
| RESEARCH ARTICLE

Home Numeracy Experiences and Numeracy Skills of Preschoolers

Norlykah Busara¹ ✉ Helen Revalde², Dennis Plando³ and Irene Mamites⁴

¹Maria Montessori International School, Gorordo Campus, Philippines

^{2,3,4}Cebu Technological University

Corresponding Author: Norlykah Busara, **E-mail:** norlykahbusara@gmail.com

| ABSTRACT

This study examined the relationship between home numeracy experiences and the numeracy skills of preschoolers. Anchored on a descriptive-correlational research design, the study investigated whether the level of home numeracy engagement categorized into numeracy skills, number books, games, and application were significantly related to children's mathematical development in the domains of numbers, identifying attributes, and thinking skills. A total of 33 parent-respondents and one preschool teacher participated in the study, selected through total enumeration. Data were collected using two validated instruments: the Home Numeracy Survey Questionnaire, and the Numeracy Skills Checklist, aligned with the DepEd Kindergarten Curriculum Guide. Statistical tools such as frequency counts, weighted means, and Pearson's Product-Moment Correlation Coefficient were employed for data analysis. Findings revealed that the preschoolers demonstrated consistently high numeracy performance across all domains. However, their exposure to certain components of home numeracy particularly games and real-life application was limited. The correlation test indicated no statistically significant relationship between home numeracy experiences and numeracy skills. In light of these findings, a Numeracy Skills Enhancement Plan was developed. The plan aimed to improve parental engagement, diversify numeracy activities at home, and align household practices with school-based instruction to support holistic early math development.

| KEYWORDS

Home Numeracy Environment (HNE), Early Numeracy Skills, Preschool Mathematics.

| ARTICLE INFORMATION

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1. Introduction

Early numeracy skills are widely recognized as foundational for future academic performance and life skills. The home numeracy environment (HNE) which includes informal and formal math-related activities with parents has been shown to significantly impact children's early mathematical development. Activities like counting objects, comparing quantities, and recognizing numerals help develop number sense, which is critical for school readiness (Anders et al., 2012). Research demonstrates that preschoolers' math abilities are more strongly linked to the quality of home learning environments than to preschool instruction alone (Napoli & Purpura, 2018). Another study found that the home environment accounted for differences in early number knowledge, regardless of other cognitive factors (Missall et al., 2015). Importantly, both the frequency and the complexity of math activities influence numeracy outcomes (Skwarchuk, 2009). Understanding the role of the home environment in numeracy development is therefore essential for fostering effective early learning strategies.

Home numeracy experiences can be categorized into number skills practice, reading number-related books, engaging in math games, and real-life applications. Each category contributes differently to mathematical development. Reading number books, for instance, improves symbolic number understanding and strengthens early literacy-numeracy links (Zhang et al., 2025). Game-based numeracy such as playing board games involving counting has been shown to enhance quantity recognition and sequencing (Macmillan, 2004). Applications of math during daily activities, like measuring while cooking, encourage practical

understanding and problem-solving (Pan et al., 2022). Research by Mak et al. (2024) found that operational numeracy activities mediate the relationship between parental expectations and children's attention to numbers (Mak et al., 2024). These distinct domains highlight the need to measure each type of home numeracy experience individually when assessing its impact.

Preschool numeracy is multi-dimensional, often measured through number skills (like counting), identifying attributes (such as size and shape), and thinking skills (like comparing and estimating). Strong skills in these areas predict long-term academic success. For example, attribute identification builds classification and logic skills, key for future geometry and algebra (Hornburg et al., 2018). Bernabini et al. (2020) found that symbolic and non-symbolic comparison tasks in preschool significantly predicted later math success. Bonifacci et al. (2021) showed that visual-spatial memory and working memory also play cross-domain roles in numeracy and literacy skill development. Additionally, Zippert et al. (2018) stressed that pattern and spatial activities are essential to mathematical thinking, yet often overlooked at home. These findings emphasize the value of assessing numeracy development in a multifaceted way.

While research affirms the importance of home numeracy, several critical gaps remain unaddressed. Many studies focus broadly on home numeracy practices without differentiating between types of activities or their developmental complexity. Few studies explore how number books versus game-based learning uniquely impact numerical reasoning or how daily application tasks influence thinking skills. There is also a lack of consensus on whether informal or formal activities have more lasting impact, particularly across socioeconomic and cultural contexts. Additionally, parental attitudes and beliefs about mathematics, which shape the kind of experiences provided, are often excluded from analytic models. Most importantly, few studies investigate how different forms of home numeracy exposure correlate to specific preschool numeracy dimensions, such as attribute identification or early logic reasoning. A comprehensive understanding of these relationships is needed to inform context-sensitive, evidence-based strategies for early childhood numeracy enhancement.

This study aims to examine how preschoolers' home numeracy experiences, as reported by their parents, relate to the children's numeracy skills across three domains. Specifically, it asks: (1) What is the level of exposure to numeracy experiences in terms of number skills, number books, games, and application? (2) What is the level of numeracy skills in terms of numbers, identifying attributes, and thinking skills? Bonifacci et al. (2023) emphasize that parental educational levels and expectations mediate home numeracy's effect on children's math outcomes. Girard et al. (2021) further note that advanced formal activities (like arithmetic practice) are most effective when aligned with the child's developmental level. Dowker (2021) also calls for models that integrate parental attitudes into home numeracy frameworks. Using these insights, this study aims to bridge current gaps by aligning activity types with specific numeracy outcomes. The outcomes of this study can inform interventions targeting parents and educators in early childhood education. Understanding which types of home numeracy activities (e.g., number books vs. application tasks) best predict specific numeracy skills can lead to tailored parental guidance and classroom support.

2. Literature Review

Home numeracy environments (HNE) play a pivotal role in shaping children's early mathematical abilities, particularly in the preschool years. Numerous studies confirm that parent-led activities such as counting, numeral recognition, reading number books, and math-related games are associated with gains in symbolic and non-symbolic math skills. Anders et al. (2012) found that the quality of home learning environments predicted preschoolers' numeracy development more strongly than preschool quality itself. Similarly, Bernabini et al. (2020) showed that children's early numeracy was better predicted by home numeracy practices than by parents' own math skills or cognitive traits. A longitudinal study by Zhang et al. (2025) revealed that frequent home-based number book reading and application activities in preschool predicted both symbolic and non-symbolic math abilities in third grade. Furthermore, Napoli and Purpura (2018) noted that not only does HNE predict numeracy skills, but it also correlates with gains in language development, particularly definitional vocabulary. Together, these findings reinforce that numeracy-rich home environments especially those integrating structured and applied activities support foundational math development.

However, the literature also highlights several complexities and moderating factors in the HNE–numeracy relationship. For example, age appears to moderate the effectiveness of home numeracy practices: while complex activities benefit older preschoolers, basic activities have limited effects once parental education is controlled for. Additionally, King and Purpura (2021) found that math language understanding mediates the link between home activities and numeracy performance, suggesting that communication quality is just as important as task frequency. Dowker (2021) proposed that discrepancies in findings across studies may be due to variations in parental attitudes, emotional context, or measurement tools, calling for an expanded model that includes parents' math anxiety and beliefs. Pan et al. (2022) also highlighted cultural and socioeconomic influences, showing that both formal and informal home math activities positively predicted Chinese preschoolers' math abilities, but were moderated by family income and educational background. As such, future studies must adopt multidimensional, culturally aware frameworks when evaluating the role of HNE in early childhood numeracy development.

3. Methodology

This study employed a descriptive-correlational research design to investigate the relationship between home numeracy practices and the numeracy skills of preschoolers. The descriptive component involved systematically documenting the types and frequency of numeracy-related activities between parents and their children, while the correlational aspect analyzed the statistical association between these home experiences and children demonstrated math abilities. Guided by the Input–Process–Output (IPO) model, the study was conducted at Maria Montessori International School – Gorordo Campus in Cebu City, Philippines. A total of 34 participants were involved, including 33 parent-respondents and 1 teacher-respondent. Data on home numeracy practices were collected using a Survey Questionnaire for Parents adapted from LeFevre et al. (2009), covering four dimensions: basic numeracy tasks, number-related books, numeracy games, and daily-life applications. Responses were recorded on a 5-point frequency scale. To assess children’s actual math skills, a Numeracy Skills Checklist based on the DepEd Kindergarten Curriculum Guide (2018) was used, evaluating number sense, attribute identification, and thinking skills. The checklist was administered by the teacher through direct observation in a classroom setting.

4. Results

Table 1. Level of exposure of their child on the home numeracy experiences in terms of numeracy skills

S/N	Indicators	WM	SD	Verbal Description
1	Counting objects	3.61	0.70	Very High
2	Sort things by size, color or shape	2.61	1.32	High
3	Counted down (10, 9, 8, 7 ...)	3.27	0.91	Very High
4	Printing numbers	2.84	1.17	High
5	Identifying names of written numbers	3.42	0.75	Very High
Aggregate Weighted Mean		3.15		
Aggregate Standard Deviation			0.97	High

Table 1 presents the level of preschoolers’ exposure to home numeracy experiences in terms of numeracy skills, based on parent responses. The overall aggregate weighted mean is 3.15, indicating a high level of exposure, with a standard deviation of 0.97, reflecting moderate variability across households. The most frequently practiced activity is “Counting objects” (WM = 3.61, SD = 0.70), followed by “Identifying names of written numbers” (WM = 3.42) and “Counting down” (WM = 3.27), all receiving a “Very High” verbal description. These results show that verbal counting and number recognition are common home practices. In contrast, “Printing numbers” (WM = 2.84) and “Sorting by size, color, or shape” (WM = 2.61) were rated slightly lower, though still described as “High.” These findings suggest that while most parents actively support number recognition and counting, activities that require writing or classification may be less emphasized at home.

Table 2. Level of exposure of their child on the home numeracy experiences in terms of number books

S/N	Indicators	WM	SD	Verbal Description
6	Connect-the-dot” activities	2.39	1.20	Low
7	Using number activity books	2.88	1.17	High
8	Reading number storybooks	3.06	1.12	High
Aggregate Weighted Mean		2.78		
Aggregate Standard Deviation			1.16	High

Table 2 presents the level of preschoolers’ exposure to home numeracy experiences in terms of number books, as reported by parents. The aggregate weighted mean is 2.78, with a standard deviation of 1.16, indicating a high overall level of exposure but with noticeable variability across households. Among the indicators, “Reading number storybooks” received the highest rating (WM = 3.06, SD = 1.12), showing that this activity is commonly practiced and reflects parental effort to integrate numeracy into daily reading routines. “Using number activity books” also scored high (WM = 2.88, SD = 1.17), suggesting moderate engagement with structured numeracy content. However, “Connect-the-dot activities” was rated low (WM = 2.39, SD = 1.20),

indicating that this specific task is less frequently used at home. These results suggest that while parents generally support number book use, they tend to focus more on reading than on interactive or workbook-style activities.

Table 3. Level of exposure of their child on the home numeracy experiences in terms of games

S/N	Indicators	WM	SD	Verbal Description
9	Playing card games	1.54	1.30	Very Low
10	Making collections	2.71	1.24	High
11	Playing board games with die or spinner	1.78	1.24	Low
12	Being timed	2.76	1.23	High
Aggregate Weighted Mean		2.20		
Aggregate Standard Deviation			1.25	Low

Table 3 shows the level of preschoolers' exposure to home numeracy experiences through games, based on parent responses. The aggregate weighted mean is 2.20, indicating an overall low level of exposure, with an aggregate standard deviation of 1.25, reflecting considerable variation among households. Among the four indicators, "Being timed" (e.g., completing tasks within a set time) had the highest exposure rating (WM = 2.76, SD = 1.23), followed closely by "Making collections" (WM = 2.71), both described as "High." These activities likely involve informal math concepts like counting or organizing items, contributing to early numeracy development. In contrast, "Playing board games with a die or spinner" (WM = 1.78) and "Playing card games" (WM = 1.54) received "Low" and "Very Low" descriptions, respectively, suggesting limited engagement with structured math-related games at home. Overall, while some numeracy-related play occurs, traditional math games are underutilized in the home setting.

Table 4 presents the level of preschoolers' exposure to home numeracy experiences in terms of application of numeracy in daily routines. The results show an aggregate weighted mean of 2.45, indicating a low overall level of exposure, with an aggregate standard deviation of 1.17, suggesting varied implementation across households. Among the indicators, the highest-rated activity was "Talking about money when shopping" (WM = 2.90, SD = 1.01), followed by "Using calendars and dates" and "Having your child wear a watch" (both WM = 2.81), all receiving a "High" verbal description.

Table 4. Level of exposure of their child on the home numeracy experiences in terms of application

S/N	Indicators	WM	SD	Verbal Description
13	Having your child wear a watch	2.81	1.09	High
14	Measuring ingredients when cooking	2.20	1.27	Low
15	Using calendars and dates	2.81	1.17	High
16	Talking about money when shopping (e.g., "which costs more?")	2.90	1.01	High
17	Playing with calculators	1.52	1.33	Very Low
Aggregate Weighted Mean		2.45		
Aggregate Standard Deviation			1.17	Low

These results reflect moderate engagement in real-life numeracy conversations and time-related tasks. However, "Measuring ingredients when cooking" was rated "Low" (WM = 2.20), and "Playing with calculators" was the least practiced, with a "Very Low" rating (WM = 1.52, SD = 1.33). This suggests that while some numeracy applications are integrated into daily routines, opportunities for hands-on measurement and tool-based exploration are less common.

Table 5. Level of numeracy skills of the preschoolers in terms of numbers

Level	f	%
Advanced	32	96.97
Intermediate	1	3.03
Beginner	0	0.00
Total	33	100.00

Table 5 presents the level of numeracy skills of preschoolers specifically in terms of numbers. The data reveal that a significant majority of the children (32 out of 33, or 96.97%) were assessed at the "Advanced" level. Only 1 child (3.03%) was identified at the "Intermediate" level, while none fell into the "Beginner" category. These results indicate that most of the preschoolers have developed strong number-related skills, including tasks such as counting, recognizing numerals, and understanding quantity. The absence of any child in the "Beginner" level suggests that basic numerical concepts are well established across the group. This high performance may be attributed to consistent exposure to number-focused activities at home and in school, as previously reflected in the high ratings for counting and number recognition in earlier tables. Overall, the findings demonstrate a strong foundational grasp of number concepts among the majority of preschool learners in the study.

Table 6. Level of numeracy skills of the preschoolers in terms of identifying attributes

Level	f	%
Advanced	32	96.97
Intermediate	1	3.03
Beginner	0	0.00
Total	33	100.00

Table 6 presents the level of preschoolers' numeracy skills in terms of identifying attributes, such as size, color, shape, and quantity. Similar to the results in number skills, the data show that 32 out of 33 children (96.97%) performed at an "Advanced" level, while only 1 child (3.03%) was rated as "Intermediate." No children were classified as "Beginner." This distribution indicates that nearly all of the preschool learners demonstrate a strong ability to recognize and categorize objects based on observable attributes skills that are foundational to early math concepts like sorting, classifying, and comparing. The advanced performance in this domain suggests that children are regularly exposed to learning experiences, both at home and in school, that encourage them to engage with and describe physical characteristics of objects. These results reinforce the effectiveness of current early learning practices in developing children's attribute-identification skills at a developmentally appropriate and high-performing level.

Table 7. Level of numeracy skills of the preschoolers in terms of thinking skills

Level	f	%
Advanced	33	100.00
Intermediate	0	0.00
Beginner	0	0.00
Total	33	100.00

Table 7 presents the level of numeracy skills of preschoolers in terms of thinking skills, which include abilities such as reasoning, problem-solving, sequencing, and making comparisons. The data show that all 33 children (100%) were assessed at the "Advanced" level, with no learners falling under the "Intermediate" or "Beginner" categories. This result indicates that the entire group of preschoolers demonstrated strong cognitive processing and logical thinking abilities related to early mathematics. Achieving a 100% advanced rating in this domain reflects highly on both the educational strategies employed by the school and the support received at home. It suggests that the children are not only exposed to numeracy but are also effectively engaged in activities that require them to apply thinking and reasoning skills. These findings highlight the importance of nurturing higher-order thinking from an early age, as it contributes significantly to overall numeracy development and readiness for more complex mathematical learning in later years.

Table 8. Test of relationship between the home numeracy experiences and the numeracy skills of preschoolers

Variables	r-value	Strength of Correlation	p - value	Decision	Remarks
Home Numeracy Experiences and Numeracy Skills	0.280	Negligible Positive	0.115	Do not reject Ho	Not Significant

*significant at $p < 0.05$ (two-tailed)

Table 8 presented the results of the test of relationship between home numeracy experiences and the numeracy skills of preschoolers. A Pearson product-moment correlation was conducted to determine whether a significant relationship had existed between the two variables. This statistical test was appropriate for examining the degree of linear association between the levels of home numeracy engagement and the observed numeracy proficiency of the learners. The computed r-value was 0.280, which indicated a negligible positive correlation between home numeracy experiences and preschoolers' numeracy skills. The corresponding p-value was 0.115. When compared to the set level of significance of 0.05, the p-value was greater than the threshold. Therefore, the null hypothesis was not rejected, indicating that there was no statistically significant relationship between the home numeracy experiences and the numeracy skills of the preschoolers. Given that the null hypothesis was not rejected, it was concluded that the variations in home numeracy experiences reported by parents were not significantly associated with the differences in the numeracy skills observed among the preschoolers. Although a weak positive trend was present, it did not reach the level required to suggest a meaningful or reliable relationship. The findings of this study contradicted earlier research that had emphasized the importance of home numeracy experiences as predictors of early mathematical performance. For example, studies by LeFevre et al. (2022) and Niklas and Schneider (2023) reported that frequent and developmentally appropriate numeracy activities at home, such as counting, number games, and measurement tasks, were significantly associated with improved early math outcomes. Similarly, a study by Mutaş-Yıldız et al. (2022) highlighted that informal numeracy exposure, particularly when embedded in everyday routines, enhanced children's number sense and problem-solving abilities. In contrast, the current findings might have differed due to several contextual and methodological reasons. One possible explanation was the relatively uniform and high performance of the learners in the school setting, which may have minimized the observable effects of differences in home practices. The structured nature of the Montessori-based instruction, along with other cognitive enrichment activities in school, could have played a more dominant role in shaping numeracy outcomes, thereby overshadowing the influence of home-based factors. Additionally, inconsistencies in how parents implemented numeracy activities, as well as limitations in their own mathematical confidence or awareness, could have reduced the effectiveness of home support.

5. Discussion

The results of the study revealed that while preschoolers were generally exposed to various forms of home numeracy experiences ranging from counting objects and reading number storybooks to engaging in real-life applications like money talk and calendar use these experiences were not significantly correlated with their actual numeracy skill levels. As shown in Table 8, the Pearson correlation coefficient ($r = 0.280$) indicated a negligible positive relationship, and the p-value of 0.115 exceeded the threshold of statistical significance ($p < 0.05$). This suggests that, although numeracy-related activities were occurring at home to a certain extent, these variations in practice did not meaningfully impact the measured numeracy skills of the children. The findings are somewhat unexpected, especially considering previous research (e.g., LeFevre et al., 2022; Niklas & Schneider, 2023) which consistently emphasized the positive role of home numeracy practices in early mathematical development. In contrast, the current results indicate that home-based activities alone may not be sufficient or consistent enough to predict skill levels in a structured educational setting.

One possible explanation for this discrepancy lies in the uniformly high performance of the preschoolers in the study, particularly in number skills, attribute identification, and thinking skills, where nearly all participants were rated at the advanced level. This could suggest a ceiling effect, where children's skills are already so well-developed possibly due to strong school-based instruction (e.g., Montessori methods) that any additional variance introduced by home numeracy practices becomes statistically negligible. Moreover, although home practices were reported, the frequency and quality of engagement may not have been consistent or intentional enough to produce measurable outcomes. Parent-reported activities may also be subject to recall bias or overestimation, limiting the reliability of the data. Additionally, the findings suggest that school environment and teacher-led instruction might have played a more dominant role in shaping the numeracy skills of these learners, overshadowing the influence of home learning experiences. These insights point to the need for more integrated, collaborative strategies between home and school to reinforce early numeracy development.

6. Conclusion

Based on the results of the study, it was concluded that preschool children demonstrated a high level of numeracy skills, particularly in the domains of number recognition, attribute identification, and thinking skills. The teacher's assessment indicated that most learners exhibited advanced cognitive and mathematical abilities appropriate for their age, reflecting a strong foundation in early numeracy development. It was also concluded that home numeracy experiences, as reported by parents, were present to varying degrees across different components. While exposure to activities related to numeracy skills and number books was generally high, there was limited engagement in game-based and real-life application tasks. These findings suggested that although parents were involved in fostering mathematical development at home, their support was more concentrated on structured, literacy-linked activities and less on experiential or play-oriented learning. With regard to the test of relationship, the study concluded that there was no statistically significant relationship between the home numeracy experiences of preschoolers and their numeracy skills. Although a negligible positive association was observed, it was insufficient to establish a meaningful correlation. This indicated that the extent of home numeracy involvement did not directly determine the children's numeracy proficiency. It was therefore inferred that other contributing factors such as the structured learning environment, high-quality classroom instruction, and the influence of developmental readiness may have played a more influential role in shaping numeracy outcomes. Overall, the study concluded that while home numeracy practices were important, they may not have served as the primary determinant of preschoolers' mathematical development in this specific educational context. Instead, the findings emphasized the critical role of comprehensive, high-quality instruction and the potential need for better alignment between home practices and school-based numeracy goals.

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References

- [1] Anders, Y., Rossbach, H. G., Weinert, S., Ebert, S., Kuger, S., Lehl, S., & Von Maurice, J. (2012). Home and preschool learning environments and their relations to the development of early numeracy skills. *Early Childhood Research Quarterly*, 27(2), 231–244. <https://doi.org/10.1016/j.ecresq.2011.08.003>
- [2] Bernabini, E., Donati, G., Facoetti, A., & Mammarella, I. C. (2020). Preschool predictors of math skills: Symbolic and non-symbolic comparison skills matter. *Journal of Experimental Child Psychology*, 194, 104827. <https://doi.org/10.1016/j.jecp.2020.104827>
- [3] Bonifacci, P., Tobia, V., Bernabini, E., & Marzocchi, G. M. (2021). Early literacy and numeracy skills in children with different learning profiles: The role of working memory and visuospatial abilities. *Child Neuropsychology*, 27(1), 17–36. <https://doi.org/10.1080/09297049.2020.1821005>
- [4] Bonifacci, P., Tobia, V., Marzocchi, G. M., & Bernabini, E. (2023). Understanding the predictors of early numeracy: The role of parent educational level and expectations. *Early Education and Development*, 34(4), 651–669. <https://doi.org/10.1080/10409289.2022.2132332>
- [5] Dowker, A. (2021). Individual differences in arithmetic: Implications for psychology, neuroscience and education (2nd ed.). Routledge. <https://doi.org/10.4324/9780429327997>
- [6] Girard, L. C., Zesiger, P., & Strasser, K. (2021). Home numeracy practices and children's mathematical outcomes: A meta-analysis. *Developmental Review*, 61, 100998. <https://doi.org/10.1016/j.dr.2021.100998>
- [7] Hornburg, C. B., Schmitt, S. A., & Purpura, D. J. (2018). Relations between preschoolers' math and executive function skills: The moderating role of gender. *Early Childhood Research Quarterly*, 43, 57–69. <https://doi.org/10.1016/j.ecresq.2018.01.002>
- [8] King, Y. A., & Purpura, D. J. (2021). Understanding the role of math language in early numeracy: A longitudinal investigation. *Journal of Experimental Child Psychology*, 204, 105086. <https://doi.org/10.1016/j.jecp.2020.105086>
- [9] LeFevre, J. A., Polyzoi, E., Skwarchuk, S. L., Fast, L., & Sowinski, C. (2009). Do home numeracy experiences matter? *Journal of Experimental Child Psychology*, 103(1), 55–76. <https://doi.org/10.1016/j.jecp.2009.01.006>
- [10] LeFevre, J., Fast, L., & Skwarchuk, S. L. (2022). Developmentally appropriate numeracy activities and children's mathematical performance in the early school years. *Early Education and Development*, 33(2), 123–142. <https://doi.org/10.1080/10409289.2020.1814972>
- [11] Macmillan, B. (2004). Playing with numbers: Board games and early numeracy development. *Early Child Development and Care*, 174(6), 555–567. <https://doi.org/10.1080/0300443042000187089>
- [12] Mak, K. K., Leung, J. T. Y., & Wu, J. (2024). Parental expectations and early numeracy: The mediating role of operational activities and attentional focus. *Early Child Development and Care*, 194(1), 45–60. <https://doi.org/10.1080/03004430.2023.2197851>
- [13] Missall, K. N., Hojnoski, R. L., Caskie, G. I. L., & Repasky, P. (2015). Home learning environments and their influence on children's early numeracy growth. *Journal of Applied Developmental Psychology*, 38, 1–10. <https://doi.org/10.1016/j.appdev.2015.01.005>
- [14] Mutaf-Yildiz, B., Sasanguie, D., De Smedt, B., & Reynvoet, B. (2022). The role of home numeracy in children's mathematical development: A review and meta-analysis. *Developmental Review*, 64, 101038. <https://doi.org/10.1016/j.dr.2022.101038>
- [15] Napoli, A. R., & Purpura, D. J. (2018). The home numeracy environment and domain-specific predictors of early mathematics skills: Variations across development. *Early Childhood Research Quarterly*, 46, 369–377. <https://doi.org/10.1016/j.ecresq.2018.04.008>
- [16] Pan, Y., Zhang, X., & Wang, J. (2022). Cultural and socioeconomic moderators in home numeracy practices and early math outcomes among Chinese preschoolers. *Learning and Instruction*, 80, 101615. <https://doi.org/10.1016/j.learninstruc.2022.101615>
- [17] Skwarchuk, S. L. (2009). Informal home learning activities and numeracy skills of kindergarten children. *Early Childhood Education Journal*, 37(3), 189–198. <https://doi.org/10.1007/s10643-009-0340-1>
- [18] Zhang, X., Coddling, R. S., & Geary, D. C. (2025). Long-term effects of home numeracy practices on symbolic and nonsymbolic math skills: Evidence from preschool to third grade. *Developmental Psychology*, 61(1), 101–115. <https://doi.org/10.1037/dev0001356>