

# Unraveling The Relationship Between Kindergartners' Fine Motor Skills with Their Numeracy Skills

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**ABSTRACT:** *Fine motor skills play a fundamental role in a kindergartner's development, serving as the building blocks for more advanced abilities. The purpose of this descriptive correlational study was to determine the influence of the kindergartners' fine motor skills on their reading and numeracy skills. The study involved 54 kindergartners who were enrolled in a private school in Cagayan de Oro City, Philippines in the School Year 2022-2023. A checklist from Early Childhood was used to assess the fine motor skills of the kindergartners. A researcher-made instrument was also crafted to assess their numeracy. Frequency, mean, percentage, standard deviation and regression analysis were employed to analyse the collected data. The results revealed that the kindergartners' fine motor skills need improvement, while the numeracy skills were good. Fine motor skills significantly influence the kindergartners' numeracy skills indicating that kindergartners with better fine motor skills more likely exhibit good performance on their numeracy skills. The findings suggest that kindergartners have to progress and comprehend numerical concepts. Based on the result of the study, it is recommended that kindergarten teachers may provide remedial instruction or any intervention to assist kindergartners who perform poorly in numeracy skills.*

**KEYWORDS:** *reading skills, numeracy skills, fine motor skills, kindergartners*

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## INTRODUCTION

Fine motor skills are fundamental in the development of young learners, underpinning a variety of critical activities. These skills, which include actions such as writing, grasping, touching, squeezing, picking up objects, and throwing, necessitate precise and skillful hand use. Mastery of fine motor skills extends beyond mere hand dexterity; it is intimately connected to a child's overall physical capability, requiring coordinated body movements for tasks that need balance and precision.

During early infancy, fine motor development typically occurs alongside gross motor development, with most fine motor actions relying on gross motor abilities (Marotz & Allen, 2016). This stage is characterized by curiosity-driven exploration and requires adult understanding and support. Observations of kindergartners during free play, for instance, show their interactions with materials and the progression of these skills (Breuhl, 2020).

As children reach the kindergarten years, there is a notable expansion in their motor function repertoire (Smith et al., 2014), signaling significant development in their ability to manipulate objects and perform tasks requiring intricate hand-eye coordination. These skills are vital for young learners, enabling them to effectively interact with the world around them. This interaction is more than physical; it encompasses a method of learning and engaging that is both participatory and imaginative. Skapik (2021) underscores the importance of experiential learning, a hands-on, task-oriented approach often adopted by parents at home through activities like assisting with meal preparation, writing letters, engaging in playful races, or using stuffed animals for creative play. These experiences not only entertain but also significantly enhance a child's fine motor skills and overall learning.

Furthermore, the development of fine motor skills in kindergartners evolves through various activities, such as pretending to place one object on another and using symbols like numbers. These skills, seen as a critical aspect of a child's growth, are influenced by environmental factors, genetics, muscle tone, and biological sex, and play a significant role in the development of early cognitive abilities (Syfril et al., 2018).

Additionally, mastering basic tasks like holding a spoon is a noteworthy milestone for toddlers, marking a step towards self-feeding and independence. However, young learners often encounter challenges in handling objects such as crayons. During crayon-based activities, they may struggle with control and precision, often resulting in messy outcomes – a normal part of developing fine motor skills and hand-eye coordination.

The motor skills program under discussion incorporated activities aimed at developing both fine and gross motor skills. Presented through game-like scenarios in small group settings, these activities were socially engaging and designed to progressively challenge children based on their individual motor competencies (Hudson, 2020). A specific subset of fine motor skills, known as graphomotor skills, involves the techniques required to operate a pencil, such as proper stroking and holding (Suggate et al., 2019). These activities are crucial for the practice and mastery of fine motor skills.

The COVID-19 pandemic posed unique challenges to the development of fine motor skills in kindergartners. Increased reliance on gadgets, as parents and teachers navigated the shift to learning at home, presented obstacles to traditional forms of motor skill development. The National

University (2021) indicated that excessive technology use could lead to social and behavioral issues in children due to reduced physical interaction. Despite these challenges, digital media, with its engaging animations, images, sounds, and music, offered some educational benefits, as suggested by Nurazka et al. (2021).

However, researchers like Hall (2021) and Arnanza (2021) observed a marked decline in fine motor skills during the pandemic. The restrictions of home confinement limited children's opportunities for social interaction and physical activities, which are crucial for developing motor skills and abilities like writing. McGlashan (2017) noted the importance of manual dexterity in kindergartners' school activities, which was impacted due to these limitations.

This period of limited physical activity and outdoor play altered children's physical behavior and dietary habits (Woods et al. 2020; She et al. 2020), emphasizing the need for a balanced lifestyle for healthy development. Studies have shown that a lack of physical activity can adversely affect children's health and movement skills (Baysun & Akar, 2020; Hidayat et al. 2020).

Sutapa et al. (2021) highlighted that early childhood is critical for stimulating motor abilities and nervous system development. The natural environment provides diverse learning opportunities beneficial for motor development (Drenowatz, 2020), as categorized into fine and gross motor skills by Aslan (2016). Wiyani (2016) and Balci (2016) emphasized the importance of both external and internal stimulation in children's growth and development, particularly through daily activities under adult supervision.

The shift to online teaching introduced new challenges, underscoring the importance of parental involvement in children's activities. Goodman (2020) highlighted the need for developing muscle strength and control in children's hands and wrists through activities like drawing, folding, cutting, tearing, and crumpling, which are vital for fine motor development.

Fine motor skills are crucial for kindergartners' daily routines, including tasks like dressing, bathing, and eating, as well as academic tasks like handwriting (Vivi, 2021; Greutman, 2020). At home, everyday activities like folding clothes, arranging toys, and wiping tables can help develop these skills (Moises, 2016). Nevertheless, the pandemic's restrictions meant many children lacked adequate practice in these areas.

Developing dexterity and agility is essential for enhancing fine motor skills in young learners (Waterford-lakes, 2019). These skills in the early years are predictive of later academic achievement, particularly in mathematics (Macdonald, 2018; de Waal, 2019; Fernández-Méndez, 2020; Dinehart & Manfra, 2013). Barnett (2021) noted that the closure of playgrounds and reduced use of worksheets during the pandemic impacted children's hand functions. Techniques like pushing, pulling, or kicking, as proposed by Bardid (2017), can be effective early interventions.

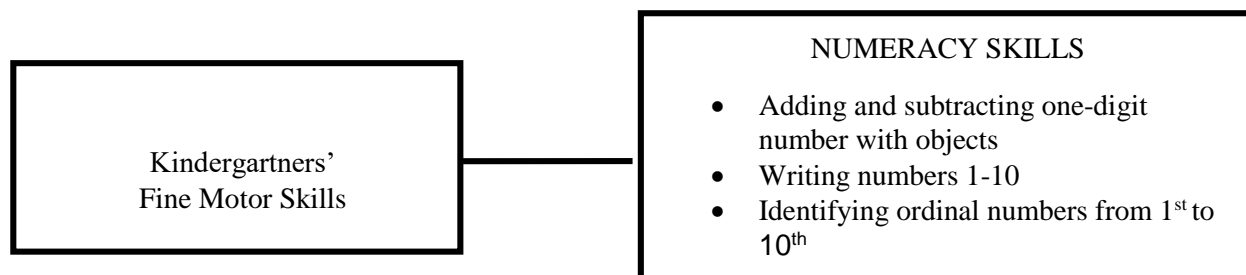
Furthermore, the use of mobile technology impacts the development of fine motor skills (Guddemi, 2016). Hand-eye coordination, crucial for various activities, develops through physical actions. Johor et al. (2020) noted that proper handling techniques aid in developing numeracy skills through play.

Young learners often need assistance with tasks like kneading clay or coloring, skills typically nurtured at home and developed in school (Syafril et al. 2018). Research by Barrocas (2020) has shown correlations between fine motor skills, finger gnosis, and mathematical abilities. However, the mechanisms linking fine motor skills to mathematical proficiency are not fully understood (Stramel, 2021).

Preschool educators hold a pivotal role in the mental development of children, particularly in areas such as mathematics, by offering engaging and resourceful materials in both domestic and educational settings. The cultivation of fine motor skills is essential for young learners to effectively explore and interact with their surroundings, necessitating the provision of dedicated guidance and support from adults. The emergence of the COVID-19 pandemic has underscored a significant gap in research concerning the effects of altered lifestyles on the development of these skills and their correlation with academic achievements (Albert, et al., 2021).

The transition to more sedentary lifestyles (Wachira, 2021), heightened dependency on technological means for learning and entertainment (Cladis, 2020), and the decreased opportunities for physical engagement and social interaction during the pandemic (Son, et al., 2021) have prompted serious concerns regarding their impact on the fine motor skill development of young learners. Despite noting a decline in these skills, there remains a conspicuous absence of in-depth research investigating the direct outcomes of these lifestyle changes on fine motor skill development and their connection with academic skills, particularly in numeracy.

This evident lack of research underscores the need for urgent and targeted investigations to thoroughly understand these implications. Such research is crucial not just for developing effective strategies and interventions to support the advancement of fine motor skills in young children during challenging periods, but also for initiating novel approaches in early childhood education. By addressing this research gap, the opportunity arises to transform a period of global adversity into a driving force for long-lasting educational progress, ensuring that the youngest learners are equipped with the skills and resilience to prosper in a constantly changing world. Hence, this study is conceptualized.



**Figure 1: The Schematic Presentation of Variables in the Study**

### **Objective of the study**

This study intended to determine the influence of fine motor skills with the kindergartners' reading and numeracy skills of a selected private school in Cagayan de Oro City.

### **METHODS**

This study intended to find out if the fine motor skills of kindergartners have bearing on their reading and numeracy skills. The study was delimited only for the kindergartners aged 5 years old. There were fifty-four (54) kindergartners enrolled in the SY 2022-2023 who participated in this research. It was a private school in Cagayan de Oro City.

This study used the descriptive-correlational research design. According to Fowler (2013), descriptive-correlational research design refers to information that has been analysed in order to reveal the basic features of data collected or used in a study. Moreover, he stated that statistical data can either be used for further research studies or as independent entity that can be used to make conclusions. Since, this study focused on the kindergartners' fine motor skills and its influence to their reading and numeracy skills during the time of pandemic, the researcher deemed the descriptive-correlational research design appropriate.

Descriptive correlational design is used in research studies that aims to provide static pictures of situations as well as establish the relationship between different variables (McBurney and White, 2009). This research is more concerned with what, rather than how or why something has happened. Therefore, observation and survey tools are often used to gather data (Gall, Gall, & Borg, 2007).

## RESULTS AND DISCUSSION

**Table 1 Summary Results for the Kindergartners' Numeracy Skills**

Numeracy Skills	Weighted Mean	Interpretation
Adding and Subtracting One-Digit Number	5.46	Good
Writing Numbers 1-10	8.98	Very Good
Identifying Ordinal Numbers 1 <sup>st</sup> to 10 <sup>th</sup>	5.52	Good

Table 1 provides a concise summary of the numeracy skills exhibited by the kindergarteners. The data reveals that their ability to write numbers 1 to 10 is notably proficient, earning a classification of 'very good'. In contrast, their performance in other numeracy skills, while still commendable, is categorized as 'good'.

Table 2 presents the regression analysis showing the influence of kindergartners' fine motor skills on their numeracy skills.

**Table 2 Regression Analysis Showing the Influence of Kindergartners' Fine Motor Skills on their Numeracy skills**

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	11.24	3.81		2.95	.005
Fine Motor Skills	4.42	1.89	.308	2.34*	.023

### Model Summary

R = .308    R<sup>2</sup> = .095    Adjusted R<sup>2</sup> = .078    F = 5.45\*    p = .023

\*significant at 0.05 level

The findings indicate the statistical significance of the model (F = 5.45, p = .023). Consequently, the null hypothesis, which posits that kindergartners' fine motor skills do not significantly influence their numeracy skills, is rejected. It becomes evident that kindergartners who have developed their motor skills effectively tend to exhibit higher levels of numeracy proficiency.

In contrast, the model summary presents an R coefficient of 0.308, suggesting a relatively low correlation between the model and the dependent variable, which in this case is numeracy skills. The adjusted R-squared value of 0.078 implies that only 7.8 percent of the variation in numeracy skills among kindergartners can be attributed to the predictor variable, fine motor skills. This

demonstrates that fine motor skills have a limited explanatory power when it comes to understanding variations in numeracy skills.

The analysis of variance results ( $F = 5.45$ ,  $p = 0.023$ ) presents a different picture, indicating that kindergartners' fine motor skills indeed significantly predict their numeracy skills. This finding suggests a noteworthy connection between fine motor skills and numeracy abilities among kindergartners.

Additionally, the figures provide valuable insights: for every unit increase in their fine motor skills, there is a corresponding 4.42 increase in their numeracy skills ( $t = 2.34$ ,  $p = .023$ ). While this correlation is statistically significant, it remains at a relatively low level ( $R = .308$ ). In practical terms, this implies that fine motor skills have a moderate influence on numeracy abilities among the subjects.

However, it is important to note that only 7.8 percent of the variability in their numeracy skills can be attributed to their fine motor skills. The remaining 92.2 percent of variability likely stems from other unexplored variables not covered in this study, such as gross motor skills, cognitive development, or working memory. These factors may play significant roles in shaping the numeracy skills of the subjects and warrant further investigation.

The results further indicate a significant influence of kindergartners' fine motor skills on their numeracy abilities. This suggests that changes in numeracy skills among kindergartners can indeed be attributed to variations in their fine motor skills. From a researcher's perspective, it's important to consider other potential factors that might influence kindergartners' numeracy skills beyond fine motor skills. These factors could encompass parental influence, the attitude and teaching methods of teachers, as well as the learners' own attitudes.

These findings align with the research conducted by Pitchford (2016), who also found that fine motor skills served as a strong predictor of early math ability. Furthermore, several authors, such as Son and Meisels (2006), Grissmer et al. (2010), Pagani et al. (2010), Cameron et al. (2012), and Dinehart and Manfra (2013), have previously highlighted the significance of fine motor skills in early childhood as predictors of later academic achievement, particularly in the domains of reading and mathematics.

However, it is important to note that as children progress in their numerical understanding and begin to count and assign names to quantities, language skills start to play a pivotal role in their arithmetic learning. Moreover, a well-developed language system becomes essential for constructing and solving more complex arithmetic problems, as noted by Butterworth (2005). Thus, while fine motor skills are a valuable factor, they interact with language development in shaping a child's mathematical abilities.

Findings were also found to be similar of the study of Kang et al. (2023) which have shown that there is a positive connection between fine motor skills and math ability, and individuals with higher fine motor skills develop better math skills. Meta-analysis of the study of Kang et al. (2023) has theoretical and practical implications. Theoretically, research supports the idea of cognitive learning theory and cognitive load theory that motor skills are closely related to math ability, and clarify the academic debate about the relationship between early fine motor skills and math ability. Practically, this study shows that teachers should focus on developing basic motor skills in early childhood and use effective motor skills teaching methods to improve children's fine motor skills to improve math ability.

In another unique study completed by Wei (2016), a three-month qualitative study was conducted to investigate the effects of planned folk games on children's fine motor skills. Four- to five-year-old public urban kindergarten students in China learn fine motor skills three times a week for 40-50 minutes. Using observations, Wei concluded that, in general, fine motor skills increased in people who participated in folk games. Children show improvement in squeezing, touching, drawing, and cutting (Wei, 2016).

Looking at the information and data above, it can be concluded that fine motor activities have been proven to promote growth, further development and improve fine motor skills. Result of various studies confirmed the above findings on the influence of fine motor skills on numeracy skills. For example, Derman, Zeteroglu and Arzu (2020), Hamilton & Liu (2018), McGlashan et.al (2017), Wei (2016) and Ohl et al. al (2013) all showed consistent results confirming the importance, value and importance of planned and meaningful fine motor activities in developing children's skills.

## **CONCLUSION**

The findings of this study offer essential insights for early childhood education, emphasizing the need for a comprehensive approach in educational strategies and curriculum design.

A critical observation from these findings is the necessity to improve fine motor skills among kindergartners. This indicates that early educational programs should incorporate specific activities aimed at developing these skills. Given the close connection between fine motor skills and cognitive development, enhancing these skills could positively impact overall academic performance. Engaging children in activities like drawing, cutting, and manipulating small objects can refine their motor skills while supporting cognitive growth, laying a foundation for future academic achievements.

Moreover, the findings reveal a strong base in basic numeracy skills among kindergartners, as evidenced by their competence in simple arithmetic operations and number writing. This proficiency suggests that educational curricula should continue to nurture and build upon these early numeracy skills, facilitating a smooth transition to more complex mathematical concepts.



The significant influence of fine motor skills on numeracy skills also highlights the benefit of an interdisciplinary approach in early education. Integrating activities that develop fine motor skills with numeracy learning can enhance both aspects simultaneously, fostering a dynamic learning environment and paving the way for early interventions. Targeted support for children struggling with fine motor skills could potentially reduce future difficulties in numeracy and other cognitive areas.

These insights are crucial for educational policymakers and researchers, emphasizing the need for comprehensive early childhood education programs that address both physical and cognitive development. Such programs, recognizing the interconnectedness of motor and cognitive skills, could lead to more effective educational strategies and policies.

Support for these findings comes from Lev Vygotsky's theory of scaffolding, which stresses the importance of providing young learners with necessary support to develop fine motor skills. Furthermore, theories like the Zone of Proximal Development and the Integrated Theory of Numerical Development support the observed correlation between fine motor skills and numeracy, advocating for educational practices that consider the comprehensive development of children.

As a whole, these findings advocate for an education system that understands the intricate connection between physical skills, such as fine motor control, and cognitive abilities like numeracy. They call for a holistic and dynamic framework in early education that supports the overall development of young learners.

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