided into four groups, namely numbers, geometry, data and uncertainty, as well as algebra with varied question forms, namely multiple choice, complex multiple choice, matching, true-false, and essays. A simple analysis of the tendency of the form of numeration questions in the minimum competency assessment and also the student's response in answering each question correctly is shown in Figure 1.

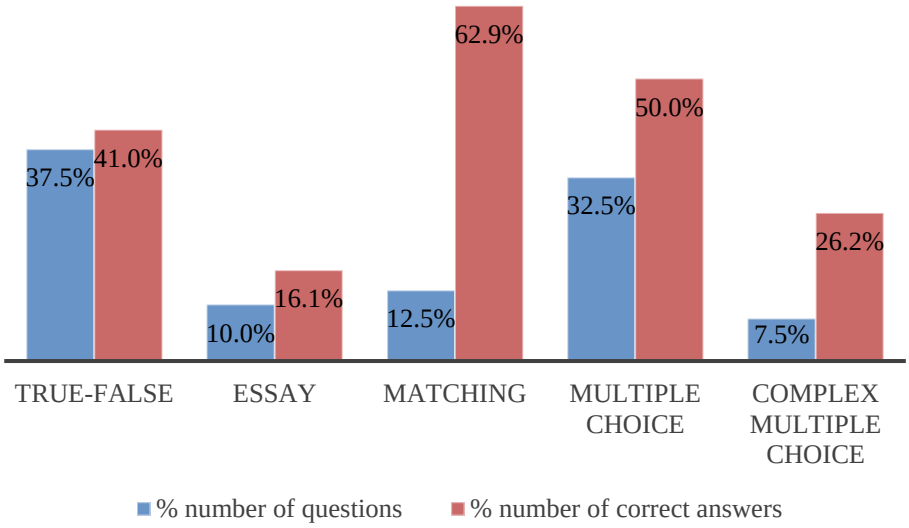


**Figure 1.** Percentage of question types and students' correct answer

Based on Figure 1, there are two information points of view that can be seen. The first information is the form of true-false questions which are the most widely contained questions in numeration questions at the minimum competency assessment which are then followed by the form of multiple choice questions. This shows that variations in the form of questions have been cultivated in evaluation practices to measure certain competencies. The data also shows that the habit of evaluating learning carried out by teachers in the form of multiple choice or essays is actually able to be broken through the positive responses shown by students. Although 50% of students were able to correctly answer multiple-choice questions, students did not disappoint when they answered numeration questions in the form of matching and true-false. It is based on finding that 62.9% students' correctly answer matching type questions and 41.00% students successfully use their numeracy competence in answering true-false type of questions. From the data it is also known that, although complex multiple choice occupies the smallest percentage of the number off question, the student's achievement in this type of question was not too disappointing, which is equal to 26.2%. Through various forms of questions, stimulation to many aspect of thinking are possible. Another consideration is the need to strengthen the number of competencies in elementary school students, as stated in research Jordan et all (2009) which show the importance of early number competence for setting children's learning trajectories in elementary

school mathematics. Furthermore, the cognitive level shows the thinking processes that are required or needed to be able to solve problems or questions that indicate the level of knowing, applying, and reasoning on students' numeracy abilities. Further analysis related to the cognitive level that students show in working on numeracy questions of certain types is presented in Figure 2.

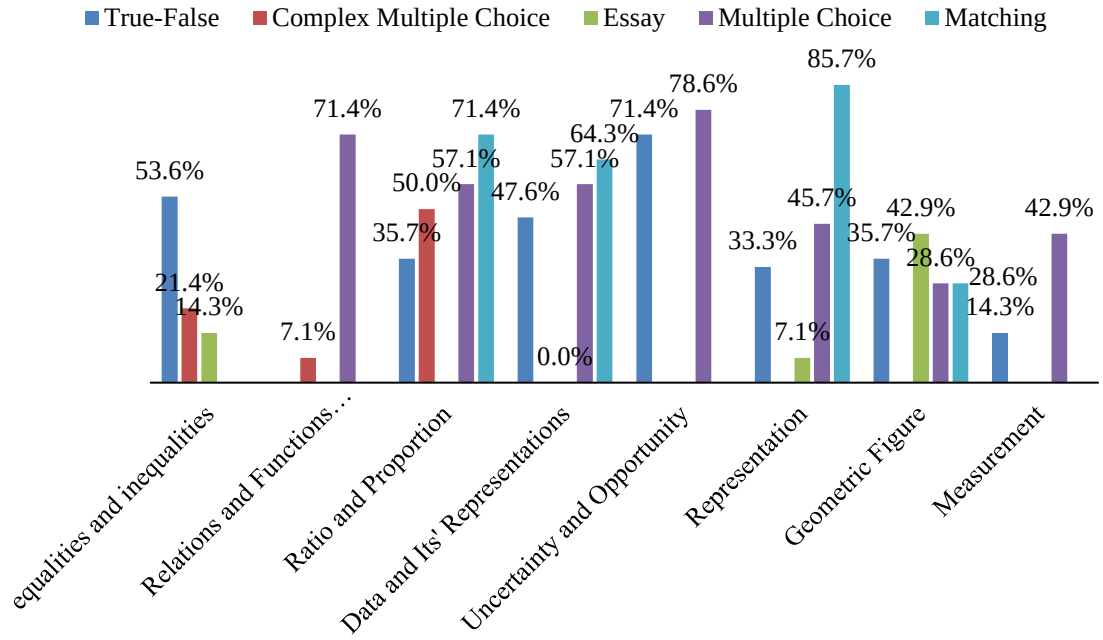


**Figure 2.** The percentage of students' cognitive level achievement in each type of numeracy question in the minimum competency assessment

At the cognitive level which involves the concepts of equality and inequality, the true-false type questions have the highest percentage of correct answers, which is 53.6%. this finding indicates two possibilities, the first one is true-false question types as the very easy question types for students and the second posibility is true false questions catch students' interest in solving mathematical problems. Indriani, Suyatna, & Ertikanto (2015) also found that true-false questions in the form of interactive quiz, were very interesting, very easy, and very useful for students in improving their understanding. At the cognitive level, which involves the concepts of measurement, relation and function, as well as uncertainty and opportunity, only two types of questions are used, with the highest percentage of correct answers shown by students on multiple choice questions. This finding reveals linear information from Furnham, Batey and Martin (2011) and Turhan (2020) study which found that multiple-choice questions can be considered as a motivation factor for students to positive attitude toward exams because multiple-choice questions decrease students stress, anxiety, and bring relatively higher scores (Traub, 1990). The concepts of ratio and proportion are measured by the most diverse forms of questions. In this concept, the highest gain is indicated by 71.4% of students successfully answering correctly the questions with the matching type. The cognitive level that involves data and representation is dominated by students' correct answers on the matching question type, while the cognitive level of students in solving problems involving geometric figures is better able to be measured by essay type questions.

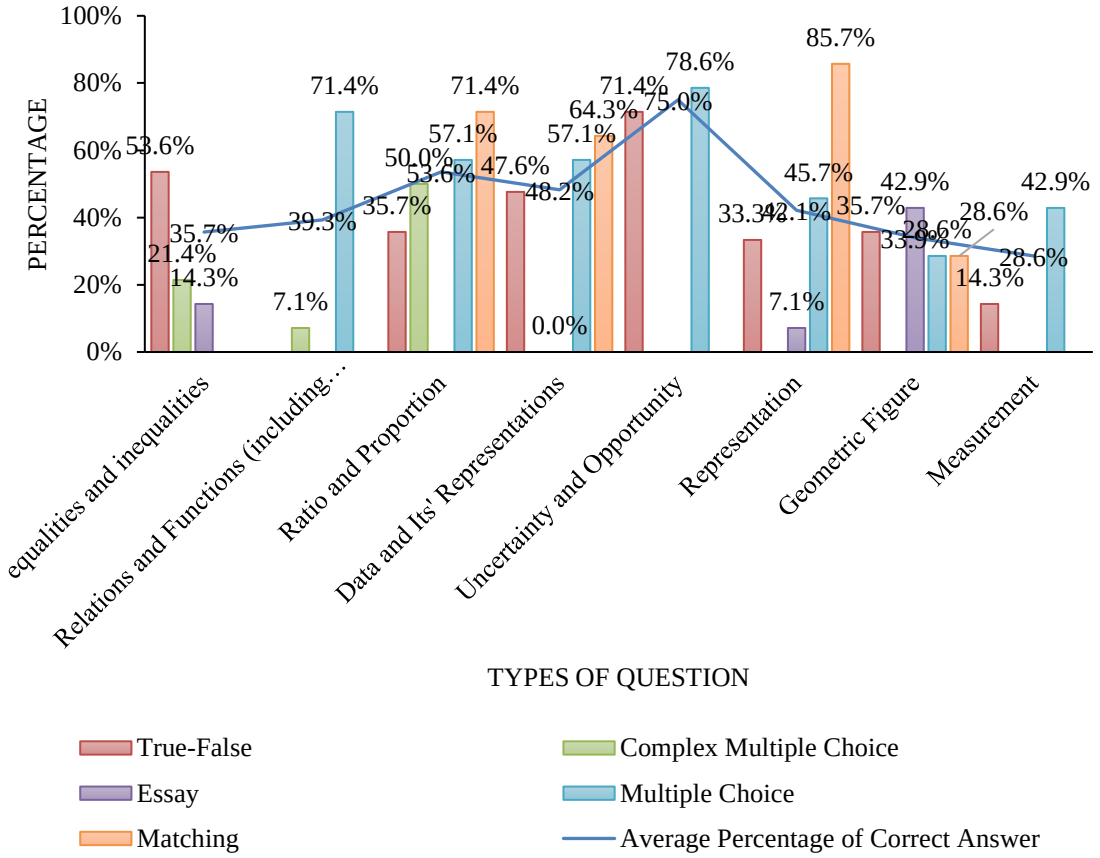


**Figure 3.** Average percentage numeracy achivement for each cognitive level

The highest achievement on students' cognitive level related to the concept of Uncertainty and Opportunity with the percentage of achievement of 75% while the lowest achievement was in the concept of measurement. The true-false numeration questions managed to exceed the total percentage average only at the cognitive level of equalities and inequalities. The multiple-choice complex failed to exceed the average total percentage at each cognitive level. The essay form succeeded in exceeding the total percentage average at the cognitive level, the total percentage average, while the multiple choice format exceeded the total percentage average for each cognitive level except for the geometric figure concept. The form of matching exceeds the average total percentage at the cognitive level involving ratio, proportion, and representation. Even the form of matching questions on the cognitive representation level is the form of questions with the highest percentage of achievement, which is 85.7%. These findings indicate the need to strengthen some basic mathematical concepts, especially those related to measurement and arithmetic. Yustitia, Siswono, Abadi (2020) study's results found that arithmetic needs to be a topic of attention to improve mathematics learning achievement in the future. Not only that, Holmes and Dowker (2013) found that many children's arithmetical difficulties are highly susceptible to intervention, and that the intervention in catch-up numeracy does not need to be intensive or delivered by highly-trained teachers to be effective.

To stimulate student curiosity, the availability of facilities and infrastructure, the capacity of school residents, and the capacity of stakeholders, a numeracy literacy work program twice a week before learning hours takes place, a mathematics and non-mathematics teacher training for thematic learning based on numeracy literacy is held, and fostering love reading to students and learning experiences that are fun while stimulating the imagination (Perdana & Suswandari, 2021). Moreover, Abduh (2019) mentions the supporting factors needed for the sustainability of good practices, including: 1) school operational assistance funding support is needed; 2) Periodic supervision by the School Supervisor; 3) teacher working group as a center for teacher learning resources and collegial learning facilities need to be preserved; and 4) Attention to teacher qualifications, employment status and welfare (especially honorary teachers). For this reason, the findings that require extra attention really require the synergy of many parties to disseminate good practices for leading school programs, as well as innovative and creative learning practices and have a positive impact on improving the numeracy skills of elementary school students at every cognitive level. Moreover, it is also important to match and link early literacy and early numeracy development (Purpura, Hume, Sims, & Lonigan, 2011).

## ▪ CONCLUSION

Based on the results of the study, it was concluded that: i) the average numeracy ability of students was 43.04 which was in the category of competent numeracy abilities; ii) there is no significant difference between the numeracy abilities of male and female students but 71.43% of female students are in the competent category while 57.14% of male students are in the basic numeracy category; iii) true-false questions are the most common questions on numeration instrument in the minimum competency assessment and matching type questions are questions with the highest percentage of correct answers, which is 62.9%; and iv) Uncertainty and Opportunity was a concept with the highest average cognitive level percentage of 75.0 while the lowest cognitive level was achieved in the measurement concept which was only 28.6.

The results of this study provide an actual condition of the cognitive level achievement of elementary school students' numeracy abilities of C-accredited school in a rural area of Lampung province. These findings enrich the reference for the development of numeracy improvement programs in schools. However, the research subjects who were students at C-accredited schools in rural areas which have minimal technological facilities, so the recommendation for further research to observe more qualified technological facilities in schools, in case of minimalizing the significant obstacles on accessing the minimum competency assessment. Based on research find, it is also suggested that elementary school mathematics teachers need to familiarize students with the mathematization process in various types of questions, especially math problems with complex multiple choices type to further develop students' numeracy skills and thinking skills.

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