Study of Numeracy Identification in Elementary Schools Using Educational Report Cards: Implications for the Development of Problem Solving Abilities

Aan Nurhasanah[*1], Tri Joko Raharjo[2], Sri Sumartiningsih[2], Barokah Isdaryanti[2]

[1]Kuningan University, Indonesia
[2]Universitas Negeri Semarang, Semarang, Indonesia

*Corresponding Author: aan.nurhasanah@uniku.ac.id

Abstract. This research aims to determine the relationship between numeracy and the problem solving abilities of elementary school students. Numeracy data was obtained from school education reports, while problem solving abilities were obtained from the results of tests specifically designed by researchers to get a more specific picture of students' abilities. The research method used is descriptive quantitative with a correlational approach. The research population was fifth grade students in several elementary schools in Kuningan Regency. Cumulative data from education reports is analyzed to see the overall numeracy pattern in each school. The test is designed to measure a person's problem-solving abilities. The results showed that there was a significant positive correlation between numeracy and students' problem solving abilities ($r = 0.869$, $p < 0.01$). Regression analysis shows that numeracy ability significantly predicts problem solving ability ($\beta = 0.54$, $p < 0.05$). These findings demonstrate the importance of evaluating individual numeracy to improve problem-solving skills. From these results, it can be concluded that increasing numeracy in students can significantly increase their ability to solve problems. Therefore, efforts to strengthen numeracy learning in elementary schools are very necessary to support the development of better problem solving skills in students.

Keywords: numeracy; educational report cards; problem solving abilities; pearson correlation; regression analysis

INTRODUCTION

Numeracy ability is one of the basic skills that is very important for elementary school students. Numeracy does not only include the ability to count, but also involves understanding broader mathematical concepts and the ability to apply this knowledge in various contexts of daily life (Nazillah & Fajar, 2023). In Indonesia, numeracy competency is one of the main focuses in basic education, in accordance with the curriculum which emphasizes mastery of mathematics as an important foundation for the development of students' cognitive skills (Anggraena et al., 2022). Even though it is important, students' numeracy skills in Indonesia are often not optimal. Based on the PISA study in (Sari & Setiawan, 2023) as well as data from several education reports, the results of Indonesian students' numeracy tests show that many students are still below the expected standards. This is a concern because low numeracy skills can have a direct impact on students' ability to solve problems. (Solehah & Setiawan, 2023) stated that problem solving ability is a crucial skill for students to face challenges in everyday life and in the future.

Education reports in elementary schools provide information about students' overall academic achievement, including numeracy skills which are often used to assess students' mathematical abilities (Nasution, 2022). This information often does not provide a specific picture of individual students' numeracy abilities. These limitations hinder efforts to understand in depth how students' numeracy abilities develop and how this is related to their ability to solve problems. Previous studies have shown a close relationship between numeracy abilities and problem solving abilities (Meliana & Sopiany, nd). Superior numeracy abilities are known to improve analytical and logical skills that are important in the problem solving process (Kallet, 2014). However, most research still pays little attention to how data from educational report cards can be used to evaluate and improve these abilities more effectively.

In the Kuningan Regency area, which is facing various challenges in improving the quality of education (Hindriana et al., 2021), a deeper understanding of the link between numeracy skills and problem solving is very relevant. The use of cumulative data from educational report cards is expected to provide a clearer picture of the patterns and factors that influence numeracy abilities and

Table 1. Instrument Validation

Question No	Level Difficulty	Validity	Reliability	Information
1	0.80	0.95(very high)	Cronbach's alpha was	Used
2	0.80	0.90 (high validity)	0.89.	Used
3	0.80	0.85 (fairly high validity)		Used
4	0.80	0.80 (fairly good validity)		Used
5	0.80	0.92 (high validity)		Used

how this contributes to the development of students' problem solving skills.

The purpose of this study was to investigate the relationship between numeracy skills and problem-solving skills in students. This study aims to understand the extent to which numeracy skills can influence or contribute to improving problem-solving skills. In addition, this study also aims to investigate the extent to which variability in problem-solving skills can be explained by variations in numeracy skills. Thus, this study is expected to provide insight into the importance of numeracy skill development as a key factor in strengthening students' problem-solving skills and encouraging improvements in the quality of numeracy teaching in schools.

METHODS

This research uses a descriptive quantitative approach with correlational analysis. (Sholihah, 2020)explains that correlation research is research that aims to see connection between the two symptom or more. This research was carried out on fifth grade students from several elementary schools in Kuningan Regency. The data collection techniques used are documentation studies and tests. According to (Equatora & Awi, 2021) Documentation study is a method of collecting information by studying documents to obtain information related to the problem being studied . Researchers conducted documentation studies on the education reports held by each school. From this education report card, students' cumulative numeracy scores will be obtained. Meanwhile, tests are a set of questions that must be answered or a set of tasks that must be carried out by someone to be able to find out or reveal the extent of their mastery of a study material (Susilawati, 2018). This test is specifically designed to assess individual problem-solving abilities. The problem-solving skills test was developed based on Polya's theory (August & Ramlah, 2021), consisting of stages, namely: the first

stage is understanding the problem, the second stage is designing a plan or strategy to solve the problem, the third stage is implementing the plan that has been designed, the last stage is evaluating the solution that has been found. Before use, the test instrument is first tested to assess whether it is suitable or not. The results of the trial were analyzed using the Item Response Theory (IRT) system. According to (Fatkhudin et al., 2014)the IRT system is the study of question items using the theory of question item answers. The results of the analysis of the questions are displayed in the following table 1.

Based on the table above, the average component level of difficulty is 0.80, validity is 0.88, and reliability component is 0.89 so that problem solving questions are feasible and can be used to measure research subjects.

With data obtained from educational report cards and tests, it is then analyzed quantitatively using a correlation test which is used to determine a quantity that states how strong the relationship between a variable is and other variables without questioning whether a particular variable depends on other variables. Meanwhile, the correlation coefficient is used to determine the degree of relationship between variables. This research uses the Pearson Product Moment Correlation Test (r) which aims to determine the level of closeness of the relationship between variables which is expressed by the correlation coefficient (r). The type of relationship between variable X (numeracy) and variable Y (problem solving) can be positive and negative. Basis for decision making these are: 1) If mark Significance < 0.05 so correlated, 2) If Significance value > 0.05 means it is not correlated. If the significance value is exactly 0.05 then we can compare the Pearson Correlation Test with the r table with the following conditions: 1) if the Pearson Correlation Test > r table then it is related, 2) if the Pearson Correlation Test < r table then it is not related. The guidelines for the degree of relationship are explained in Table 2.

Table 2. Guidelines for Degree of Relationship

Intervals Coefficient	Relationship Level
0.00 – 0.199	Very Weak
0.20 – 0.399	Weak
0.40 – 0.599	Currently
0.60 – 0.799	Strong
0.80 – 1.000	Very strong

RESULTS AND DISCUSSION

Numeracy Ability

Numeracy is the ability to understand and work with numbers and other mathematical concepts (Jain & Rogers, 2019) . At the elementary school level, numeracy covers several main domains, namely algebra, data and uncertainty, geometry, and numbers (Pratiwi et al., 2023). Algebra at the elementary level involves a basic understanding of patterns, relationships, and operations that enable students to solve simple problems and recognize regularities. Data and uncertainty include the ability to collect, organize, and interpret information as well as understand the concepts of chance and simple predictions. Geometry teaches students about shape, space, and size, helping them to recognize and understand various geometric shapes as well as the concepts of position and direction. Meanwhile, Numbers includes an understanding of numbers, basic operations (such as addition, subtraction, multiplication, and division), as well as concepts such as fractions and decimals. All of these domains play an important role in building a strong foundation for advanced mathematical understanding and logical thinking skills in everyday life.

Numeracy assessments of students in elementary schools are carried out by the government periodically to ensure students' development and understanding of mathematical concepts (Ainissyifa et al., 2024). One form of this evaluation is through the Computer-Based National Assessment (ANBK) which is held once a year (Gofur, 2023). This assessment is specifically targeted at class V students, aiming to measure their numeracy abilities in accordance with established standards. One of the ANBKs is designed to provide an accurate picture of students' abilities in applying numeracy concepts, including algebra, data and uncertainty, geometry, and numbers. The results of this assessment not only help the government evaluate the effectiveness of the curriculum and the quality of education, but also provide important feedback for schools and teachers to improve mathematics teaching and learning methods at the elementary level .

The results of the Computer-Based National Assessment (ANBK) are presented in the form of an Education Report Card, which provides a comprehensive report on school achievements (Mujiburrahman et al., 2023) . This report not only provides data on students' numeracy abilities, but also covers various other aspects of the school's academic and non-academic achievements. The Education Report Card functions as a comprehensive evaluation tool to assess the quality of education in each school, including information such as literacy levels, student learning outcomes, learning effectiveness, and the school environment. The data collected in this report card helps schools, teachers, and the government to understand areas that need improvement, formulate more effective learning strategies, and ensure that every student has an equal opportunity to reach their maximum potential.

To provide a clearer picture of numeracy abilities, researchers have conducted a documentation study of the education report cards of 5 schools. The following is a table that summarizes the results of the numeracy assessment at each school.

Table 3. Recapitulation of Numeracy Ability Achievements

NO	School name	Numeracy				Average Numeracy
		Algebra Domain	Data Domain and Uncertainty	Geometry Domain	Number Domain	
1	SDN 1 Ciomas	42.65	62.12	64.29	71.23	60.07
2	SDN 1 Kadurama	50.16	62.9	63.58	66.36	60.75
3	Dukuh Dalem Elementary School	44.52	46.87	53.75	58.1	50.81
4	Babatan Elementary School	39.05	49.01	54.07	58.99	50.28
5	SDN Mekarjaya 1	49.92	57.44	50.72	57.28	53.84

Table 4 Stages of Mathematical Problem Solving Ability

NO	School name	Number of students	Problem Solving Stage				Average The Value of Problem Solving
			1	2	3	4	
1	SDN 1 Ciomas	10	8	5	4	3	2.10
2	SDN 1 Kadurama Dukuh Dalem	13	12	11	8	3	2.08
3	Elementary School	44	40	38	10	6	2.09

Based on the table above, it can be seen that all schools show different strengths in various numeracy components. Overall, the number , data and uncertainty components tended to have higher scores, indicating that students were more proficient in these areas compared to algebra and geometry. All schools recorded relatively low scores on the algebra component. This suggests a need for improvements in algebra teaching methods, perhaps using approaches that are more engaging and relevant to students.

Mathematical Problem Solving Ability

The results of further research relate to students' problem solving abilities. Problem solving ability is a student's ability to use their thinking processes to solve problems through activities of collecting facts, analyzing information, compiling various alternative solutions , and choosing the most effective (Purba & Sirait, 2017). Polya in (Yuwono et al., 2018)problem solving abilities consist of four stages, namely the first stage is understanding the problem. Interpreted by understanding what is required in a problem. This involves various activities such as identifying the information provided, what to look for, and existing limitations. The second stage is designing a plan or strategy to solve the problem. This may include the use of various mathematical techniques or other creative approaches. The third stage is implementing the plan that has been designed. This means following carefully thought out steps to reach a solution. The final stage is evaluating the solutions that have been found. This involves double-checking whether the solution meets all the requirements given in the problem, as well as considering whether there are more efficient ways or alternative approaches that could be used. By carrying out tests on class V students in each school, the following data was obtained in table 4.

From the data provided, we can see the distribution of students in five different elementary schools in terms of their problem-solving abilities. This data includes the number of students from each school and the problem-solving stages they have achieved. Each school shows variations in the number of students and the stages achieved by the students. For example, at SDN 1 Ciomas with 10 students, it shows that most students (8 students) were able to achieve the first stage of problem solving, but only 3 students managed to reach the final stage. The average problem-solving score at this school is 2.10. This result is in line with research by (Lidinillah, 2011) which found that "students in elementary schools often show higher abilities in the early stages of problem solving compared to the final stage." Likewise, SDN 1 Kadurama with 13 students showed that almost all students (12 students) were able to complete the first stage, but only 3 students managed to reach the final stage, with an average problem-solving score of 2.08.

This phenomenon was also identified in a study by (Kristiyani, 2020), which indicated that "factors

Table 5. Pearson Correlation Products Moments

Parameter	Mark
Mean Numeracy ($\bar{x}$)	55.15
Mean Problem Solving ($\bar{y}$)	2.04
Numeracy Standard Deviation (σx)	4.57
Standard Deviation Problem solving (σy)	0.047
Number n	5
Pearson Correlation Coefficient (r)	0.896
Regression Equations	Y=0.214+0.024X
Coefficient of Determination (R^2)	0.541

such as time constraints and experience can affect students' achievement at more complex problem-solving stages." The school with the largest number of students was SDN Dukuhdalem with 44 students, where most students (40 students) reached the first stage, but only 6 students reached the last stage, with an average problem-solving score of 2.09. This result is consistent with research by (Astari, 2023) which stated that "most students tend to be able to complete basic problem-solving tasks but have difficulty at higher stages." SDN Babatan with 22 students showed a similar pattern with 21 students at the first stage and only 4 students at the final stage, and an average problem-solving score of 2.00. Previous research by (Yulianti et al., 2023) also found that "increased task complexity often leads to decreased student success in solving problems." Finally, SDN Mekarjaya 1 has 30 students, all students successfully passed the first stage, but only 5 students reached the final stage, with an average problem-solving score of 2.06. Overall, out of a total of 119 students in the five schools, 93% successfully achieved the first stage of problem solving, 76% achieved the second stage, 43% achieved the third stage, and only 17% achieved the final stage. This shows that most students are able to complete the initial stages of problem solving, but there is a significant decline when they have to proceed to more complex stages. Research by (Jemin et al., 2024) also supports this finding by stating that "students' problem-solving abilities decrease as the difficulty of the task increases." The average problem-solving scores across schools were relatively consistent, ranging from 2.00 to 2.10, indicating that overall problem-solving abilities are fairly evenly distributed among the schools analyzed.

Correlation of Numeracy and Mathematical Problem Solving Ability

To find out the relationship between numeracy and students' problem solving abilities, a test is then carried out Correlation Pearson Products Moment to the data that has been obtained. As for correlation test results is displayed on table 3.

Based on the analysis of numeracy data and problem-solving ability, the numeracy data consisted of five values, namely 60.07, 60.75, 50.81, 50.28, and 53.84, with an average value of 55.15 and a standard deviation of 4.57. The problem-solving ability data also consisted of five values, namely 2.1, 2, 2.09, 2, and 2, with an average value of 2.038 and a standard deviation of 0.047. The correlation between these two variables is indicated by the Pearson correlation coefficient of 0.896, which

indicates a very strong positive relationship between numeracy scores and problem-solving ability. This means that an increase in numeracy scores tends to be associated with an increase in problem-solving ability. This finding is supported by previous research, such as that found by (Nahdi, 2019), which states that "numeracy skills play an important role in developing problem-solving skills, especially in the context of mathematics." As stated by Fauziah et al. (2022), the results of their study showed that mathematical problem-solving ability was relatively low, with an average score of 5.47. Then, from the results of the interviews conducted, it was obtained that students did not understand the types of Asesmen Kompetensi Minimum (AKM) questions in the algebra component, so they had difficulty in solving the questions given. This is in line with the findings that show that "difficulty in understanding algebraic concepts is a major obstacle to mastering mathematical problem solving" (Ebell, Robert L. & Friesbie, 1991)

Furthermore, a simple linear regression analysis produces a regression equation $\hat{Y} = 0.214 + 0.024X$ which shows that for every one unit increase in numeracy value, problem-solving ability is predicted to increase by 0.024 units. The coefficient of determination (R^2) of 0.541 indicates that around 54.1% of the variation in problem-solving ability can be explained by variations in numeracy scores. This shows that the regression model used is quite good at explaining the relationship between the two variables, although there is still 45.9% of the variation explained by other factors. This finding is consistent with research by (Fitriana et al., 2023), which found that "numeracy ability has a significant contribution to problem-solving ability, but other factors such as learning motivation and teaching strategies also play an important role." Overall, these results indicate that numeracy has a significant effect on problem-solving ability. However, because R^2 only explains more than half of the variation, there are other factors that need to be considered to get a more complete picture of what influences problem-solving ability. As stated by (Fitriana et al., 2023), "non-cognitive factors such as self-efficacy and math anxiety can also significantly affect problem-solving outcomes."

Implications of Research Results

The results of this research produce important implications in the context of education and student skill development. The finding of a strong correlation between numeracy ability and problem solving ability shows that improvements in

numeracy can significantly improve students' ability to solve problems. The first implication is the need for curriculum development that integrates more deeply between numeracy learning and the development of problem solving skills. By strengthening these connections in teaching, educators can help students develop skills that are not only mathematical, but also practical in dealing with everyday problems.

Apart from that, these findings also suggest the need to develop more contextual and applied learning methods. Through a learning approach that allows students to apply numeracy concepts in real problem solving situations, schools can increase the relevance and effectiveness of learning. This not only prepares students for academic success, but also for real-world challenges where strong problem-solving skills are highly valued.

Thus, these findings also have implications for the development of educator professionalism and the development of educational policies that support the integration of numeracy and problem solving in the national curriculum. Through this effort, it is hoped that we can create a better learning environment and make a greater contribution to the development of students' skills for a more successful and highly competitive future.

CONCLUSION

Based on the analysis that has been carried out, it can be concluded that there is a significant relationship between numeracy abilities and problem solving abilities in students. An increase in numeracy will be followed by an increase in problem solving abilities. In addition, the coefficient of determination of 54.1% indicates that variations in numeracy are able to explain most of the variations in problem-solving abilities, although there are still other factors that need further investigation. So it can be concluded that the importance of developing numeracy skills as one of the key components for improving problem-solving abilities, and shows that efforts to strengthen numeracy teaching in schools can have a significant positive impact on students' ability to solve problems.

REFERENCES

Ainissyifa, H., Nasrullah, Y. M., Fatonah, N., Indriani, S. A., Asyifiya, S. N., Rohmah, A., & others. (2024). Manajemen Pendidikan dalam Kurikulum Merdeka di Madrasah. Cahaya Smart Nusantara.

Anggraena, Y., Felicia, N., Eprijum, D., Pratiwi, I., Utama, B., Alhapip, L., & Widiaswati, D. (2022). *Kajian akademik kurikulum untuk pemulihan pembelajaran*.

August, F. M., & Ramlah, R. (2021). Analisis kemampuan pemecahan masalah matematis siswa berdasarkan prosedur polya. *JIPMat*, *6*(1), 43–59.

Ebell, Robert L. & Friesbie, D. A. (1991). *Fifth Edition Essentials of Educational Measurem*. 1–383. https://ebookppsunp.files.wordpress.com/2016/06/robert_l-ebel_david_a-_frisbie_essentials_of_edbookfi-org.pdf

Equatora, M. A., & Awi, L. M. (2021). *Teknik pengumpulan data klien*. Bitread Publishing.

Fatkhudin, A., Surarso, B., & Subagio, A. (2014). Item response theory model empat parameter logistik pada computerized adaptive test. *Jurnal Sistem Informasi Bisnis*, *2*, 121–129.

Fitriana, I. A., Andinasari, A., & Utari, R. S. (2023). Pembelajaran Cooperative Intergreted Reading and Composition (CIRC) terhadap Kemampuan Numerasi dalam Menyelesaikan Soal Pemecahan Masalah. *Prima Magistra: Jurnal Ilmiah Kependidikan*, *4*(3), 312–318.

Gofur, A. (2023). Problematika Pelaksanaan Asesmen Nasional Berbasis Komputer (ANBK) Sekolah di Kabupaten Seruyan. *Adaara: Jurnal Manajemen Pendidikan Islam*, *13*(1), 1–9.

Hindriana, A. F., Setiawati, I., Solihin, N., & Sholikah, M. (2021). Pengembangan Kompetensi Guru dalam Menghadapi Program Merdeka Belajar. *Empowerment: Jurnal Pengabdian Masyarakat*, *4*(03), 254–260.

Jain, P., & Rogers, M. (2019). Numeracy as Critical Thinking. *Adults Learning Mathematics*, *14*(1), 23–33.

Kallet, M. (2014). *Think smarter: critical thinking to improve problem-solving and decision-making skills*. John Wiley \& Sons.

Meliana, R., & Sopiany, H. N. (n.d.). *Profil Kemampuan Pemecahan Masalah Matematis Siswa Pada Kategori Tinggi Ditinjau dari Motivasi Belajar dan Kemampuan Numerasi Profile of Students' Mathematical Problem Solving Ability in the High Category in terms of Learning Motivation and Numeracy*.

Mujiburrahman, M., Kartiani, B. S., & Parhanuddin, L. (2023). Asesmen pembelajaran sekolah dasar dalam kurikulum merdeka. *Pena Anda: Jurnal Pendidikan Sekolah Dasar*, *1*(1), 39–48.

Nahdi, D. S. (2019). Keterampilan matematika di abad 21. *Jurnal Cakrawala Pendas*, *5*(2).

Nasution, S. W. (2022). Asesment kurikulum

merdeka belajar di sekolah dasar. *Prosiding Pendidikan Dasar*, *1*(1), 135–142.

Nazillah, H. I., & Fajar, A. (2023). Peningkatan Budaya Literasi Dan Numerasi Dalam Pembelajaran Tematik Melalui Proyek Kreatif Pada Siswa Kelas V Di MI Al-Barokah Cihanjawar. *Abdi Widya: Jurnal Pengabdian Masyarakat*, *2*(1), 34–44.

Pratiwi, F., Sukri, M., & others. (2023). Profil kemempuan numerasi siswa kelas III dan IV SDN 1 Selebung berbasis tes palatform merdeka mengajar (PMM). *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *8*(3), 4865–4877.

Purba, O. N., & Sirait, S. (2017). Peningkatan Kemampuan Pemecahan Masalah dengan Model LAPS-Heuristic di SMA Shafiyyatul Amaliyah. *Jurnal Mathematic Paedagogic*, *2*(1), 31–39.

Sari, D. A. K., & Setiawan, E. P. (2023). Literasi baca siswa Indonesia menurut jenis kelamin, growth mindset, dan jenjang pendidikan: Survei PISA. *Jurnal Pendidikan Dan Kebudayaan*, *8*(1), 1–16.

Sholihah, Q. (2020). *Pengantar Metodologi Penelitian*. Universitas Brawijaya Press.

Solehah, H., & Setiawan, D. (2023). Kurikulum Merdeka dan Penilaian Pembelajaran Matematika dalam Membangun Generasi Matematika yang Kompeten (Studi Literatur). *Jurnal Pendidikan Tambusai*, *7*(3), 23929–23940.

Susilawati, D. (2018). *Tes dan pengukuran*. UPI Sumedang Press.

Yuwono, T., Supanggih, M., Ferdiani, R. D., & others. (2018). Analisis kemampuan pemecahan masalah matematika dalam menyelesaikan soal cerita berdasarkan prosedur Polya. *Jurnal Tadris Matematika*, *1*(2), 137–144.