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FACTORS SHAPING KINDERGARTNERS' NUMERACY SKILLS

Jeffry W. Arancon, Revina O. Mendoza

Graduate School, Lourdes College, Inc. Cagayan de Oro City, Philippines

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ABSTRACT

Early numeracy forms the foundation of later mathematics learning, yet children's performance varies depending on environmental support and self-regulation abilities. While prior studies have examined teacher–child interactions, home numeracy practices, and executive functions, limited empirical evidence in the Philippine context has explored these factors collectively. This study examined the influence of teacher–child instructional interaction, inhibitory control, and the home numeracy environment on the numeracy skills of kindergarten learners in a central elementary school in Bukidnon. A descriptive–correlational design was employed. Data were collected from 129 kindergarten learners, their parents, and teachers using adapted rating scales, questionnaires, and a numeracy assessment. Descriptive statistics and multiple regression analysis were utilized. Results indicated that teacher–child instructional interaction was high, while opportunities for questioning and problem-solving were less evident. The home numeracy environment was frequently practiced but emphasized basic number skills over reasoning activities. Learners demonstrated moderate to high inhibitory control, and overall numeracy skills were very good. Regression analysis revealed that teacher–child instructional interaction and inhibitory control significantly influenced numeracy skills, whereas the home numeracy environment did not show a significant effect, suggesting that classroom instruction and self-regulation play a more immediate role in shaping early numeracy outcomes. The findings highlight the importance of strengthening interactive teaching and self-regulation in early mathematics development.

Keywords: *Numeracy Skills, Teacher–Child Interaction, Inhibitory Control, Home Numeracy Environment, Kindergarten*

INTRODUCTION

Early numeracy skills serve as a foundation for later mathematical learning and broader academic achievement. Children who demonstrate strong number knowledge and counting skills at school entry are more likely to sustain achievement in mathematics across grade levels (Spiegel et al., 2021). However, early numeracy development is not shaped by exposure to numbers alone but is influenced by both environmental and cognitive factors. Classroom interactions, home learning experiences, and children's ability to regulate attention and behavior jointly shape how mathematical concepts are understood and applied. These interconnected influences highlight the need to examine early mathematics learning through an integrated perspective that considers both contextual and self-regulatory processes.

Within the classroom, teacher–child instructional interaction plays a central role in supporting early numeracy development. Instructional quality is reflected in how teachers explain concepts, provide feedback, ask questions, and sustain children's engagement during learning activities. Research indicates that effective instructional practices and classroom management significantly influence interaction quality and, in turn, children's engagement and academic outcomes (Tilbe & Xiaosong, 2024; Zhang, 2026). However, studies also report variability in opportunities for inquiry and problem-solving, which are essential for developing deeper conceptual understanding (Karuppiah, 2021). Beyond school, the home numeracy environment further contributes to early mathematical learning through everyday activities such as counting, number talk, and number-related play (Susperreguy et al., 2020). Yet, children do not benefit equally from similar experiences, as regulatory abilities influence how they engage with and learn from these opportunities (Silver et al., 2022).

Inhibitory control, a key component of executive function, is another factor that supports early mathematics performance. It enables children to suppress impulsive responses, maintain attention, and respond accurately during cognitively demanding tasks. Empirical evidence shows that inhibitory control predicts early numeracy outcomes, particularly in tasks involving counting accuracy and comparison of quantities (Cueli et al., 2020), with meta-analytic findings confirming its consistent association with mathematics ability (Zhu et al., 2024). Despite strong international evidence on the roles of instructional interaction, home numeracy, and inhibitory control, limited research has examined how these factors collectively influence early numeracy development within the Philippine context (Quisumbing & Suryadarma, 2023). At the same time, national assessments such as the Southeast Asia Primary Learning Metrics reveal persistent gaps in foundational mathematics skills among Filipino learners (Philippines Department of Education et al., 2021). Under the MATATAG Curriculum, kindergarten learners are expected to develop competencies in number sense and counting, recognizing and naming shapes, and comparing quantities, highlighting the urgency of strengthening early numeracy foundations.

Given these conditions, this study investigates how teacher–child instructional interaction, home numeracy environment, and inhibitory control collectively influence the numeracy skills of kindergarten learners in a public school in Manolo Fortich, Bukidnon. By integrating classroom, home, and cognitive dimensions within a descriptive-correlational framework, the study addresses a critical gap in localized evidence and provides a more comprehensive understanding of early numeracy development. The findings offer practical implications for improving instructional practices, strengthening family involvement, and informing early childhood education policies aimed at enhancing foundational mathematics skills among young Filipino learners.

Research Questions

The research investigated the implications of teacher–child instructional interaction, home numeracy environment, and inhibitory control on the numeracy skills of kindergarten learners.

Specifically, it addressed the following questions:

1. What is the participants' assessment of the quality of the teacher-child instructional interactions as assessed by the kindergartners?
2. What is the level of home numeracy environment as rated by parents and kindergarten learners?
3. What is the kindergartners' level of inhibitory control as assessed by the teachers?
4. What is the kindergartners' level of numeracy skills?
5. Do teacher-child instructional interaction, home numeracy environment, and inhibitory control significantly influence the numeracy skills of kindergartners?

METHODOLOGY

A descriptive–correlational research design was used to examine the relationships between teacher–child instructional interaction, home numeracy environment, inhibitory control, and the numeracy skills of kindergarten learners. This design was appropriate as it allowed the investigation of naturally occurring variables without manipulation, consistent with the objective of determining their influence on early numeracy outcomes.

The participants were kindergarten learners, their parents, and teachers from a public elementary school in Manolo Fortich, Bukidnon, during the school year 2025–2026. From a total population of 225 learners, a sample of 144 was initially determined using Taro Yamane's formula with a 95% confidence level and 5% margin of error. After data screening, 15 outliers were removed, resulting in a final sample of 129 participants. Stratified random sampling was employed by grouping learners according to their class sections and selecting a proportionate number from each group to ensure representation.

Data were collected using four instruments. Teacher–child instructional interaction was measured using a researcher-developed tool adapted from the Classroom Assessment

Scoring System (CLASS) for Pre-K, using a child-friendly emoticon-based scale. Inhibitory control was assessed through a teacher-rating scale based on observable classroom behaviors, informed by constructs from the Head-Toes-Knees-Shoulders (HTKS) framework. The home numeracy environment was measured using both parent- and learner-reported questionnaires adapted from the Home Numeracy Questionnaire (HNQ), capturing formal and informal numeracy practices. Numeracy skills were assessed through a standardized test covering number sense and counting, recognizing and naming shapes, and comparing quantities. All instruments underwent expert validation and pilot testing, yielding acceptable reliability coefficients ($\alpha = 0.731$ to 0.878).

Data gathering was conducted with proper ethical clearance and informed consent from parents, along with assent from the learners. The researcher administered the instruments with the assistance of teachers in a classroom setting, ensuring that procedures were age-appropriate and non-disruptive. Participation was voluntary, and confidentiality of responses was strictly maintained.

Descriptive statistics, including mean and standard deviation, were used to summarize the variables. Multiple regression analysis was employed to determine the influence of teacher–child instructional interaction, home numeracy environment, and inhibitory control on numeracy skills. Prior to analysis, assumptions of regression were tested, including multicollinearity and normality of residuals, which confirmed that the data met the required statistical conditions.

The scope of the study was limited to examining the relationships among the identified variables within one public kindergarten setting. Other factors such as socioeconomic status and long-term learning outcomes were not included, which may limit the generalizability of the findings.

RESULTS

Research Question 1. What is the assessment of the quality of the teacher-child instructional interactions?

Table 1 shows the frequency, percentage, and descriptive statistics describing the quality of teacher–child instructional interactions. The computed mean is 3.63 ($SD = 0.35$), which falls within the 3.51–4.50 range, interpreted as high. This suggests that, in general, teachers demonstrate effective instructional interaction practices, indicating that children frequently experience supportive and structured learning guidance in the classroom. The distribution further reveals that 74.42% (96 out of 129) of the participants perceived the interactions as “high”**,** followed by 23.26% (30 learners) who rated them as “moderate”, and only 2.33% (3 learners) who viewed them as “low”. No responses fell under the very high or very low categories.

This pattern implies that most learners consistently experience quality instructional support from their teachers, with only a small portion perceiving limited interaction. Overall, the data reflected a positive classroom environment where teachers regularly

engage learners in meaningful instruction. This is supported by research showing that high-quality teacher–child interactions are strongly associated with children's engagement and learning outcomes, as such interactions provide meaningful instructional support that promotes active participation and understanding (Zheng et al., 2023).

Table 1

Frequency Distribution and Descriptive Statistics of Teacher-Child Instructional Interactions

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Very High	0	0.00
3.51 – 4.50	Often	High	96	74.42
2.51 – 3.50	Sometimes	Moderate	30	23.26
1.51 – 2.50	Rarely	Low	3	2.33
1.00 – 1.50	Never	Very Low	0	0.00
		Total	**129**	**100**
		Mean	**3.63**	
		Interpretation	**High**	
		SD	**0.35**	

No.	Statement	Mean	SD	Description
1.	My teacher explains lessons clearly.	3.84	0.43	Often
2.	My teacher helps me when I do not understand.	3.78	0.56	Often
3.	My teacher gives me time to think before answering.	3.64	0.65	Often
4.	My teacher shows me how to solve problems.	3.43	0.79	Sometimes
5.	My teacher gives me opportunities to ask questions during activity.	3.43	0.79	Sometimes
6.	My teacher listens when I answer.	3.62	0.68	Often
7.	My teacher explains my mistakes kindly.	3.56	0.68	Often
8.	My teacher makes lessons fun and interesting.	3.53	0.76	Often
9.	My teacher helps me stay focused in class.	3.69	0.63	Often
10.	My teacher encourages me to join activities.	3.74	0.58	Often

Results of the specific indicators revealed that the highest rating was given to explaining lessons clearly (*M* = 3.84), followed by helping when the child does not understand *(M* = 3.78*)* and encouraging participation in activities (*M* = 3.74). Learners also reported that teachers help them stay focused (*M* = 3.69), give them time to think before answering (*M*

= 3.64), and listen when they respond (*M* = 3.62), all interpreted as *sometimes*, indicating that these supportive instructional behaviors are commonly practiced. Likewise, teachers explain mistakes kindly (*M* = 3.56) and make lessons engaging (*M* = 3.53), showing consistent positive interaction patterns.

On the other hand, relatively lower means were observed in showing how to solve problems (M = 3.43) and providing opportunities to ask questions (M = 3.43), both interpreted as not sure. These results highlight that, compared to other aspects of instructional interaction, learner engagement in inquiry and problem-solving is less consistently facilitated in the classroom. While teachers frequently guide and assist learners, opportunities for deeper inquiry and active participation in problem-solving may not be as strongly emphasized. Based on the researcher's observation during classroom visits, kindergarten lessons often focused on teacher explanations and guided activities where learners followed instructions step by step.

Research Question 2. What is the assessment of home numeracy environment as rated by parents and kindergarten learners?

Table 2 presents the frequency, percentage, and descriptive statistics describing the home numeracy environment as rated by parents. The overall mean score is 3.89 with a standard deviation of 0.58, which falls within the range of 3.51 to 4.50 and is interpreted as high. This indicates that, according to parents, numeracy related activities such as counting objects during daily routines, recognizing numbers in the environment, engaging in number talk, and playing number-related games are commonly practiced in the home setting. The distribution shows that 76 out of 129 parents or 58.91 percent rated the home numeracy environment as high, while 20 parents or 15.50 percent rated it as very high. Meanwhile, 30 parents or 23.26 percent assessed it as moderate and only 3 parents or 2.33 percent perceived it as low. No responses fell under the very low category. This pattern suggests that parents generally perceive themselves as regularly providing opportunities for their children to engage in number related experiences in daily life.

Table 2

Frequency Distribution and Descriptive Statistics of Home Numeracy Environment as Rated by the Kindergartners' Parents

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Very High	20	15.50
3.51 – 4.50	Often	High	76	58.91
2.51 – 3.50	Sometimes	Moderate	30	23.26
1.51 – 2.50	Rarely	Low	3	2.33
1.00 – 1.50	Never	Very Low	0	0.00
	Total		**129**	**100**
	Mean		**3.89**	
	Interpretation		**High**	

SD		**0.58**	

No.	Statement	Mean	SD	Description
1.	My child counts objects during daily routines (e.g., toys, fruits, or groceries).	4.05	0.74	Often
2.	My child plays games that involve numbers or counting.	4.02	0.86	Often
3.	My child is being encouraged to recognize numbers in the environment (e.g., signs, labels).	4.19	0.77	Often
4.	My child talks about prices, money, or quantities when buying things with family member.	3.76	1.04	Often
5.	My child asks to compare which group has more or less items.	3.57	1.04	Often
6.	My child practices writing or tracing numbers together.	3.91	0.94	Often
7.	My child reads storybooks or materials that include counting or numbers.	3.68	1.03	Often
8.	My child uses simple math during playtime (e.g., adding or removing toys).	3.66	1.06	Often
9.	My child is being praised by us when they use numbers correctly.	4.04	0.98	Often
10.	My child makes learning numbers a part of our everyday conversations.	4.05	0.90	Often

A closer examination of the individual indicators shows that numeracy activities are frequently integrated into everyday routines at home. The highest mean was recorded for encouraging children to recognize numbers in the environment such as signs and labels with a mean of 4.19, interpreted as often. This was followed by counting objects during daily routines and making numbers part of everyday conversations, both with a mean of 4.05. Parents also reported praising their child when numbers are used correctly with a mean of 4.04 and engaging children in number games with a mean of 4.02. These findings indicate that parents actively support early numeracy development through interaction, conversation, and reinforcement within ordinary home activities, which is consistent with research showing that frequent parental engagement in everyday numeracy activities provides children with opportunities to develop early mathematical skills through regular exposure and interaction (Elliott et al., 2023).

Other practices were also reported to occur often, though at slightly lower levels. Practicing writing or tracing numbers obtained a mean of 3.91, while talking about prices, money, or quantities when buying things had a mean of 3.76. Reading storybooks that include counting or numbers recorded a mean of 3.68, and using simple math during playtime such as adding or removing toys had a mean of 3.66. Asking children to compare

which group has more or fewer items had the lowest mean of 3.57, but it still falls within the often category. This suggests that while parents consistently expose children to basic numeracy skills such as counting and number recognition, activities that require comparison and reasoning are practiced less frequently.

In addition, this pattern may indicate that parents tend to prioritize foundational numeracy activities that are easier to integrate into daily routines, while more cognitively demanding tasks such as comparison and reasoning require intentional guidance and are therefore less frequently practiced. Consequently, children may have fewer opportunities to develop higher-order thinking skills at home, highlighting the need to encourage more interactive activities that involve reasoning, problem solving, and mathematical thinking.

Table 3 presents the results of the home numeracy environment as rated by kindergartners which is generally very high. The computed mean score of 4.56 (*SD* = 0.31) falls within the 4.51–5.00 range, indicating that learners consistently experience numeracy-related activities at home, such as engaging in counting, recognizing numbers in their surroundings, participating in number-related conversations, and applying numbers in everyday situations. The frequency distribution reveals that 62.79% of learners perceived their home numeracy experiences as very high and 35.66% as high, while only 1.55% rated them as moderate. No learners reported low or very low exposure. This pattern suggests that almost all children regularly encounter number-related interactions in their home environment.

Table 3

Frequency Distribution and Descriptive Statistics of Home Numeracy Environment as Rated by Kindergartners

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Very High	81	62.79
3.51 – 4.50	Often	High	46	35.66
2.51 – 3.50	Sometimes	Moderate	2	1.55
1.51 – 2.50	Rarely	Low	0	0.00
1.00 – 1.50	Never	Very Low	0	0.00
	Total		**129**	**100**
	Mean		**4.56**	
	Interpretation		**Very High**	
	SD		**0.31**	

No.	Statement	Mean	SD	Description
1.	I count objects at home like toys, fruits, or groceries.	4.71	0.52	Always
2.	I play games that use numbers or counting.	4.61	0.59	Always
3.	I see numbers at home like on signs, labels, or packages.	4.64	0.66	Always

4.	I talk about money or prices when buying things.	4.57	0.67	Always
5.	I compare which group has more or less objects.	4.47	0.71	Often
6.	I practice writing or tracing numbers at home.	4.57	0.69	Always
7.	I listen to stories or books with numbers or counting.	4.34	0.93	Often
8.	I use numbers when playing (like adding or taking away toys).	4.46	0.83	Often
9.	I feel happy when I use numbers correctly at home.	4.67	0.61	Always
10.	I talk about numbers every day at home.	4.59	0.76	Always

Looking at the specific indicators, the highest ratings were observed in activities involving direct interaction with numbers. Children frequently count objects at home (*M* = 4.71)**,** feel happy when using numbers correctly (*M* = 4.67), and see numbers in the environment such as labels or packages (*M* = 4.64). They also often play number games (*M* = 4.61) and talk about numbers daily (*M* = 4.59). Practical everyday applications such as talking about money or prices (*M* = 4.57) and practicing writing or tracing numbers (*M* = 4.57) were also consistently practiced. These findings indicate that numeracy learning commonly occurs through daily routines, conversations, and play-based activities.

Other numeracy experiences were present but comparatively less frequent. Learners reported using numbers during play (*M* = 4.46) and comparing quantities (*M* = 4.47) at slightly lower levels than counting and recognition activities. The lowest mean score was observed in listening to stories or books involving numbers (*M* = 4.34), although this still falls under the high category. This implies that while interactive and activity-based numeracy experiences are strongly practiced at home, literacy-based numeracy exposure occurs somewhat less often. This pattern is supported by research indicating that home numeracy activities are more strongly associated with direct and interactive practices such as counting and number use, while literacy-related activities like storybook exposure contribute less frequently and often have indirect effects on numeracy development (Salminen et al., 2021).

Moreover, the findings indicate that kindergartners are exposed to a rich home numeracy environment characterized by frequent counting, number recognition, and everyday application of numbers. In summary, children regularly encounter numbers in daily activities and interactions at home, demonstrating that the home setting serves as a consistent and supportive context for early numeracy development. This is supported by research showing that the frequency of home numeracy activities, such as counting and number-related interactions during everyday routines, is associated with children's early mathematical skills and development (Elliott et al., 2023).

Table 4 presents the combined summary of the home numeracy environment based on both parent and learner perspectives. The results show that parents rated the home numeracy environment with a mean of 3.89 (*SD* = 0.58) interpreted as high, while learners rated it higher with a mean of 4.56 (*SD* = 0.31) interpreted as very high. When both perspectives were combined, the overall mean became 4.23 (*SD* = 0.35), which falls under the high category. This indicates that numeracy-related activities are commonly practiced at home, though children tend to perceive these experiences more strongly than parents report them. Children may perceive numeracy activities as more engaging and meaningful in daily interactions, while parents may view these as routine and therefore underreport them. Research shows that parent reports may not fully capture the frequency or quality of informal numeracy experiences, highlighting the value of including children's perspectives when assessing home learning environments (Bonifacci et al., 2023; Elliott et al., 2023).

Table 4

Summary Table of the Participants' Assessment of Home Numeracy Environment

Home Numeracy Environment	Mean	SD	Interpretation
Parent's Assessment	3.89	0.58	High
Learner's Assessment	4.56	0.31	Very High
Overall	**4.23**	**0.35**	**High**

The overall high rating indicates that the home setting regularly exposes children to number-related experiences in daily routines. Both parent and learner responses suggest that numbers are commonly encountered through conversations, counting activities, and shared participation in everyday tasks rather than through formal teaching. This pattern reflects how early numeracy experiences in the home are embedded in ordinary family interactions. Consistent with this observation, literature describes the home numeracy environment as involving frequent number talk, counting, and informal math activities integrated into daily life (Daucourt et al., 2021). This is further supported by research showing that early home learning environments that include regular informal numeracy activities and parental engagement during daily routines are positively associated with children's mathematical development (Zhao et al., 2023).

Research Question 3: What is the kindergartners' level of inhibitory control as assessed by the teachers?

Table 5 presents the frequency, percentage, and descriptive statistics describing the level of inhibitory control of kindergarten learners as rated by their teachers. The computed mean score is 4.15 (*SD* = 0.70), which falls within the 3.51–4.50 range and is interpreted as high. This indicates that learners generally demonstrate the ability to regulate their behavior, follow rules, and manage impulses during classroom activities. Coelho et al. (2023) further explain that self-regulation skills, including inhibitory control, are positively associated with children's classroom engagement and adaptive behavior, enabling them to follow instructions and participate effectively in learning tasks.

The distribution further shows that 41.86% (54 out of 129) of the learners were rated as very high in inhibitory control, followed by 35.66% (46 learners) rated as high, and 20.93% (27 learners) rated as moderate. Only 1.55% (2 learners) were rated low, and none were classified as very low. This pattern suggests that most learners can control their actions appropriately in structured classroom situations, with only a very small proportion experiencing difficulty in behavioral regulation.

Table 5

Frequency Distribution and Descriptive Statistics of Inhibitory Control

Range	Description	Interpretation	Frequency	Percentage
4.51 – 5.00	Always	Very High	54	41.86
3.51 – 4.50	Often	High	46	35.66
2.51 – 3.50	Sometimes	Moderate	27	20.93
1.51 – 2.50	Rarely	Low	2	1.55
1.00 – 1.50	Never	Very Low	0	0.00
	Total		**129**	**100**
	Mean		**4.15**	
	Interpretation		**High**	
	SD		**0.70**	

No.	Statement	Mean	SD	Description
1.	The student can stop an action immediately when a “stop” signal during activities (e.g., stop–go games).	4.22	0.85	Often
2.	The student can start an action only when the correct signal is given.	4.40	0.73	Often
3.	The student can wait patiently for his/her turn during rule-based games and classroom activities.	4.29	0.91	Often
4.	The student can follow instructions that require doing the opposite action (e.g., clap when told not to clap).	3.91	0.91	Often
5.	The student avoids blurting out answers impulsively.	3.97	0.87	Often
6.	The student stays seated, focused, and attentive during activities that require focus.	3.98	0.94	Often
7.	The student can ignore distractions and continue working when others are moving or talking.	3.98	0.92	Often
8.	The student corrects himself/herself after making a mistake.	4.31	0.82	Often
9.	The student avoids distractions and maintains attention during tasks.	4.03	0.88	Often

10.	The student can change behavior when reminded by the teacher.	4.39	0.80	Often

Examining the specific indicators, the highest rating was observed in starting an action only when the correct signal is given (*M* = 4.40, *SD* = 0.73) and changing behavior when reminded by the teacher (*M* = 4.39, *SD* = 0.80). Learners also showed strong ability in correcting themselves after making mistakes (*M* = 4.31, *SD* = 0.82), waiting patiently for their turn (*M* = 4.29, *SD* = 0.91), and stopping immediately when a stop signal is given (*M* = 4.22, *SD* = 0.85). These results indicate that children are capable of responding to classroom cues and adjusting their behavior according to instructions. This is supported by research indicating that young children's inhibitory control enables them to regulate their responses, follow rules, and adjust behavior based on external cues, which are essential components of self-regulation in classroom settings (Ahmed et al., 2022).

Other behaviors were consistently observed but at slightly lower levels. Learners were reported to maintain attention during tasks (*M* = 4.03, *SD* = 0.88), stay focused during activities (*M* = 3.98, *SD* = 0.94), and ignore distractions (*M* = 3.98, *SD* = 0.92). Similarly, avoiding blurting out answers impulsively (*M* = 3.97, *SD* = 0.87) and following opposite-action instructions (*M* = 3.91, *SD* = 0.91) received the lowest means, although all remained within the "often" category. This indicates that while learners generally regulate their behavior well, more cognitively demanding inhibitory tasks, such as resisting impulses and managing distractions, are slightly less consistent compared to responding to clear external cues.

The results show that kindergartners generally demonstrate a high level of inhibitory control in classroom settings, as reflected by the overall mean of 4.15. Learners were observed to regulate their behavior, follow instructions, wait for their turn, and respond appropriately to teacher cues. Teachers reported that children could stop actions when signaled, start tasks at the appropriate time, and adjust their behavior after reminders. These observed behaviors suggest that learners are able to respond to classroom routines and instructional cues during activities.

Research Question 4: What is the kindergartners' level of numeracy skills?

Table 6 presents the frequency distribution of the kindergartners' performance in number sense and counting. The computed mean score is 6.31 (*SD* = 1.55), which falls within the 6.01–7.00 range and is interpreted as very good. This indicates that, in general, learners demonstrate a very good level of understanding of numbers and are able to perform counting tasks accurately.

Table 6

Frequency Distribution of the Participants' Number Sense and Counting

Score Range	Interpretation	Frequency	Percentage
7.01 – 8.00	Outstanding	66	51.16
6.01 – 7.00	Very Good	42	32.56

4.01 – 6.00	Good	9	6.98
2.01 – 4.00	Fair	6	4.65
1.00 – 2.00	Poor	6	4.65
Total		**129**	**100**
Mean		**6.31**	
Interpretation		**Very Good**	
SD		**1.55**	

The distribution shows that 51.16% (66 out of 129) of the learners obtained an outstanding level, followed by 32.56% (42 learners) who achieved very good performance. Meanwhile, 6.98% (9 learners) were classified as good, 4.65% (6 learners) as fair, and another 4.65% (6 learners) as poor. This pattern reveals that the majority of learners already possess well-developed number sense and counting abilities, while only a small proportion still experience difficulty in basic number understanding.

The findings indicate that kindergartners demonstrate a generally strong level of competence in number sense and counting, as reflected by the overall mean score of 6.31 interpreted as outstanding. More than half of the learners achieved outstanding performance, while a large proportion also fell within the very good category, showing that most children can identify numbers, count objects correctly, and understand number order. Only a small group performed at the fair and poor levels, suggesting that foundational number skills are already well developed among the majority of learners. These results imply that children are acquiring early mathematical competencies that support readiness for more complex mathematical learning.

Table 7 presents the frequency distribution of the kindergartners' performance in recognizing and naming shapes. The computed mean score is 6.22 (*SD* = 1.34), which falls within the 6.01–7.00 range and is interpreted as very good. This indicates that learners generally demonstrate strong ability in identifying and correctly naming basic geometric shapes, meaning that most children can accurately recognize common shapes such as circles, squares, triangles, and rectangles and correctly label them. This also implies that learners are able to distinguish shapes based on their visual properties and apply this knowledge consistently during learning activities.

The distribution shows that 47.29% (61 out of 129) of the learners achieved a very good level, followed by 31.01% (40 learners) who performed at a very good level. Meanwhile, 13.18% (17 learners) were classified as good, 6.20% (8 learners) as fair, and 2.33% (3 learners) as poor. This pattern reveals that the majority of learners have already developed accurate shape recognition skills, while only a small number still experience difficulty in identifying basic shapes.

Table 7
Frequency Distribution of Participants' Scores in Recognizing and Naming Shapes

Score Range	Interpretation	Frequency	Percentage
7.01 – 8.00	Outstanding	61	47.29
6.01 – 7.00	Very Good	40	31.01
4.01 – 6.00	Good	17	13.18
2.01 – 4.00	Fair	8	6.20
1.00 – 2.00	Poor	3	2.33
Total		**129**	**100**
Mean		**6.22**	
Interpretation		**Very Good**	
SD		**1.34**	

The results indicate that learners generally demonstrate a high level of competence in recognizing and naming shapes, as reflected by the mean score of 6.22 interpreted as outstanding. A large proportion of the learners achieved outstanding and very good levels, indicating that most children can correctly identify and label common geometric figures. Only a small number of learners were classified under fair and poor levels, suggesting that difficulties in visual discrimination and shape identification are limited to a few individuals. This pattern indicates that foundational geometric understanding is already established among the majority of learners during the kindergarten stage.

Table 8 presents the frequency distribution of the kindergartners' performance in comparing quantities using the symbols greater than (>), less than (<), and equal to (=). The computed mean score is 5.78 (*SD* = 1.25), which falls within the 5.01–6.00 range and is interpreted as very good. This indicates that learners generally demonstrate strong ability in determining relationships between quantities and applying appropriate comparison symbols, meaning that most children can accurately identify which groups have more, less, or equal amounts and correctly use the corresponding symbols. This also suggests that learners are able to understand basic numerical relationships and apply these concepts consistently during comparison tasks.

The distribution shows that 65.12% (84 out of 129) of the learners achieved an outstanding level, followed by 22.48% (29 learners) who performed at a very good level. Meanwhile, 6.20% (8 learners) were classified as good, 3.10% (4 learners) as fair, and another 3.10% (4 learners) as poor. This pattern reveals that the majority of learners can accurately compare quantities and understand numerical relationships, while only a small portion still experiences difficulty in applying comparison concepts.

Table 8

Frequency Distribution of Participants' Scores in Comparing Quantities Using >, =, <

Score Range	Interpretation	Frequency	Percentage
6.01 – 7.00	Outstanding	84	65.12
5.01 – 6.00	Very Good	29	22.48
3.01 – 5.00	Good	8	6.20
2.01 – 3.00	Fair	4	3.10
1.00 – 2.00	Poor	4	3.10
Total		**129**	**100**
Mean		**5.78**	
Interpretation		**Very Good**	
SD		**1.25**	

The findings show that kindergartners demonstrate a very good competence in comparing quantities using the symbols greater than, less than, and equal, as reflected by the mean score of 5.78 interpreted as outstanding. A large majority of learners performed at the outstanding and very good levels, indicating that most children can determine numerical relationships between sets and apply the correct mathematical symbols. Only a small proportion were classified under good, fair, and poor levels, suggesting that difficulty in relational number understanding is limited to a few learners. This pattern indicates that learners already possess an emerging understanding of quantitative relationships, an important component of early number sense development.

Table 9 presents the frequency distribution of the kindergartners' overall numeracy skills. The computed mean score is 18.31 (*SD* = 2.59), which falls within the 14.01–19.00 range and is interpreted as very good. This indicates that, in general, learners demonstrate a solid level of competence across the combined numeracy domains of number sense and counting, recognizing and naming shapes, and comparing quantities, meaning that most learners can perform these skills accurately and consistently with minimal errors. This also suggests that they have developed a strong foundational understanding of basic mathematical concepts and are able to apply these skills effectively across different numeracy tasks.

The distribution shows that 58.14% (75 out of 129) of the learners achieved a very good level, while 34.88% (45 learners) attained an outstanding level. Meanwhile, 6.20% (8 learners) were classified as good and only 0.78% (1 learner) as fair. No learners were classified under the poor category. This pattern reveals that nearly all learners possess adequate to advanced numeracy skills, with only a minimal number still developing foundational competencies.

Table 9
Frequency Distribution of the Participants' Overall Numeracy Skills

Score Range	Interpretation	Frequency	Percentage
19.01 – 23.00	Outstanding	45	34.88
14.01 – 19.00	Very Good	75	58.14
9.01 – 14.00	Good	8	6.20
4.01 – 9.00	Fair	1	0.78
1.00 – 4.00	Poor	0	0.00
Total		**129**	**100**
Mean		**18.31**	
Interpretation		**Very Good**	
SD		**2.59**	

The large concentration of learners in the very good and outstanding categories suggests that most children can perform various early mathematics tasks accurately, including counting, identifying shapes, and comparing quantities. The very small proportion in the lower categories indicates that difficulties in numeracy are limited to a few individuals. The results reflect that early numeracy competencies are generally well established among the learners, although variations in mastery remain across the group. Salminen et al. (2021) similarly found that young children commonly develop core numeracy skills such as counting, number recognition, and understanding numerical relationships during early childhood, although individual differences in skill levels remain evident.

Research Question 5: Do teacher-child instructional interaction, home numeracy environment, and inhibitory control significantly influence the numeracy skills of kindergartners?

> **H_{o1}:** *The kindergartners' quality of teacher-child instructional interactions, home numeracy environment, and inhibitory control do not significantly influence their numeracy skills.*
> **H_{o2}:** *The kindergartners' instructional interactions with teacher do not significantly influence their numeracy skills.*
> **H_{o3}:** *The kindergartners' home numeracy environment does not significantly influence their numeracy skills.*
> **H_{o4}:** *The kindergartners' inhibitory control does not significantly influence their numeracy skills.*

Table 10 shows the multiple regression analysis predicting Numeracy Skills from Home Numeracy Environment, Inhibitory Control, and Teacher-Child Instructional Interaction. The regression model was statistically significant, $F(3, 125) = 11.3$, $p < .001$, $R = 0.461$, $R^2 = 0.213$. This indicates that 21.3 percent of the variability of Numeracy Skills was explained by the predictors. The remaining 78.7 percent may be attributed to other variables such as language and vocabulary skills, attention span and school-related

factors. Hence, the first hypothesis is rejected. This means that home numeracy environment, inhibitory control, and quality of teacher-child interaction collectively shape the kindergartners' numeracy skills.

Table 10

Regression Analysis of Home Numeracy Environment, Inhibitory Control, and Teacher-Child Instructional Interaction on Numeracy Skills

Predictor	Unstandardized Coefficients		β	95% CI		t	p
	B	SE		Lower	Upper		
Constant	3.10	2.95		-2.73	8.93	1.053	0.294
Home Numeracy Environment	0.47	0.65	0.063	-0.82	1.75	0.719	0.473
Inhibitory Control	0.64*	0.30	0.170	0.05	1.23	2.131*	0.035
Teacher-Child Instructional Interaction	2.92**	0.65	0.393	1.64	4.21	4.508**	<.001

Model Summary

R = 0.461	R^2 = 0.213	Adjusted R^2 = 0.194	F(3,125) = 11.3**	p<.001

*Note. B = unstandardized beta coefficient, SE = standard error, β = standardized beta coefficient, 95% CI = 95% confidence interval, t = t statistic, p = probability value. *Significant at 0.05 two-tailed alpha level. **Significant at 0.01 level.*

Model Equation: N = 0.64I + 2.92T

Legend: N = Numeracy Skills, I = Inhibitory Control, T = Teacher-Child Instructional Interaction

The regression analysis indicates that the predictors, when taken together, significantly influence children's numeracy skills ($F(3,125) = 11.3$, $p < .001$), explaining 21.3% of the variance. Among the variables, teacher–child instructional interaction and inhibitory control emerged as significant predictors, while the home numeracy environment did not show a significant independent effect. Teacher–child instructional interaction demonstrated the strongest contribution ($\beta = 0.393$, $p < .001$), indicating that consistent instructional support, guidance, and engagement in the classroom play a central role in developing children's numeracy skills. This suggests that classroom-based interactions provide structured opportunities that directly support children's understanding of early mathematical concepts.

Inhibitory control also significantly influenced numeracy skills ($\beta = 0.170$, $p = 0.035$), indicating that children with stronger self-regulation abilities tend to perform better in numeracy tasks. Specifically, the regression coefficient shows that for every one-unit increase in inhibitory control, numeracy skills increase by approximately 0.64 units. This highlights the importance of children's ability to regulate attention, control impulses, and

follow procedures during counting and comparison activities. These findings support existing research emphasizing that executive functioning, particularly inhibitory control, plays a key role in enabling children to process numerical information accurately and engage effectively in early mathematics learning tasks (Napoli & Purpura, 2021; Schmitt et al., 2021).

In contrast, the home numeracy environment did not significantly predict numeracy skills ($\beta = 0.063$, $p = 0.473$), suggesting that home-based numeracy activities alone may not directly influence children's mathematical performance when other factors are considered. Although such activities provide opportunities for practice and exposure, their effects may depend on the presence of stronger predictors such as instructional interaction and self-regulation. Overall, the findings indicate that early numeracy development is shaped by the combined influence of classroom experiences and cognitive regulation, with teacher–child instructional interaction serving as the most immediate and influential factor in supporting children's numeracy skills.

Conclusions

The findings of the study indicate that teacher–child instructional interaction and inhibitory control significantly influence the numeracy skills of kindergarten learners, while the home numeracy environment does not show a significant independent effect. This suggests that classroom-based instructional support and children's ability to regulate attention and behavior play a more immediate role in shaping early numeracy development. Learners demonstrated strong performance in foundational numeracy skills, including number sense and counting, recognizing and naming shapes, and comparing quantities, reflecting the combined influence of instructional practices and self-regulation abilities.

The results further emphasize that effective teacher–child interaction, characterized by clear guidance, feedback, and engagement, serves as a key factor in supporting children's understanding of mathematical concepts. Inhibitory control also contributes to numeracy performance by enabling learners to focus, follow procedures, and respond accurately during tasks. Although home numeracy activities provide opportunities for exposure and practice, their influence appears to depend on the presence of stronger instructional and cognitive factors. These findings highlight the importance of strengthening classroom instruction and supporting the development of self-regulation skills, in alignment with the goals of the MATATAG Curriculum, to improve early numeracy outcomes among kindergarten learners.

Recommendations

Based on the findings, kindergarten teachers are encouraged to strengthen teacher–child instructional interaction by incorporating more interactive and inquiry-based strategies such as guided questioning, think-aloud activities, and simple problem-solving tasks. Providing opportunities for learners to explain their answers, compare quantities, and demonstrate counting processes can enhance deeper understanding of numeracy concepts. In addition, integrating classroom routines that support inhibitory control, such

as turn-taking, waiting activities, and step-by-step instructions, may help improve learners' attention and accuracy during numeracy tasks.

School administrators may support these efforts by providing professional development programs focused on improving instructional interaction and promoting learner engagement. Strengthening school-based initiatives that integrate numeracy learning with self-regulation skills is also recommended, along with ensuring the availability of appropriate learning materials that encourage active exploration of numbers, shapes, and quantity relationships. Furthermore, collaboration between schools and families should be promoted by guiding parents on practical ways to support numeracy learning at home.

For parents, engaging children in everyday numeracy-related activities such as counting objects, comparing quantities, and discussing shapes during daily routines is encouraged to reinforce classroom learning. Establishing consistent routines that support attention and self-control can further enhance children's ability to participate effectively in learning tasks. Future researchers are recommended to examine these variables using larger and more diverse samples, explore additional factors influencing numeracy development, and investigate intervention programs that integrate instructional interaction and self-regulation to determine their effects on early mathematics outcomes.

Compliance with Ethical Standards

This study adhered to established ethical standards, with approval secured from the Research Ethics Committee of Lourdes College prior to data collection. The research followed the principles of respect for persons, beneficence, and justice, ensuring that participants' rights, welfare, and dignity were prioritized throughout the study. Permission to conduct the research was obtained from the school authorities, and all procedures were carried out in a manner appropriate for young learners. Informed consent was obtained from parents or guardians, who were provided with clear information regarding the purpose, procedures, potential risks and benefits, confidentiality measures, and the voluntary nature of participation. Assent was also secured from the kindergarten learners using age-appropriate explanations. Participants were informed of their right to withdraw at any time without penalty. Measures were taken to ensure that all activities were safe, non-disruptive, and consistent with regular classroom experiences to protect the well-being of the children. The study complied with the Data Privacy Act of 2012 by ensuring strict confidentiality and anonymity of all participants. Data were coded to remove identifying information, securely stored, and used solely for academic purposes. Only aggregated results were reported, and no individual responses were disclosed. The researcher declares that there is no conflict of interest, no plagiarism was committed, and the findings were interpreted objectively without bias. AI-assisted tools were used only for language refinement and did not influence the data analysis or interpretation of results.

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Corresponding author: *aranconjeffry@gmail.com*