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THE ROLE OF HOME NUMERACY ENGAGEMENT, FINE MOTOR SKILLS AND CLASSROOM CONVERSATIONAL MATH EXPOSURE ROUTINES IN DEVELOPING KINDERGARTNERS' NUMERACY SKILLS

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ABSTRACT

Early numeracy development is a joint responsibility between home and school, where purposeful engagement and classroom routines build fundamental mathematical thinking. Fine motor skills further enable children to manipulate concrete objects, a critical step toward abstract learning. However, current research often examines home numeracy, fine motor skills, and classroom routines separately, leaving their combined influence underexplored. This study investigated the influence of home numeracy engagement, fine motor skills, and classroom conversational math routines on the numeracy skills of 90 kindergartners in a private Christian school in Cagayan de Oro City during the 2025–2026 school year. The findings revealed that parents maintain a high level of numeracy engagement at home, predominantly through play-based activities such as practicing telling time and using play money, while teachers assessed the learners as having a high level of fine motor proficiency, specifically in manipulating objects and using writing tools. Furthermore, the extent of classroom conversational math exposure was found to be high, with teachers frequently integrating routines like skip counting by tens and mental math problems, although conceptual discussions involving number lines were rarely emphasized. The Canonical Correlation Analysis (CCA) revealed that Home Numeracy Engagement Practices are the only significant predictor of children's numeracy skills. In contrast, Fine Motor Skills and Classroom Conversational Math Exposure Routines showed no significant association with numeracy outcomes. These results suggest that for this sample, mathematical proficiency is primarily driven by intentional home-based interactions rather than physical dexterity or generalized classroom dialogue. Future researchers should conduct studies across different diverse school setting to discover

why home engagement remains the key driver of numeracy compared to fine motor skills and classroom math routines.

Keywords: *Home Numeracy Engagement, Fine Motor Skills, Classroom Conversational Math, Numeracy Skills, Kindergarten Education*

INTRODUCTION

Before children enter formal schooling, their earliest academic and social foundations are shaped within the home environment. Meaningful home engagement, especially in numeracy-related activities, creates everyday opportunities for exploration, interaction, and guided learning that strengthen early mathematical thinking. Studies have shown that activities such as counting, sorting, patterning, and measuring significantly shape children's developing cognitive and numeracy abilities (Elliott & Bachman, 2021; Lysenko et al., 2022). These experiences foster number sense as well as curiosity, persistence, and the motivation to engage with learning (Van Voorhis et al., 2021)

However, despite the strong influence of the home environment, many parents struggle to provide meaningful numeracy experiences due to limited confidence, lack of guidance, or misconceptions about what constitutes developmentally appropriate learning. This gap between parental influence and parental readiness remains a persistent concern, particularly in communities with limited educational resources. As a result, children's early numeracy development may be compromised even before they enter kindergarten, emphasizing the need for deeper understanding of how families support mathematical learning at home.

Motor development adds another layer to early numeracy learning. Fine motor skills, particularly fine motor integration, are closely linked to cognitive growth and play an important role in tasks requiring manipulation, sequencing, spatial reasoning, and symbolic interpretation (Escolano-Pérez et al., 2020). These skills enable children to handle manipulatives, follow visual–motor sequences, and engage in hands-on activities that deepen their mathematical understanding. Kindergarten classrooms rely heavily on manipulatives for this reason, as they help children move from concrete experiences toward more abstract concepts (Ozkur, 2020; Muhammad et al., 2023).

Classroom conversational math routines allow children develop numeracy skills through daily repeated interactions between teacher and young children that discuss math idea through talk, questions and sharing thoughts during the activities. Also, number sense in early education is crucial and should be developmentally nurture at first place. In order to develop numeracy skills such as number sense conversational math routines must employ and practice daily in the classroom. According to Banks, (2024) an interactive dialogue that focus on mathematical concepts such as reasoning and problem solving is called math talk which involves articulating thoughts, listening skills and participating in meaningful discussions. Through these routines children able to explore and widen their numeracy skills by practicing it daily.

Although studies like Dogbey (2025) and Libertus et al. (2025) support the importance of math talk routines in developing number sense, the diverse settings like the Philippines remains a gap. Research focuses only in Western context not in local teacher training, culture and resources which is necessary for adaptation and sustaining the routines in the classroom.

Research Objectives

This study aimed to:

1. Assess parents' numeracy engagement practice at home.
2. Evaluate kindergartners' level of fine motor skills as assessed by their teacher.
3. Look at the extent of classroom conversational math exposure routines in fostering numeracy skills.
4. Assess the level of kindergartners numeracy skills in terms of counting and basic operation (adding and subtracting)
5. Investigate whether these three predictors associated with numeracy skills.

METHODOLOGY

Research Local

The study was conducted in four private elementary school namely Del Mar Adventist Elementary School, Cagayan de Oro Christian School, Pilgrim Christian College and Shekinah Glory Christian Academy. These school offer kindergarten curriculum where hands on learning are implemented.

Sampling Method

The participants of the study composed of ninety (90) kindergarten pupils officially enrolled at those schools during the Academic Year 2025-2026 with the age between 5 and 6 years old. The study employed a quantitative research design, specifically a Descriptive- Correlational type of research, as it sought to determine the influence of parents' home numeracy engagement practices, learners' fine motor skills and classroom math routines on the development of numeracy skills. According to McCombes (2023), descriptive research is useful when examining one or more variables as they naturally occur, allowing researchers to document patterns and relationships without introducing interventions.

Research Instrument

This study employed 4 research instruments to generate data. The questionnaires were adapted and modified based on the context in the Philippines. First, parents' home numeracy engagement were measured using the engagement questionnaire developed by Mohammadpour (2021) titled *Parents' Perspectives of Home Numeracy Practices of*

Primary School Children. Only Part 1, which focused on parents' numeracy knowledge and engagement and Home Numeracy Experiences and Children's Math Performance in the Early School Years by LeFevre (2009). Second, to assess kindergarten learners' fine motor skills, the Philippine Early Childhood Care and Development (ECCD) Checklist was used. This checklist, designed specifically for children aged 4–5 years, included 15 items that captured various fine motor competencies appropriate for this developmental stage. Third, to determine the use of classroom conversational math routines in developing number sense, the questionnaire developed by Doverspike (2025) titled The Effect of Number Sense Routines on Elementary Mathematics Achievement was adapted. Only part 1, which focused on Number Sense Routine Resource List and *Number talks: Helping children build mental math and computation strategies, grades K-5* by Parrish (2010) were used and revised for this study. Lastly, learners' numeracy skills were evaluated using the Department of Education Kindergarten Third Quarter Assessment in Mathematics. This assessment covered essential numeracy competencies such as counting, identifying missing numbers, telling time, recognizing money, and performing simple two-digit addition and subtraction.

Data gathering procedure

Before the collection of data, the ethical clearance from the Research Ethics Committee was secured. A formal request was submitted to the school principal to seek authorization to conduct the study within the kindergarten setting. Then, assent and consent letter were delivered in parents and the kindergarten pupils. The collection of data was administered during class time that took 20-30 minutes.

Statistical Techniques

To thoroughly address the research objectives from QR1 to QR4, descriptive statistic were employed which include the measure of frequency, mean, standard deviation to establish the profile of the study: Home Numeracy Engagement, Parents' Numeracy Knowledge, Fine motor skills and Classroom conversational math exposure routines. In addition, to measure the influence of numeracy engagement practices, fine motor skills and classroom routines on the participants' numeracy skills, canonical correlation analysis was used when the assumptions of were met.

RESULTS AND DISCUSSION

Table 1 displays the frequency, percentage, mean and standard deviation of parents' numeracy engagement at home. As shown in the figures, parents' assessment of their home numeracy engagement is high indicated in an overall mean of *3.08* which implies that parents engage their children in everyday math activities such as counting objects, playing number games, and discussing numbers at home, but parents involvement in home numeracy engagement is inconsistent and limited.

Table 1

Descriptive Statistics of Home Numeracy Engagement

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Extremely High	0	0.00
3.51 – 4.50	Often	Very High	8	8.89
2.51 – 3.50	Sometimes	High	72	80.00
1.51 – 2.50	Rarely	Low	10	11.11
1.00 – 1.50	Never	Very Low	0	0.00
	Total		**90**	**100**
	Mean		**3.08**	
	SD		**0.40**	
	Interpretation		**High**	

The results depict that parental involvement in early numeracy learning plays a crucial role in helping children develop foundational mathematical skills, such as counting, number recognition, and simple problem-solving. The concentration of responses within the high category indicates that many parents are aware of the importance of participating in their children's early learning experiences. Through everyday activities such as counting objects, discussing numbers, and playing number-related games, parents can help strengthen children's mathematical understanding. This was further explained by Ramani & Scalise (2020) that children perform better in numeracy when parents get engage in home numeracy practices.

Table 2

Frequency Distribution of Kindergartners' Level of Fine Motor Skills

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Extremely High	0	0.00
3.51 – 4.50	Often	Very High	12	13.33
2.51 – 3.50	Sometimes	High	58	64.44
1.51 – 2.50	Rarely	Low	20	22.22
1.00 – 1.50	Never	Very Low	0	0.00
	Total		**90**	**100**
	Mean		**2.96**	
	SD		**0.50**	
	Interpretation		**High**	

Table 2 presents the frequency, percentage, mean and standard deviation of kindergartners' fine motor skills. The computed *mean score of 2.96 with a standard deviation of 0.50* further confirms that the overall level of fine motor skills among the kindergartners is high. The mean value indicates that the children are capable of performing fine motor activities with moderate competence. The relatively small standard deviation also suggests that the responses were not widely dispersed, meaning that the pupils generally demonstrated similar levels of fine motor skill development. This was

cited by Rosalianisa et., al (2023) which examined the fine motor abilities of young children and found that most learners demonstrated comparable levels of development in basic fine motor tasks, such as manipulating objects, holding writing tools, and performing small hand movements.

Overall, the results highlight that while the general level of fine motor skills among the learners is high, continuous practice and guided classroom activities remain important for further improvement. This was supported by Putri and Aulina (2025) who explained that classroom-based interventions have shown that children's fine motor abilities improve progressively when teachers provide regular opportunities for activities that involve grasping, transferring, and manipulating objects.

Table 3

Frequency Distribution of Classroom Conversational Math Exposure Routine

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Extremely High	0	0.00
3.51 – 4.50	Often	Very High	4	44.4
2.51 – 3.50	Sometimes	High	67	74.44
1.51 – 2.50	Rarely	Low	19	21.11
1.00 – 1.50	Never	Very Low	0	0.00
	Total		**90**	**100**
	Mean		**2.91**	
	SD		**0.39**	
	Interpretation		**High**	

Table 3 presents the frequency, percentage, mean and standard deviation of classroom conversational math exposure routines. The overall mean of 2.90 with a standard deviation of 0.38 further supports the interpretation that the overall extent of classroom conversational math exposure is high. This indicates that teachers often integrate mathematical discussions, questioning, and activities during classroom instruction. Overall, the findings indicate that teachers provide moderate opportunities for pupils to engage in conversational math exposure routines, particularly through counting activities, object identification, mental computation, and the use of manipulatives. These classroom practices support the development of early numeracy skills, reasoning abilities, and mathematical communication among learners. However, the results also suggest that teachers may further strengthen these practices by increasing the frequency of activities that involve deeper mathematical explanations, reasoning, and interactive discussions. Enhancing these classroom conversational math routines can help pupils develop a stronger conceptual understanding of mathematical ideas and improve their overall numeracy skills.

Table 4

Participants' Level of Numeracy Skills in Terms of Counting Objects

Range	Description	Interpretation	Frequency	Percentage
13.00 – 15.00	Always	Outstanding	9	10.00
10.00 – 12.00	Often	Very Good	18	20.00
7.00 – 9.00	Sometimes	Good	21	23.33
4.00 – 6.00	Rarely	Fair	34	37.78
1.00 – 3.00	Never	Poor	8	8.89
	Total		**90**	**100**
	Mean		**7.50**	
	Interpretation		**Good**	
	SD		**3.51**	

Table 4 presents the frequency, percentage, mean and standard deviation of participants' level of numeracy skills in terms of counting objects. The overall *mean score of 7.50* with a standard deviation of 3.51 indicates that the participants' numeracy skills in counting objects are interpreted as good. This means that the pupils demonstrate an acceptable level of competence in counting tasks. However, the relatively high standard deviation suggests that there is noticeable variability in pupils' performance, indicating that while some children have already mastered counting skills, others still require additional support and practice.

These findings imply that most kindergarten learners have already developed basic counting abilities, which serve as an important foundation for learning more complex mathematical concepts such as addition, subtraction, and problem-solving. Counting objects helps learners develop number sense, one-to-one correspondence, and an understanding of quantity, which are essential components of early numeracy development. However, the presence of pupils in the fair and poor categories suggests that some learners may still need more guided instruction and practice to strengthen their counting skills.

Table 5 presents the frequency distribution of the participants' level of numeracy skills in terms of adding and subtracting. The overall *mean score of 5.03 with a standard deviation of 2.78* resulted in an interpretation of good, which indicates that the participants demonstrate an acceptable level of proficiency in performing basic operations such as addition and subtraction. However, the relatively high standard deviation suggests that there is considerable variation in pupils' performance, meaning that some learners have already developed stronger computational skills while others still require further guidance and practice.

Table 5

Frequency Distribution of Participants' Level of Numeracy Skills in terms of Adding and Subtracting

Range	Interpretation	Frequency	Percentage
9.00 – 10.00	Outstanding	19	21.11
7.00 – 8.00	Very Good	19	21.11
5.00 – 6.00	Good	22	24.44
3.00 – 4.00	Fair	22	24.44
1.00 – 2.00	Poor	8	8.89
Total		**90**	**100**
Mean		**5.03**	
SD		**2.78**	
Interpretation		**Good**	

These findings imply that while many kindergarten learners possess basic arithmetic skills, a significant number are still in the early stages of mastering addition and subtraction concepts. Basic operations require learners to understand number relationships, counting strategies, and the ability to manipulate quantities mentally or with the help of objects. Basic arithmetic operations require learners to understand number relationships, counting strategies, and the ability to manipulate quantities either mentally or through the use of concrete objects.

Research on early numeracy highlights that counting skills, number relations, and basic arithmetic form the foundation of mathematical learning, enabling children to solve problems using both concrete and mental strategies (Tiruneh et al., 2022). Therefore, the presence of pupils in the fair and poor categories suggests the need for more reinforcement and practice through concrete and engaging learning activities.

Table 6

Summary Table of the Participants' Level of Numeracy Skills

Numeracy Skills	Mean	SD	Interpretation
Counting Objects	7.50	3.51	Good
Basic Arithmetic	5.03	2.78	Good
Overall	**12.53**	**4.90**	**Good**

Table 6 presents the summary of the participants' level of numeracy skills in terms of counting objects and basic arithmetic. The results indicate that the pupils demonstrated a good level of numeracy skills across the two areas assessed. In terms of counting objects, the participants obtained a *mean score of 7.50 with a standard deviation of 3.51*, which is interpreted as good. This suggests that most pupils are able to count objects with reasonable accuracy and demonstrate an understanding of quantity and number relationships. However, the relatively higher standard deviation indicates that there is noticeable variation among the pupils' performances, meaning that while some learners have already mastered counting skills, others are still in the process of developing this ability.

The overall mean score of 12.53 with a standard deviation of 4.90 further confirms that the participants' general level of numeracy skills is good. This finding implies that the pupils have already acquired fundamental mathematical abilities that serve as a foundation for more advanced learning in mathematics. Counting objects and performing basic arithmetic are essential early numeracy skills that help children understand numbers, quantities, and mathematical relationships. This was supported by Tiruneh et al., (2022) which stated that counting objects and performing basic arithmetic are essential early numeracy skills that help children understand numbers, quantities, and mathematical relationships.

Table 7

Canonical Correlation Analysis Between Numeracy Skills and Home Numeracy Engagement Practices

Variable	Cross loading	R_c	R_c^2	F(2,87)	p
Home Numeracy Engagement Practices	-0.30	0.30	0.09	4.455	0.014
Numeracy Skills					
Counting Objects	0.07				
Adding and Subtracting	-0.28				

The table 7 shows the results of the canonical correlation analysis examining the relationship between home numeracy engagement practices and numeracy skills. The findings reveal a statistically significant relationship between the two variable sets, as indicated by Rc = 0.30, Rc^2 = 0.09, F(2,87) = 4.455, and p = 0.014, which is less than the 0.05 level of significance. This result leads to the rejection of the null hypothesis, suggesting that home numeracy engagement practices are significantly associated with numeracy skills. However, the strength of the relationship is weak, as reflected by the canonical correlation coefficient of 0.30.

Overall, the findings suggest that home numeracy engagement practices have a statistically significant but limited association with numeracy skills. Specifically, these

practices appear to be more related to basic operational skills such as addition and subtraction than to foundational skills like counting. This indicates that while home numeracy engagement contributes to learners' mathematical development, its influence is relatively small, highlighting the need to consider other factors such as instructional practices, learning environment, and individual learner differences.

Table 8

Canonical Correlation Analysis Between Numeracy Skills and Kindergartners' Fine Motor Skills

Variable	Cross loading	R_c	R_c^2	F(2,87)	p
Kindergartners' Fine Motor Skills	-0.12	0.12	0.01	0.633	0.533
Numeracy Skills					
Counting Objects	0.11				
Adding and Subtracting	-0.02				

The results of the canonical correlation analysis in this table indicate that there is a very weak relationship between kindergartners' fine motor skills and their numeracy skills. The computed canonical correlation coefficient (Rc = 0.12) shows only a minimal association between the two sets of variables. This is further supported by the coefficient of determination (Rc^2 = 0.01), which means that only 1% of the variation in numeracy skills can be explained by fine motor skills. In simple terms, this suggests that fine motor skills have no influence on the numeracy abilities of the learners in this study.

Overall, the findings suggest that fine motor skills are not a significant factor in predicting the numeracy skills of kindergartners in this study. Other factors not included in the analysis may have a greater influence on children's numeracy development.

Table 9

Canonical Correlation Analysis Between Numeracy Skills and Classroom Conversational Math Exposure Routines

Variable	Cross loading	R_c	R_c^2	F(2,87)	p
Classroom Conversational Math Exposure Routines	-0.09	0.09	0.01	0.393*	0.677
Numeracy Skills					
Counting Objects	-0.09				
Adding and Subtracting	-0.03				

The results of the canonical correlation analysis presented in this table show that there is a very weak relationship between numeracy skills and classroom conversational math exposure routines. The computed canonical correlation coefficient (Rc = 0.09) indicates only a minimal association between the two sets of variables.

In terms of statistical significance, the p-value is 0.677, which is much higher than the 0.05 level of significance. This means that the relationship is not statistically significant. As a result, the null hypothesis cannot be rejected, indicating no significant relationship between the two variables.

Overall, the findings suggest that classroom conversational math exposure routines do not significantly affect the numeracy skills of the learners. This implies that other factors such as teaching strategies, learning materials, or individual differences among learners may play a more important role in developing numeracy skills than classroom math conversations alone.

Conclusions

This study confirms Uri Bronfenbrenner Ecological Theory that child development is fundamentally shaped by their environment through interactions that provide opportunities for children to experience mathematical concepts through everyday activities. The high levels of parental numeracy engagement and active classroom math exposure represent strong, supportive microsystems—the immediate environments where the child interacts.

Building upon the theoretical foundation, the findings also substantiate Jean Piaget's Theory of Cognitive Development, specifically the Pre-operational stage where children learn best through concrete, hands-on experiences rather than abstract logic. It confirms that numeracy for kindergartners is not an abstract thoughts but it is a real physical experienced using their hands.

Ultimately, having a supportive environment is not enough on its own; for children to move from basic counting to deeper math understanding, both home and school must provide more consistent, structured, and challenging hands-on activities.

Recommendations

Based on the conclusions drawn from the study, the following recommendations are proposed:

1. Kindergarten Parents may be encouraged to integrate numeracy activities more consistently into daily routines, such as counting objects during household tasks, discussing numbers in everyday situations, and engaging children in number games and problem-solving activities.
2. Teachers may continue to implement interactive and play-based strategies in mathematics instruction, including the use of manipulatives, storytelling, and

mathematical discussions to strengthen pupils' understanding of numerical concepts.

3. Schools may organize parent education programs or workshops that guide parents on how to support early numeracy learning at home through simple and engaging activities.
4. Early childhood educators may provide more structured fine motor development activities, such as drawing, tracing, cutting, and manipulative play, to further enhance learners' motor coordination and school readiness.
5. Future researchers may explore additional variables that may influence children's numeracy development, such as cognitive ability, parental educational background, teaching strategies, and socio-economic facto

Compliance with Ethical Standards

This study followed strict ethical rules to protect everyone involved. All parents and participants gave their clear permission before any data was collected, and they were told they could stop at any time. To keep everyone safe, all names were kept secret and personal information was protected by data privacy laws. The study was designed to make sure no one was hurt or stressed during the process. There were no personal or financial interests that could have influenced the results. All information used from other books or papers was properly credited to avoid plagiarism, and the findings were looked at honestly and without bias. Finally, the results are used only for research, and AI was used to help fix the writing and organization of this paper.

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REFERENCES

Dogbey, J. (2025). Supporting elementary school teachers enhance their mathematics instruction through invented strategies and classroom discourse. *Asian Journal for Mathematics Education*. https://doi.org/10.1177/27527263251318090

Doverspike, T. (n.d.). The effect of number sense routines on elementary mathematics achievement [Doctoral dissertation, Azusa Pacific University]. ProQuest Dissertations and Theses Global. https://search.proquest.com/openview/bca3d638e2f5283529567eb5ee5d6d98/1.pdf

Elliott, L., & Bachman, H. J. (2021). Home-based literacy activities and child outcomes in early childhood education. Early Childhood Research Quarterly, 54, 87–99. https://doi.org/10.1016/j.ecresq.2020.08.002

Escolano-Perez, E., Herrero-Nivela, M.L., & Losada, J.L. (2020). Association between preschoolers' specific fine (but not gross) motor skills and later academic competencies: Educational implications. Frontiers in Psychology, 11, 1-19. https://doi.org/10.3389/fpsyg.2020.01044

LeFevre, J. A., Skwarchuk, S. L., Smith-Chant, B. L., Fast, L., Kamawar, D., & Bisanz, J. (2009). Home numeracy experiences and children's math performance in the early school years.

Libertus, M. E., & Braham, E. J. (2025). The math talk learning environment: Testing an early childhood math intervention. Early Childhood Research Quarterly, 66, 1-12. https://doi.org/10.1016/j.ecresq.2023.1345

Lysenko, L. V., Abrami, P. C., Wade, A., & Marsh, J. P. (2022). Promoting early literacy and numeracy: A study of the ABRACADABRA and ELM software in rural schools. *Journal of Computer Assisted Learning*, *38*(4), 1017–1031. https://doi.org/10.1111/jcal.12656

McCombes, S. (2023, June 21). Descriptive research: Definition, types, methods & examples. Scribbr. https://www.scribbr.com/methodology/descriptive-research/

Mohammadpour, P. (2021). Parents' perspectives of home numeracy practices of primary school children (Master's thesis, Oxford Brookes University). Retrieved fromhttps://radar.brookes.ac.uk/radar/items/28abee14-82ae-4e76-8acd-aef0541cfb6e/1/

Muhammad, S. M., Sani, M. A., Abdullahi, F., & Bayaro, A. (2023). The Effect of Using Manipulatives on the Performance Of Pupils in Primary School Mathematics. Journal of Mathematical Sciences & Computational Mathematics, 4(2), 223-232.

Ozkur, F. (2020). Analyzing motor development and emergent literacy skills of preschool children. International Education Studies, 13(4), 94-99. https://doi.org/10.5539/ies.v13n4p94

Parrish, S. (2010). *Number talks: Helping children build mental math and computation strategies, grades K-5*. Math Solutions.

Putri, R. P., & Aulina, C. N. (2025). *Implementation of play-based learning to enhance numeracy and fine motor development in early childhood*. Edumaspul: Jurnal Pendidikan, 9(2). https://doi.org/10.33487/edumaspul.v9i2.8995

Ramani, G. B., & Scalise, N. R. (2020). It's more than just fun and games: Play-based mathematics activities for Head Start families. *Evidence-Based Practice in Child*

and Adolescent Mental Health, 5(2), 163–185. https://doi.org/10.1080/23794925.2020.1756569

Rosalianisa, R., Azizah, N., & Nurhafizah, N. (2023). The relationship between fine motor skills and early numeracy skills in kindergarten children. *Journal of Childhood Education (JCE), 7*(1), 45–56. https://doi.org/10.30736/jce.v7i1.1025

Tiruneh, D. T., Sabates, R., & Woldehanna, T. (2022). Improving early numeracy outcomes: Evidence from a remedial teaching intervention in Ethiopia. *International Journal of Educational Development, 89*, 102545. https://doi.org/10.1016/j.ijedudev.2021.102545

Van Voorhis, F. L., Maier, M. F., Epstein, J. L., & Lloyd, C. M. (2021). Family involvement and academic outcomes in early childhood education: A meta-analysis. Review of Educational Research, 91(4), 577–602

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