KIDDO : JURNAL PENDIDIKAN ISLAM ANAK USIA DINI
http://kiddo@iainmadura.ac.id
E-ISSN : 2716-1641; P-ISSN: 2716-0572

Early Childhood Numeracy Skill Assessment: A Preparation Study For Elementary School Transition

Nurul Kusuma Dewi
Universitas Sebelas Maret, Indonesia
email: kusuma.dewi@staff.uns.ac.id

Adriani Rahma Pudyaningtyas
Universitas Sebelas Maret, Indonesia
email: adriani.rahma@staff.uns.ac.id

Vera Sholeha
Universitas Sebelas Maret, Indonesia
email: verasholeha@staff.uns.ac.id

Anayanti Rahmawati
Universitas Sebelas Maret, Indonesia
email: Anayanti_r@staff.uns.ac.id

Warananingtyas Palupi
Universitas Sebelas Maret, Indonesia
email: Palupi_paud@staff.uns.ac.id

Muhammad Munif Syamsuddin
Universitas Sebelas Maret, Indonesia
email: wandamunif@yahoo.com

Keywords:
Numeracy Literacy; Early Childhood; School Readiness;

Abstract

Low numeracy skills in early childhood affect primary school readiness. Children will have difficulty facing challenges in mathematics, problem solving, other subjects, daily activities, self-confidence, motivation to learn, and social interaction. This study aims to analyze the level of numeracy skills of children aged 5-6 years in the Surakarta Residential and identify aspects of numeracy skills that are still low, so that it can be a reference in providing appropriate stimulation. The research method used a survey. Data collection techniques through a numeracy assessment questionnaire and validated by expert judgment. The sampling technique used convenience sampling by randomly selecting two kindergartens in each district / city in Surakarta Prefecture, so that 386 respondents of children aged 5-6 years were obtained. The data were analyzed using descriptive statistics. The results showed that 13.2% of the children had high numeracy skills, 67.9% were in the medium category, and 18.9% were in the low category. Of the five aspects of numeracy measured (number, geometry, measurement, computation, and data analysis), the number

aspect was found to be the most mastered by the children. The geometry, measurement, and computation aspects were in the moderate category. The data analysis aspect showed the lowest results, indicating difficulties in understanding more complex numerical concepts. These findings suggest the need for more innovative and inquiry-based learning strategies to improve children's numeracy skills. The research recommendations emphasize the importance of strengthening activity-based learning methods, using interactive teaching aids, and increasing the involvement of teachers and parents in supporting early numeracy skills.

Kata Kunci: Literasi Numerasi; Anak Usia Dini; Kesiapan Sekolah;

Abstrak

Kemampuan numerasi yang rendah pada anak usia dini memiliki dampak terhadap kesiapan sekolah dasar. Anak akan kesulitan menghadapi tantangan dalam pelajaran matematika, pemecahan masalah, mata pelajaran lain, aktivitas sehari-hari, kepercayaan diri, motivasi belajar, dan interaksi sosial. Penelitian ini bertujuan untuk menganalisis tingkat kemampuan numerasi anak usia 5-6 tahun di Karisidenan Surakarta dan mengidentifikasi aspek numerasi yang masih rendah sehingga dapat menjadi rujukan dalam memberikan stimulasi yang tepat. Metode penelitian menggunakan survei. Teknik pengumpulan data melalui angket penilaian numerasi dan divalidasi isi oleh expert judgment. Teknik sampling menggunakan random sampling dengan memilih secara random dua TK disetiap kabupaten/kota yang ada di Karisidenan Surakarta sehingga diperoleh 386 responden anak usia 5-6 tahun. Data dianalisis menggunakan statistik deskriptif. Hasil penelitian menunjukkan bahwa 13,2% anak memiliki kemampuan numerasi tinggi, 67,9% berada pada kategori sedang, dan 18,9% berada pada kategori rendah. Dari lima aspek numerasi yang diukur (bilangan, geometri, pengukuran, perhitungan, dan analisis data), ditemukan bahwa aspek bilangan paling dikuasai oleh anak. Aspek geometri, pengukuran, dan perhitungan berada dalam kategori cukup baik. Aspek analisis data menunjukkan hasil paling rendah, yang mengindikasikan adanya kesulitan dalam memahami konsep numerasi yang lebih kompleks. Temuan ini mengindikasikan perlunya strategi pembelajaran yang lebih inovatif dan berbasis eksplorasi untuk meningkatkan kemampuan numerasi anak. Rekomendasi penelitian menekankan pentingnya penguatan metode pembelajaran berbasis aktivitas, penggunaan alat peraga interaktif, serta peningkatan keterlibatan guru dan orang tua dalam mendukung literasi numerasi sejak dini.

Received : 14 November 2024; Revised: 13 January 2025; Accepted: 4 February 2025

http://doi.org/10.19105/15886

1. Introduction

The Central Bureau of Statistics (2020) said that the 2018 Early Childhood Development Index (ECDI) data analysis showed the results of children's physical ability achievement of 97.8%, learning ability of 95.2%, social emotional ability of 69.9%, and numeracy literacy of 64%. ECDI data shows that children's ability to read and count is still low compared to other abilities. PISA 2022 results show that Indonesian children's mathematics ability is 18.35%, this data is far below the average Organisation for Economic Co-operation and Development (OECD) which reaches 68.91% (Kemdikbud, 2023). The results showed that the numeracy literacy skills of children aged 5-6 years only reached 25.46% (Aliyah & Nurajizah, 2025), and the ability to count, classify, distinguish the quantity of objects, and calculation operations was still low (Yusra, Kurnia, & Nurlita, 2023). Data in the field shows that children's abilities are still on basic concepts in number, geometry, algebra, and simple calculations but when applying in solving math problems in everyday life children still have difficulty, for example, children have number skills but when children use money they are unable to use the concept of buying and selling. This shows that children's numeracy skills are still very low.

Numeracy skills are one of the important aspects of early childhood cognitive development that plays a role in children's readiness to enter primary school. Numeracy skills in early childhood emphasize the various skills that must be possessed, namely: (1) children's ability to use numbers and symbols related to basic mathematics for practical problem solving in everyday life; and (2) children's ability to analyze data in the form of graphs, charts, tables and use the interpretation of analysis results to make hypotheses and decisions. Numeracy skills are very important for children to master to prepare themselves as global citizens who face the challenges of 21st century competencies. The urgency of numeracy skills for early childhood aims to stimulate children to think rationally, systematically and critically in solving and making decisions in various contexts, especially related to numbers. Numeracy skills in early childhood are one of the academic readiness that must be prepared during the transition of children to elementary school. Children's numeracy skills include aspects of number, geometry, measurement, and calculation, data and data analysis. Children who have numeracy skills will find it easier to follow math learning in elementary school

Mathematics learning has been a difficult thing for students to learn and understand. This is reinforced by the research of Prof. Widodo (Professor of Mathematics, Gajah Mada University) in 2010 which explains the factors that cause mathematics to be considered difficult, namely: (1) mathematics books published in Indonesia do not present many problems in the form of context, so that mathematics feels abstract to learn; (2) 11.35% of mathematics teachers do not have qualified teaching competencies, so they are unable to answer students' critical questions; (3) the mindset that is instilled from an early age that math is difficult (Fianto, 2018). The problem faced by students is not only the mindset that instills a difficult math mindset and the ability of

children but the ability or competence of teachers in teaching mathematics is still low. Mathematics learning is not only given at formal schools such as elementary school (SD), junior high school (SMP), and senior high school (SMA) levels but in early childhood mathematics learning is also given to stimulate children's cognitive development in the form of logical thinking, symbolic thinking, and problem solving. Factors that influence early childhood literacy skills include genetic factors, the environment, the role of parents and learning activities (Hidayah, Sutarto, & Aeni, 2023; Tamara, Elnawati, & Zultiar, 2024; Saputri, Fauzi, & Nurhidah, 2017). In early childhood, math learning is closely related to media, methods, strategies, and the role of teachers in learning math.

The purpose of learning mathematics in early childhood is carried out to provide knowledge of mathematical concepts and skills to apply mathematical concepts to everyday life. Mathematics learning is important to be given since early childhood with the aim of stimulating children's cognitive development, providing an understanding of space and time, developing creativity, carrying out activities through abstraction, appreciation and high accuracy, as well as adjusting and involving themselves in social life which requires numeracy skills. Children's ability to relate to math concepts and use them in everyday life is called ability.

Aunio & Rasanen (2015) explain that the mathematics learning model in young children should include symbolic numbers using numbers or words and non-symbolic numbers using objects or visual patterns (Dahaene, 2011), understanding mathematical relationships, counting skills, and basic arithmetic skills where this learning model can stimulate children's numerical skills and help teachers organize comprehensive learning. Numeracy skills in early childhood are related to basic problem solving abilities, knowledge, skills, behaviors, and tendencies that a person needs to be able to use mathematics in various situations in everyday life (Wardhani, et. al., 2021).

Children's numeracy skills include patterning, seriation, comparison, calculation and symbolic number knowledgeHirsch, Lambert, Coppens, & Moeller, 2018), number, geometry, measurement, data analysis(Kemdikbud, 2018), superlative language (Charlesworth, 2005). In the 21st century literacy skills are linked to problem solving skills. Children can use number symbols related to basic mathematics to solve problems in everyday life, analyze information displayed in the form of data (graphs, tables, charts, diagrams, etc.) and then interpret it to predict and make decisions (Rachmawati, 2023) . Purpura & Lonigan (2015) explain that early childhood numeracy is related to verbal intelligence, phonological ability, processing speed, working memory and indirectly related to children's non-verbal intelligence. Smith & Price (2012) that there are important keys in recognizing the concept of measurement, namely (1) understanding the concept of size using descriptive language; (2) comparing the concept of size with comparative language; (3) ranking objects according to size using superlative language, such as highest, lowest, most, least and others; 4) using real measuring instruments. Seefeldt & Wasik (2008) explain

DOI: 10.19105/*kiddo.v5i1.15886* **Kiddo: Jurnal Pendidikan Islam Anak Usia Dini**; Vol. 6 No. 1, 2025

that early childhood geometry concepts start from identifying shapes and investigating buildings, as well as separating images.

Mastery of literacy and numeracy in children from an early age provides benefits in building children's independence and confidence in dealing with various problems in daily life with critical analysis (Sadriani, Arifin, & Ruslan, 2023), and helps children understand and use mathematical concepts in everyday life (Chasanah, Faradiba, & Ilmi, 2023). Literacy skills are not only mastering related to basic mathematical concepts academically but rather using basic mathematical concepts to solve everyday problems, such as managing finances, making decisions using data, and critically analyzing information.

The literacy and numeracy skills of school-age children are influenced by the communication needs of the pre-school years, so that academically the basic skills of reading, comprehension, and basic math skills of children are better prepared when entering primary school(Mcleod, Harrison, & Wang, 2019). Children's literacy and numeracy skills are important in preparing children academically to enter primary school, because these two skills will be interrelated. Children's future numeracy skills are supported by early language and literacy(Hornburg, King, Westerberg, Schmitt, & Purpura, 2024). Children who have a richer vocabulary will tend to show better numeracy comprehension, as language skills help children understand numeracy conceptsNovita, Anindhita, & Wijayanti., et. al., 2024). The literacy and numeracy achievements of each child will vary. Children's literacy and numeracy inequalities are influenced by socioeconomic factors, geography, parental education and gender(Urwick, 2022). Differences in literacy and numeracy skills are also influenced by gender where girls will excel in literacy, while boys excel in numeracy (Borgonovi, Choi, & Paccagnella, 2021; Tazouti et. Al., 2024).

Numeracy skills are very important to be stimulated in early childhood so as to prepare children academically for primary school. Children who already have numeracy readiness are expected to be able to follow learning in elementary school. Various stimulations through learning will be a way to improve children's numeracy skills. Appropriate support and interventions from the education system such as literacy and numeracy support programs will help reduce academic gaps and improve children's future opportunities(Bell, et. al., 2023). The quality of preschool education plays an important role in supporting children's literacy and numeracy development with active learning and activities that stimulate children's cognitive development so that it has an impact on children's academic development (Chan & Rao, 2023), while the lack of direct physical learning involvement can hinder basic cognitive skills, especially literacy and numeracy skills (Lynch, Lee, & Loeb., 2023).

Cooperation from various parties is an important key in strengthening children's numeracy skills, including families, schools and communities. All parties must be integrated in strengthening children's literacy skills as an early stage of academic preparation for entering primary school. The role of parents in using decontextualized language in the preschool period makes children have better literacy and

numeracy skills in elementary school(Conoca, Nixon, & Quigley., 2023).Children who have numeracy skills will be better prepared to receive material in elementary school.

Sabrina et. al, (Nughraha & Muntazhimah, 2024) identified that there is a very low initial numeracy ability of children aged 3-5 years, so the urgency of introducing the concept of numeracy literacy in early childhood is quite large(Rahmadeni, 2022). The low early numeracy skills of early childhood are caused by the understanding of people who think numeracy only studies related to numbers and counting operations, so that in early childhood learning has not applied the concept of numeracy meaningfully in everyday life. Government policies related to the prohibition of teaching reading, writing and counting in early childhood reinforce teachers' understanding that teaching basic math concepts is not important. Meanwhile, in primary school children must be ready for academic learning. This results in a lack of integration of school readiness transitions in Early Childhood Education and Primary School so that children experience many difficulties at the beginning of Primary School. The dimensions of school readiness include: (1) academic dimensions in the form of academic knowledge and cognitive abilities of children; (2) dimensions of physical well-being and motor development; (3) dimensions of social-emotional maturity; and (4) dimensions of communication skills (Rahmawati, Tairas, & Nawangsari, 2018). One of the components of the academic dimension in cognitive development that must be prepared from an early age in facing elementary school is children's numeracy skills. The purpose of the study was to conduct an initial assessment in identifying the numeracy skills of children aged 5-6 years, so as to provide appropriate stimulation.

2. Method

This study aims to determine the numeracy literacy skills of children aged 5-6 years as one of the components to prepare children for the transition to elementary school. The research was conducted in the Surakarta karisidenan which consists of 6 districts (Boyolali, Sragen, Karanganyar, Sukoharjo, Wonogiri, and Klaten) and 1 city (Solo). The research approach used quantitative with survey method. The population was children aged 5-6 years who attended kindergarten in the Surakarta Prefecture, with a sample size of 386 children. The sampling technique used random sampling by randomly selecting two kindergartens in each district or city in the Surakarta Prefecture (Solo Raya). The data collection technique used a questionnaire of numeracy skills of children aged 5-6 years using a rating scale of 0 (not appearing) and 1 (appearing). The data validity test uses content validity by expert judgment by using checking the instrument using several theories by early childhood mathematicians. Data analysis uses descriptive statistics by presenting in frequency tables related to the interpretation of research data.

DOI: 10.19105/*kiddo.v5i1.15886* **Kiddo: Jurnal Pendidikan Islam Anak Usia Dini**; Vol. 6 No. 1, 2025

Table 1: Numeracy Ability Instrument for 5-6 Year Old Children

Variables	Component	Indicator
Numeracy Literacy	Numbers	1. Calling out number symbols
		2. Numbers objects/pictures
		3. Writing number symbols
		4. Comparing two different groups of numbers
		5. Sorting groups of numbers
	Geometry	1. List the characteristics of geometric shapes (flat and space shapes)
		2. Recognize the names of geometric shapes (flat and spatial shapes)
		3. Differentiate between flat and spatial shapes
	Measurement	1. Knowing standard units by using measuring instruments (scales, ruler, meter, clock, etc.)
		2. Recognize non-building units by using nonstandard measuring instruments (inch, step, etc.)
		3. List various kinds of measurements (length, area, weight, time)
		4. Distinguish two different sizes (long-short, heavy-light,
	Data Analysis	1. Observe differences and similarities in groups
		2. Classify based on characteristics/type/shape/size
		3. Sort size (length, weight, area)
		4. Data collection by observing
		5. Create simple tables/graphs
		6. Distinguish, measure, explain the graph table made
	Calculation Operation	1. Perform simple subtraction using objects/pictures/symbols
		2. Perform simple addition using objects/pictures/symbols
		3. Perform simple division using objects
		4. Perform simple multiplication using objects

3. Result and Discussion

Data on Numeracy Skills of 5-6 Year Old Children

Data on the numeracy skills of children aged 5-6 years were obtained using an assessment questionnaire. The questionnaire for the numeracy skills of children aged 5-6 years consisted of 22 indicator items with 386 respondents.

Table 2: Frequency Distribution of Numeracy Skills of 5-6 Year Old Children

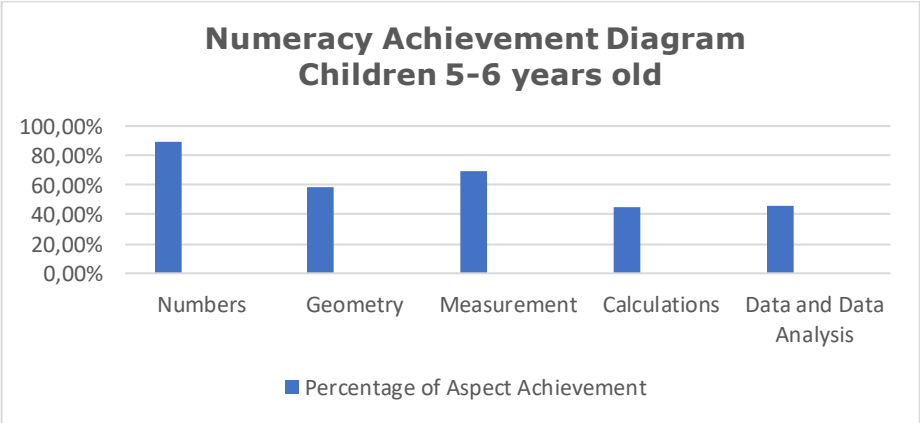
N	Valid	386
	Missing	0
Mean		13.53
Median		14.00
Std. Deviation		4.074
Range		20
Minimum		2
Maximum		22

The data in Table 1 shows that the average value of the achievement of indicator items that children's numeracy skills in six districts and 1 city of the Surakarta Karisidenan area (Solo Raya) is 13.53 while the lowest value achievement of 22 measurable indicator items is 0.3% and the maximum value achievement is 0.8%. The distribution of the data explains that the distribution of numeracy data the smaller the number of item scores obtained by children and the higher the number of item scores obtained by children, the fewer the number of frequencies will be

Table 3. Categorization of Numeracy Ability of 5-6 Year Old Children

No.	Category	Score	Total	Percentage
1.	High	X ≥ 17,59	51	13,2%
2.	Medium	9,44 ≤ X < 17,59	262	67,9%
3.	Low	X < 9,44	73	18,9%

The results of research from 386 respondents of children aged 5-6 years in the Surakarta Karisidenan (Solo Raya) showed that children's numeracy skills reached 13.2% in the high category, 67.9% in the medium category, and 18.9% in the low category. The data shows that children have fairly good numeracy skills but still need to be improved. Out of 386 respondents, 18.9% of children's numeracy skills are still low, indicating that there are still quite a number of children who are not cognitively prepared for elementary school.



Fg. 1 Diagram of the achievement of numeracy skills of children aged 5-6 years in terms of Numbers, Geometry, Measurement, Calculation, Data Analysis

DOI: 10.19105/*kiddo.v5i1.15886* **Kiddo: Jurnal Pendidikan Islam Anak Usia Dini**; Vol. 6 No. 1, 2025

Data on children's numeracy skills above are reviewed from the aspects of number, geometry, measurement, data and data analysis, and calculation. The data shows the achievement of the number aspect is 88.9%. This data shows that children's mastery of numbers is good. Children's numeracy skills related to number concepts include: (1) understanding the concept of number, (2) understanding number symbols, (3) counting, and (4) sorting and comparing numbers. Children's ability to understand numbers well. Number-related skills are the most basic and main skills that children must master, because numbers are integrated with other aspects of numeracy.

The achievement of geometry aspects in the data shows 58.8%. Children's numeracy skills related to geometry include: (1) mentioning the names and characteristics of spatial and flat shapes; (2) identifying and distinguishing spatial and flat shapes based on their characteristics; and (3) using flat and spatial shapes in play activities. Children's abilities related to geometry aspects are quite good. The data shows that children have knowledge related to geometry but still on primary flat shapes such as triangles, quadrilaterals, rectangles, and circles. As for spatial shapes, they are still limited to blocks so that children have limitations in using various flat and spatial shapes in daily activities.

Children's numeracy skills related to the measurement aspect reached 69.6%. Indicators of measurement aspects in children include: (1) recognize standard and non-standard units of measure; (2) mention various sizes; (3) use standard and non-standard measuring instruments; and (4) distinguish, sort, and compare sizes. The data shows that children's abilities related to the measurement aspect are quite good. Children understand various sizes, differentiate, sort and compare. However, children's ability to understand and use standard and nonstandard measuring instruments is still low. Children also do not understand measurement units such as meters, centimeters, kilograms, kilometers, liters, etc.

Children's numeracy skills related to the calculation aspect reached 44.8%. Indicators related to aspects of simple calculation in children aged 5-6 years, include: (1) identify various symbols of calculation operations; (2) perform simple addition; (3) perform subtraction; (4) perform simple multiplication; and (5) perform simple division. Children's ability related to the calculation aspect is quite good on the concept of understanding the symbols of calculation operations as well as the concept of simple addition and subtraction, but still low on the concept of multiplication and division.

Children's numeracy ability related to data and analysis aspects is 45.7%. The achievement of data and data analysis aspects in children includes: (1) collecting data through observing, classifying, sorting, and comparing; (2) presenting data in the form of tables, graphics, diagrams, etc.; and (3) presenting hypotheses or conclusions from the data obtained. Children's abilities related to data and data analysis aspects are very low. The ability shown by children is still in

the activity of collecting data, but not yet presenting data or making hypotheses or drawing conclusions.

Analysis of Numeracy Skills in Readiness for Primary School Transition

The research data shows that children's numeracy skills are not good enough as a basic ability to master more complicated numeracy skills. The data also shows that the calculation and data analysis aspects are still quite low. Children aged 5-6 years already have the ability to recognize numbers and use them in simple addition and subtraction operations. This shows that children's numeracy skills develop from informal numeracy, numeracy knowledge, and formal numeracy, so that when children enter the early age of elementary school their numeracy skills develop to the numeracy knowledge stage (Sudarti, 2022) and will develop to abstract concepts (Sarama & Clements, 2009). Early numeracy skills are a predictor of children's academic success in mathematics at later levels of education. Children with strong basic numerical skills experience more positive development in mathematics when entering primary school (Passolunghi, Lanfranchi, Altoe, & Sollazo, 2015). This explains that it is important for children to master basic numeracy skills well in order to help their development in learning mathematics in primary school.

Children's numeracy skills, which reached 67.9% still in the medium group and 18.9% in the low group, showed that one of the dimensions of children's cognitive readiness was not maximally prepared for school readiness to the elementary school level. Children are still at basic numeracy skills and children still have difficulty in conceptual understanding. It can be seen that children's achievement related to numbers is better than data and data analysis. Basic numeracy skills include number recognition and simple operations in early childhood using a more formal approach while formal numeracy skills in early childhood have deeper conceptual understanding over time for more complex numeracy development (Aunio, Korhonen, Bashash, & Khoshbakht, 2014). Numeracy skills in early childhood are not just mastering numbers and calculation operations but children must be given conceptual understanding related to numeracy so that children will have skills in using numeracy concepts in the development of academic achievement in elementary school.

Low basic numeracy skills in children will have an impact on further numeracy skills, especially at the abstract concept stage, one of which is learning math at the next level of education. This shows that children's numeracy skills at an early age are the basis for developing numeracy skills in elementary school and will even help children to understand math learning. Literacy and numeracy skills at an early age have a significant impact on children's future mathematical abilities, so educational interventions that focus on developing basic skills can support children's mathematical achievement (Dzumhur, Seva, & Rozman, 2019). Early numeracy skills are the beginning of a child's ability to understand early math concepts in primary school and are integrated with other skills, so they must be developed with appropriate learning activities.

The development of literacy skills supports early childhood numeracy development, so a holistic approach is needed by integrating literacy and numeracy as two basic skills that support each other (Cui, & Zhou., 2024). Stimulation activities to improve early childhood numeracy should be through fun activities, as the combination of structured numeracy practices and play activities that support the understanding of mathematical concepts naturally can be an effective approach for numeracy development in early childhood (Aunio, Aubrey, Godfre., Pan, & Liu, 2008). The use of multiple representations in numeracy teaching in preschool strengthens the understanding of the basic concept of "more or less", thus supporting early cognitive and numeracy skills, building a strong foundation of higher mathematical thinking, and increasing children's interest and engagement in numeracy learning (Bautista, Habib, Ong, Eng, & Bull., 2019).

Multilingual environments can support children's all-round development, maximize the potential of literacy and numeracy integration, and balance the importance of literacy and numeracy in classroom learning (Graven & Jorgensen, 2024). Learning numeracy in a more fun and innovative way by paying attention to pedagogical principles that are in accordance with early childhood development can improve children's numeracy skills(Tazouti, et. al., 2024). Strengthening early childhood numeracy skills must consider various learning programs, learning environments, and the role of teachers, all of which are integrated with early childhood literacy skills. Children who learn numeracy concepts in a fun way will strengthen their numeracy skills. Strengthening numeracy skills in early childhood helps prepare children academically for primary school. School readiness in early childhood includes various skills that children must master. Children who are school-ready have skills in areas such as early math, early literacy, self-regulation, social-emotional regulation, and motor skills (ÇOBAN et al., 2023; Lonigan et al., 2015; McClelland et al., 2019; Marti et al., 2018; Walker & MacPhee, 2011)

Numeracy skills are one of the important skills for children to have before entering elementary school. Early childhood numeracy skills are closely related to cognitive development, especially in problem solving, critical thinking, and decision making (Kilpartrick, Sawafford, & Findel, 2011; National Council of Teachers of Mathematics, 2000). Children who have numeracy skills will be better prepared to learn mathematics in elementary school (National Council of Teachers of Mathematics, 2001) because children will be better prepared to understand more complex mathematical concepts in elementary school (Jordan, Kaplan, Olah, & Locuniak, 2006) so that it can support children's academic achievement (Ducan et.al., 2007). Early childhood that already has basic numeracy skills such as number concepts, geometry, measurement, calculation, and data analysis will be easier in solving math problems and solving math problems in everyday life. Children's school readiness is determined from non-academic aspects such as social skills, discipline, independence, emotional regulation, while academic aspects include reading, counting, writing, and physical readiness. Good numeracy skills in early childhood contribute significantly to children's readiness to enter

primary school, as children who have a strong numeracy foundation tend to adapt more easily to the mathematics curriculum in primary school and show better academic performance.

4. Conclusion

Based on the results of a study of 386 respondents aged 5-6 years in Solo Raya, it was found that children's numeracy skills were mostly in the medium category (67.9%), with 13.2% in the high category and 18.9% in the low category. Children's numeracy skills were measured through five main aspects, namely number, geometry, measurement, calculation, and data and data analysis. The results of the analysis, the number aspect was best mastered by the children, while the geometry, measurement, and calculation aspects were also quite good although there were some weaknesses in certain items. However, the data analysis aspect has the lowest score, indicating that children still have difficulty in understanding the concept of data analysis.

The research findings show that although the majority of children have good numeracy skills in basic concepts, there are still weaknesses in certain aspects, especially in the aspect of data analysis, which require more attention in the learning process. Therefore, interventions are needed in numeracy learning strategies, both in exploration-based teaching methods, interactive media development, as well as training for teachers and parents in understanding numeracy literacy so that children are better prepared to face academic challenges at the next level of education. To be able to stimulate numeracy skills better, we must understand the factors that cause low numeracy skills in children, so that we can provide appropriate stimulation. In addition, policy support related to curriculum development, teaching materials, learning programs, and the involvement of parents and communities must be integrated with the concept of early childhood numeracy literacy so that children will develop numeracy skills optimally.

5. Acknowledgements

Thanks to Sebelas Maret University for providing the research grant; the entire Child Development and Education research group team for their cooperation in carrying out the research; research assistants who have helped collect data; schools, teachers, and children who have been involved in this study.

References

Aliyah, S., & Nurajizah, N. (2025). Peningkatan Kemampuan Literasi Numerasi Anak Usia 5-6 Tahun Menggunakan Media Loose Part Di Raudhatul Athfal Al Barokah Kecamatan Garut Kota. *Jurnal Pendidikan Islam Anak Usia Dini, 3*(2). 48-57. https://doi.org/10.37968/anaking.v3i2.755

Aunio, P., & Rasanen, P. (2015). Core numerical skills for learning mathematics in children aged five to eight years – a working model for educators. *European Early Childhood Education*

Research Journal, 24(05), 684-704. https://doi.org/10.1080/1350293X.2014.996424

Aunio, P., Aubrey, C., Godfrey, R., Pan, Y., & Liu, Y. (2008). Children's early numeracy in England, Finland and People's Republic of China. *International Journal of Early Years Education,* 16(3), 203-221. https://doi.org/10.1080/09669760802343881

Aunio, P., Korhonen, J., Bashash, L., & Khoshbakht, F. (2014). Children's early numeracy in Finland and Iran. *International Journal of Early Years Education*, 22(4), 423-440. https://doi.org/10.1080/09669760.2014.988208

Badan Pusat Statistik. (2020). *Analisis Perkembangan Anak Usia Dini Indonesia 2018: Integrasi Susenas dan Riskesdas 2018*. Jakarta: BPS.

Bautista, A., Habib, M., Ong, R., Eng, A., & Bull, R. (2019). Multiple Representations in Preschool Numeracy: Teaching a Lesson on More-or-Less. *Asia- Pasific Journal of Research*, 13 (2), 95-122. https://doi.org/10.17206/apjrece.2019.13.2.95

Bell, M. F., Segal, L., Dennison, S., Kinner, A. S., Dawe, S., Spittal, M. J., & Preen, D. B. (2023). Numeracy and literacy attainment of children exposed to maternal incarceration and other adversities: A linked data study. *Journal of School Psychology, 100,* 101241 https://doi.org/10.1016/j.jsp.2023.101241

Borgonovi, F., Choi, A., & Paccagnella, M. (2021). The evolution of gender gaps in numeracy and literacy between childhood and young adulthood. *Economics of Education Review*. 82(C), 102119. https://doi.org/10.1016/j.econedurev.2021.102119

Chan, Y. Y., & Rao, N. (2023). Home and Preschool Influencces on Early Literacy and Numeracy Development i England, Estonia, and the United States. *Europan Early Childhood Education Research*, 32(3), 399-415. https://doi.org/10.1080/1350293X.2023.2257913

Charlesworth, Rosalind. (2005). *Experirnces in Math for Young Children*. United State: Thomson.

Chasanah, A., Faradiba, S. S., & Ilmi, Y. I. (2023). Deskripsi Kemampuan Numerasi Siswa Pada Materi Trigonometri Ditinjau dari Pengetahuan Metakognitif. *Jurnal Penelitian, Pendidikan, dan Pembelajaran,* 18(24), 1-9.

ÇOBAN, A.,YILDIZ, E., ASLAN, H. S., ÖĞÜTCEN, A., KOCA, O., & KAYNAR, F. (2023). Effectiveness of School Readiness Programs for Preschool Children: A Meta-Analysis Study. Educational Policy Analysis and Strategic Research, 18(3), 50-77. https://doi.org/10.29329/epasr.2023.600.3

Conica, M., Nixon, E., & Quigley, J. (2023). Talk outside the box: Parents' decontextualized language during preschool years relates to child numeracy and literacy skills in middle childhood. *Journal of Experimental Child Psychology, 236,* 105746. https://doi.org/10.1016/j.jecp.2023.105746

Cui, Z., Cui, W., Cui, J., & Zhou, X. (2024). Literacy Rather than Non-verbal Number Sense Predicts Kindergarteners' Numerical Abilities. *Journal of Child and Family Studies*, 33, 822-834. https://doi.org/10.1007/s10826-023-02723-9

Ducan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., & Japel, C. (2007). School Readiness and Later Achievement. Developmental Psychology, 43(6), 1428-1446.

Dzumhur, Z., Seva, N., & Rozman, M. (2019). Early Literacy and Numeracy Competencies: Predictors of Mathematics Achievement in the Dinaric Region. *IEA Research for Education*, 101-122.

Fianto,F. (2018). *Seri Manual GLS Literasi Numerasi dalam Pengembangan Klub Steam dan Wirausaha di Sekolah.* Jakarta: Direktorat Jenderal Pendidikan Dasar dan Menengah Kementerian Pendidikan dan Kebudayaan.

Graven, M., & Jorgensen, R. (2024). Early numeracy opportunities through number stories with marginalised families. *ZDM – Mathematics Education*, 56, 319-333. https://doi.org/10.1007/s11858-023-01537-9

Hidayah, Stutarto, J., & Aeni, K. (2023). Pembelajaran Literasi Numerasi Anak Usia Dini Barbasis Kemitraan Keluarga di PAUD. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 4431- 4440. https://doi.org/10.31004/obsesi.v7i4.4692

Hirsch, S., Lambert, K., Coppens, K., & Moeller, K. (2018). Basic numerical competences in large-scale assessment data: Structure and long-term relevance. *Journal of Experimental Child Psychology*, 167, 32-48. https://doi.org/10.1016/j.jecp.2017.09.015

Hornburg, C. B., King, Y. A., Westerberg, L., Schmitt, S. A., & Purpura, D. J. (2024). The roles of mathematical language and emergent literacy skills in the longitudinal prediction of specific early numeracy skills. *Journal of Experimental Child Psychology*. 244, 105959. https://doi.org/10.1016/j.jecp.2024.105959

Jordan, N. C., Kaplan, D., Olah, L. N., & Locuniak, M. N. (2006). Number sense growth in kindergarten: A longitudinal study. Child Development, 77(1), 159-171

Kemdikbud. (2020). *Panduan Toolkit Kesiapan Sekolah.* Jakarta: Kementerian Pendidikan dan Kebudayaan.

Kemdikbud (2023). *PISA 2022 dan Pemulihan Pembelajaran di Indonesia.*

Kilpatrick, J., Swafford, J., & Findell, B. (2001). Adding it up: Helping children understand math. National Academy Press.

Kim, H., & Connelly, J. (2019). Early Childhood Preservice Teachers' Mathematics Teaching Efficacy: Effects of Passion and Teacher Efficacy. *Asia- Pasific Journal of Pasific*, 13(1), 1-21. https://doi.org/10.17206/apjrece.2019.13.1.1

Lonigan, C. J., Phillips, B. M., Clancy, J. L., Landry, S. H., Swank, P. R., Assel, M., Taylor, H. B., Klein, A., Starkey, P., Domitrovich, C. E., Eisenberg, N., de Villiers, J., de Villiers, P., & Barnes, M. (2015). Impacts of a comprehensive school readiness curriculum for preschool children at risk for educational difficulties. Child Development, 86(6), 1773-1793. http://www.jstor.org/stable/24698576

Lynch, K., Lee, M., & Loeb, S. (2023). An investigation of Head Start preschool children's executive function, early literacy, and

numeracy learning in the midst of the COVID-19 pandemic. *Early Childhood Research Quarterly*, 64(3), 255-265. https://doi.org/10.1016/j.ecresq.2023.04.002

National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. National Council of Teachers of Mathematics.

National Research Council. (2001). Eager to learn: Educating our preschoolers. National Academy Press.

Marti, M., Melvin, S., Noble, K. G., & Dutch, H. (2018). Intervention Fidelity of Getting Ready for School: Associations with Classroom and Teacher Characteristics and Preschooler's School Readiness Skills. Early Childhood Research Quarterly, 44, 55-71. https://doi.org/10.1016/j.ecresq.2018.02.010

McClelland, M. M., Tominey, S. L., Schmitt, S. A., Hatfield, B., Purpura, D., Gonzales, C., & Tracy, A. (2019). Red Light, Purple Light! Results of an intervention to promote school readiness for children from low-income backgrounds. Frontiers in psychology, 10, 2365. https://doi.org/10.3389/fpsyg.2019.02365

Mcleod, S., Harrison, L. J., & Wang, C. (2019). A longitudinal population study of literacy and numeracy outcomes for children identified with speech, language, and communication needs in early childhood. *Early Childhood Research Quarterly*, 47, 507-517. https://doi.org/10.1016/j.ecresq.2018.07.004

Novita, S., Anindhita, V., & Wijayanti, P. A. (2024). Relationship Between Numeracy and Vocabulary Skills in Indonesian Preschool Children and the Impacts of Learning Environments. *IJEC*, 56, 297-314. https://doi.org/10.1007/s13158-023-00356-z

Nughraha, A. C., & Muntazhimah. (2024). Analisis Konten Penelitian Kemampuan Numerasi Awal pada Anak Usia Dini: Tinjauan Metodologi Penelitian. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 8(5), 1174-1184. https://doi.org/10.31004/obsesi.v8i5.6098

Passolunghi, M. C., Lanfranchi, S., Altoe, G., & Sollazo, N. (2015). Early numerical abilities and cognitive skills in kindergarten children. *Journal of Experimental Child Psychology*, 135, 25-42. https://doi.org/10.1016/j.jecp.2015.02.001

Purpura, D. J., & Lonigan, C. J. (2015). Early Numeracy Assessment: The Development of the Preschool Early Numeracy Scales. *Early Education and Development*, *36, 286-313*. https://doi.org/10.1080/10409289.2015.991084

Rachmawati. (2023). Kajian literatur: kemampuan numerasi pada perkembangan peserta didik di lingkungan sekolah. *Cakrawala Jurnal Ilmiah Bidang Sains*, *2(1) 7-13*. https://doi.org/10.28989/cakrawala.v1i2.1456

Rahmadeni, F. (2022). Urgensi Pengenalan Konsep Literasi Numerasi pada Anak Usia Dini. *Arithmetic: Academic Journal of Math*, 4(1) 79-92. https://doi.org/10.29240/ja.v4i1.4626

Rahmawati, A., Tairas, M. M., & Nawangsari, N. A. (2018). Profil Kesiapan Sekolah Anak Memasuki Sekolah Dasar. *Jurnal Pendidikan Usia Dini*, 12(2), 201-210. https://doi.org/10.21009/JPUD.122.01

Sadriani, A., Arifin, I. G., & Ruslan, Z. A. (2023). Peningkatan Literasi dan Numerasi Siswa Melalui Program Pojok Baca di SD Negeri Pampang. *Ininnawa: Jurnal Pengabdian Masyarakat*, 1(1), 30-36. https://doi.org/10.26858/ininnawa.v1i1.126

Saputri, K., Fauzi, & Nurhidah. (2017). Faktor-Faktor yang Mempengaruhi Literasi Anak Kelas 1 SD Negeri 20 Banda Aceh. *Jurnal Pendidikan Guru Sekolah Dasar*, 2(1), 98-104.

Sarama, J., & Clements, H. D. (2009). *Early Childhood Mathematics Education Research: Learning Trajectories for Young Children.* New York: Routledge.

Seefeldt, C., & Wasik, B. A. (2008). *Pendidikan Anak Usia Dini Menyiapkan Anak Usia Tiga , Empat, dan Lima Tahun Masuk Sekolah Dasar(Alih Bahasa: Pius Nasar).* Jakarta: PT Indeks.

Sudarti, S. (2022). Penerapan Pembelajaran Literasi Numerasi pada Anak Usia Dini. *Pembelajaran Kolaboratif Matematika Berbasis Lesson Study di SMP: Mewujudkan Siswa Mandiri dan Bermartabat, Sutama*, 130-139.

Tamara, P. R., Elnawati, E., & Zultiar, I. (2024). Peningkatan Kemampuan Literasi dan Numerasi Pada Anak Usia 5-6 Tahun Melalui Media Papan Terawang Di Tk Nurul Amanah Cianjur. *Cendikia: Jurnal Pendidikan dan Pengajaran, 2*(10), 437-446.

Tazouti, Y., Thomas, A., Hoareau, L., Jariegan, A., Hubert, B., & Luxembourger, C. (2024). Assessment of an educational classroom app's impact on preschoolers' early numeracy skills. *European Journal of Psychology of Education*, 39, 1-27. https://doi.org/10.1007/s10212-023-00698-1

Urwick, J. (2022). Dimensions of inequality in children's literacy and numeracy in Uganda: Evidence from a household-based assessment. *International Journal of Educational Development*, 88, *102525*. https://doi.org/10.1016/j.ijedudev.2021.102525

Walker, A. K., & MacPhee, D. (2011). How home gets to school: Parental control strategies predict children's school readiness. Early Childhood Research Quarterly, 26(3), 355-364. https://doi.org/10.1016/j.ecresq.2011.02.001

Wardhani, B., Adi, E. S., Rengganis, N., FR, L. M., Pratiwi, W. C., & Wulandari, R. (2021). *Buku Saku Pengembangan Numerasi untuk Anak Usia 5-6 Tahun.* Jakarta: Unicef.

Yusra, R. A., Kurnia, R., & Nurlita. (2023). Analisis Kemampuan Literasi Numerasi Anak Usia 5-6 Tahun di TK Melayu Fathrizk Kids, Kota Baru. *Innovative: Journal of Social Science Research, 3*(5), 5949-5958.