Exploring Relationships among Chopstick Use in Preschool Years and Writing and Math Development in Elementary Years

by

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DISSERTATION ABSTRACT

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Title: Relationships among Chopstick Use in Preschool Years and Writing and Math Development in Elementary Years

This study investigates the relationship between preschool chopstick use and early elementary academic achievement in writing and math. Building upon prior research linking chopstick usage to enhanced fine motor skills and brain activity, the study examined whether early exposure to chopsticks relates with improved academic performance. A statistically significant positive relationship was found between chopstick use and writing achievement, but not in math. While factors such as gender, age, and maternal education may have influenced the results, this study provides preliminary evidence suggesting that early chopstick training could positively impact writing skills in young children.

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DEDICATION

To my parents, who taught me the value of hard work and the importance of education. To my family, for their unwavering love and support. For my husband who cooked every meal since I started my doctorate courses. To my children, may you always find joy in learning and passion to reach all your dreams.

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CHAPTER I

INTRODUCTION

"Exploring Relationships among Chopstick Use in Preschool Years and Writing and Math Development in Elementary Years" examines the potential relationship between early chopstick usage and the influence it may bear upon children's academics in math and writing. However, this study actually begins with my own childhood. I can remember my mother correcting my chopstick technique, how I held them, how I used them to manipulate food on my plate. She would tell me that people would make judgments about my character just by watching how I used chopsticks. Needless to say, I spent many hours perfecting my form. Now, as an adult with children of my own, I continue to reflect on chopstick use. Both of my children were able to maneuver chopsticks prior to one year old and were proficient by the age of two. They also met their typical age milestones ahead of their peers and this has led me to wonder about the impact that the use of chopsticks might have had on their fine motor development and what relationship that might have had on their academic learning. Over two decades ago, Wong (2002) found that both fine motor and visual motor skills, the foundation of academics, are necessary for chopstick maneuvering. Would early exposure to chopsticks build fine motor skills that can contribute to pencil grip and control, detailed drawing, and the ability to form letters which then increases the opportunity for early exposure and learning of the writing process?

My children learned to use chopsticks through observation and trial and error, aligning with research showing children learn by observing parents. In fact, Osera et al. (2018) found a statistically significant relationship between mothers' chopstick usage and their children's chopstick usage. While this specific research focused in Japan, it could be broadened to children who use chopsticks regularly. The sole purpose of chopsticks for my children was for eating

using a traditional and culturally relevant tool. Historically, chopsticks were used for efficient eating 5000 years ago in China (California Academy of Science, n.d.). Beyond practicality, I have wondered if there are additional benefits that can come from this experience. Could this common eating tool have a significant impact on the academic experiences that contribute to the observed excellence of Asian American students?

The perception of Asian Americans as a "model minority," achieving exceptional academic success, is a prevalent stereotype. It is true that currently the category of Asian, scores higher than all other identified races in both reading and math, as identified on The Nations Report Card (2011), however, this myth has a deep root in racialized narratives and has significantly impacted learning opportunities for students of color. To truly understand the Model Minority myth, we must begin with the historical construction of Black inferiority and the systemic oppression that accompanied it. This historical foundation is essential for understanding how the "model minority" narrative was constructed, often in contrast to and at the expense of other minority groups.

Asian American History

The history of Asian immigration to the United States is marked by periods of both opportunity and intentional racism. Prior to World War II, Asian immigrants, primary Chinese and Japanese, faced significant racism while also contributing essential labor that has shaped the United States. Before World War II, the Chinese and Japanese individuals sought work in the United States, facing persistent racism despite their contributions. For example, in 1863, Chinese laborers played a crucial role in constructing the Transcontinental Railroad. Later, in 1868, Japanese immigrants immigrated to Hawaii to work in sugarcane fields and other work in the United States. However, during this time, the Chinese and Japanese faced intense racism. The

laws were also not on their side. For example, the 1882 Chinese Exclusion Act banned Chinese laborers from immigrating and led to the return of many Chinese to China (Loh-Hagan, 2022; Orfano & Denshō, 2021). Subsequently, the Gentlemen's Agreement, beginning in 1907, while allowing some Japanese individuals to remain in the United States, denied them fundamental rights, such as land ownership (Denshō, 2024; Imai, 2024). Throughout these fluctuating policies, both Chinese and Japanese communities faced immense pressure and were forced to adapt to ever-changing circumstances including Japanese internment camps that stripped the Japanese of all rights in the 1940s (Loh-Hagan, 2022, Cheng, 2021). Despite their contributions to the nation's economy, they were subjected to discriminatory laws and societal racism. The necessity of developing survival skills to navigate the pressures of change was essential and important to note as we think about Asian excellences today.

Asian American Excellence

The idea of "Asian excellence" is often superficially linked to the Model Minority Myth, which expects or assumes Asian populations to outperform other racial groups in areas like income, education, and crime rates, while ignoring underlying social factors and racial history. This narrative begins with the United States intentionally creating a hierarchy of positioning Black Americans as inferior to other races, especially Asian Americans, attributing their struggles to deficiencies rather than systemic racism. In the 1950s, during the Black civils rights movement, as demands for equal rights in housing and education increased, the United States utilized Chinese and Japanese Americans as counterexamples to Black Americans, arguing that the Asian, perceived successful, demonstrated equal opportunities, therefore, there was no need for civil rights legislation (Orfano & Denshō, 2021). While race as a hierarchy and Model Minority was being propagated within the nation prior to 1966, it was proclaimed by Pettersen's

(1966) *New York Times* article, “Success Story, Japanese American Style; Success Story, Japanese American Style”. While the story may appear complimentary, it was continuing to construct the racial hierarchy, pitting Asian Americans against other minority groups, particularly to perpetuate Black inferiority also known as anti-Blackness (Blackburn, 2019). This myth also creates a stereotype of Asian American needing to be compliant, quiet, and hardworking. Thus, the historical construction of Asian Americans, including a multitude of ethnicity and often Pacific Islanders, as a monolithic 'model minority' in the United States, while seemingly positive, has reinforced racial hierarchies and Black inferiority ultimately perpetuating harmful racism (Wu, 2023).

The pressure for Asian Americans to assimilate into white dominant American culture was driven by the need to avoid the continuous racism rathe persistent challenges of systemic racism. During and after World War II, after the Japanese American internment camps and revolving door of legislations for the Chinese and Japanese caused many Asian Americans to adopt behaviors and values deemed "American." While the experiences were predominately centered around Chinese and Japanese Americans, it would be irresponsible to not mention that other ethnic groups in America also experienced discrimination and racism. The mere view of Asian Americans, as a monolith group erased the history, culture, language, experiences and traditions of many ethnic groups (Center for Asian American Media, 2020). Nevertheless, the force of assimilation created the invisibility of the Asian Americans, however, the community could be strategically publicized to reinforce racial hierarchies. As Erika Lee (PBS, 2018, 3:22) explained, “the "good Asian American" was portrayed as one who prioritized American identity, embraced Christianity, worked diligently, and expressed gratitude,” essentially assimilated and invisible to the white dominant culture. In essence, the assimilation and invisibility of Asian

Americans was not merely a matter of individual choice, but a complex interaction with the ongoing systems of racism, where they were used to uphold white dominance (Wu, 2023).

To analyze the potential academic impacts of chopstick use, it's important to dive into the diverse ethnicities in the United States. Again, the term "Asian", a broad category used in the United States to create an artificial group, is inclusive of many cultures and ethnicities with unique experiences (Monte, L. M. & Shin, H. B., 2022). While not all Asian cultures use chopsticks, their usage is prevalent. Chopsticks are a common tool used in Eastern Asian areas including Chinese, Vietnamese, Japanese, and Korean and Nepali cultures for eating (Zuckerman, 2015). According to the most recent United States Census Bureau data, the top six Asian American groups in the United States by population are Chinese, except Taiwanese (5.2 million), Asian Indian (4.8 million), Filipino (4.4 million), Vietnamese (2.3 million), Korean (2.0 million) and Japanese (1.6 million); which is roughly 20 million people in the United States (Census Report, 2023). Contrary to chopstick use, Filipinos' cultures typically use forks and spoons, and Asian Indians use their hands as their primary tool (Zuckerman, 2015; Hegde et al, 2018). Globally, there are approximately 4.64 billion people who identify themselves as Asian in the world, more than double the 1974 count of 2.35 billion (The World Counts, 2024). An increase of more than a half billion is projected for the next 50 years, which would mean a worldwide population of 5.27 billion Asians in 2074. The large number of Asians in the world is one reason the current study on chopstick usage might have substantial practical implications.

Although the United States' social and racial history is a significant factor, since 1990, NAEP data (1990, 2003, 2019, 2022, 2024) indicates that students identifying as "Asian" have, on average, outperformed other racial groups. NAEP assessments prior to 1990 were not accessible on their website. This trend may be influenced by cultural values within certain East

Asian American communities, such as a strong emphasis on education, academic achievement and emphasis on higher education (Hsin & Xie, 2014; Kao, G, 2998; Portes & Zhou, 1993). Again, it's crucial to avoid generalizations, as educational outcomes vary significantly among Asian. Note that NAEP offers both options of Asian and Pacific Islander. The term "outperforming" should be interpreted cautiously due to the diverse factors influencing test scores. Furthermore, the "model minority" myth can obscure the challenges faced by some Asian students and perpetuate harmful stereotypes. The historical context of racism, rooted in anti-Blackness, also impacted Asian Americans, necessitating adaptability and invisibility for survival. Beyond the history and the continued racism of the present, it's worth exploring potential commonalities within these East Asian communities, who are prevalent in the United States as academically strong, that contribute to current academic success. One such tangible element is the shared practice of using chopsticks.

More than a Tool

Perhaps my mom's desire to perfect my chopstick use and form so that people would not make negative judgments about my character has implications beyond character formation. Specifically, if the intricate manipulation required for chopstick use during early childhood significantly enhances fine motor skills and hand-eye coordination—both of which are foundational for later academic success in literacy and numeracy—then this seemingly simple tool could offer a practical and engaging method of learning. Imagine the benefits of children developing crucial pre-writing skills through the precise grasping and movement needed for picking up small food items or improving spatial reasoning by coordinating their hand movements to navigate food with chopsticks to their mouths. This practical, culturally embedded activity could potentially serve as a valuable, accessible, and enjoyable pathway to school

readiness skills, as supported by research highlighting the importance of early motor skill development for academic achievement (Olmore, 2016). By integrating such culturally relevant practices into early childhood education, we might unlock new pathways for enhancing children's developmental readiness.

CHAPTER II

LITERATURE SYNTHESIS

Although chopsticks are commonly used eating utensils, they may also have the potential to influence a child's educational journey as a tool that increases fine motor development in early learning (Olmar, 2016). Considering the developmental requirements of students as they enter school and the relationships between chopstick proficiency and academic achievement, there is a compelling argument for exploring this potential relationship further. As I searched the literature, I found no peer-reviewed articles that examine whether early proficiency with chopsticks, or simply chopstick usage, predicts academic performance in primary school.

Process Used to Identify Sources for Inclusion

In the process of preparing and writing this Literature Synthesis, I initially used a series of search terms such as *chopsticks*, *fine motor*, *literacy*, *mathematics*, *writing*, *academic achievement* and *early learning* as I searched through Academic Search Premier, ERIC, Psychology and Behavior Sciences Collection, and Google Scholar. This search was expanded to include terms like "predictor" and "indicators". Additionally, I searched using the terms *mother's education*, *chopstick holds*, *impacts of chopsticks*, *cognition*, *gender*, and *relationship*. As I continued to read articles, I made notes of additional research that could contribute to my study and searched directly for those sources.

Use of AI

ChatGTP (OpenAI, 2023) and Gemini (Google, 2025) were used in three ways including translation, theme analysis and editing. While they were used for these purposes, the translations were corrected by human translators and the questions were piloted with native speakers. I

reviewed each of the thematic analysis and verified the frequency counts and considered and reviewed every edit that suggested.

Early Skills and Later Achievement

Early childhood development is built upon a foundation of interconnected skills, each playing a crucial role in a child's overall learning trajectory. In educational research, there is continuous ongoing discussion about how young children learn. We know that basic understanding of math, reading, writing, and both cognitive and motor skills are important for school. However, the understanding of the interconnected development of different contents, literacy (reading, writing, listening, and speaking), cognitive and motor skills, and mathematics, are what educators strive to continue to understand in order demystify how little human brains learn best (La Paro & Pianta, 2000).

Early Learning Academic Impacts

The Power of Writing

In multiple subject areas, throughout a student's educational day, writing is integrated and a necessity for academic success. The National Assessment of Educational Progress (NAEP) measures academic progress by administering various subject-area assessments throughout the nation including writing. According to the 2011 U.S Department of Education, NAEP reports show that only 27% of eighth grade and 27% of twelfth grade students demonstrated proficiency in writing skills nationwide. This national writing assessment sample was taken by 24,100 eighth graders and 28,100 twelfth graders, a significant sample size. With the large gaps in writing achievement and the criticality of writing in everyday education, establishing literacy skills earlier in a child's education is imperative, even at an early age.

The ability to write one's name upon entering kindergarten is widely recognized as a pivotal milestone, often serving as a strong predictor of future academic success. A compelling study conducted in England, Scotland, and Australia provides evidence highlighting the critical link between early writing skills and subsequent academic achievement. In this research, Copping et al. (2016) assessed the writing abilities of 14,932 students between 2011 and 2013. Participants were tasked with writing their names, and teachers evaluated their attempts using a six-point Likert scale, ranging from 0 to 5. The findings revealed a significant relationship between a child's ability to write their name and their performance in reading, phonological awareness, and mathematics. Interestingly, the length of the child's name showed no correlation with these academic outcomes. While not explicitly stated in the study, it can be inferred that the crucial factor is not the letters themselves, but rather the child's ability to form and write those letters. Although the study was conducted outside the United States, its findings are likely generalizable to American educational practices, given the shared language and similar early literacy development principles. Thus, this highlights the importance of beginning writing skills early on in a student's schooling prioritize the development of fine motor skills and shape formation in early childhood which then impacts their later academic outcomes.

Handwriting and Speed

Studies highlight the significant relationship between fine motor skills, orthographic awareness, and the development of essential writing and reading proficiencies in young learners. Writing requires fine motor hand and hand-eye coordination while reading requires fine eye movements for tracking, both of which are strengthened with chopstick usage (Luo et al., 2007). Berninger et al. (1992) analyzed data from 300 first, second, and third grade students, looking particularly at the developing skills of beginning writers. They concluded that the developmental

level of orthographic, neuromotor, and orthographic-motor integration skills was related to the achievement level in handwriting and composition, underlying essentials for beginning writers.

Hooper et al. (2010) analyzed data that included core language abilities, prereading skills, and material education at preschool. Handwriting proved to be a significant indicator of later writing achievement, but early writing concepts, phonological processing, and knowledge of writing concepts did not. Fine motor skills speed and coordination reportedly are the first of the writing skills (Dinehart, 2015; Hooper et al., 2010). Without these beginning skills of letter formation and speed, it is challenging to demonstrate higher order skills of writing. There is considerable evidence that fine motor speed and coordination are strong predictors of writing fluency as students learn to write in the primary grades. What complicated the issue was the conflicting research including Costa et al. (2018) reported that in their study fine-motor skills in writing, such as speed, coordination, and other linguistic functions beyond orthographic processes, did not have significant predictive power. In their study, orthographic processes were the most predictive of writing, along with executive functioning, in first grade. Therefore, while Costa et al. (2018) highlighted the importance of orthographic processes and executive functioning in early writing development, this widens the debate of the various factors that impact of fine-motor skills and continues the ongoing debate.

The development of writing fluency relies heavily on a set of foundational skills, with handwriting and writing speed being particularly significant. Among these, handwriting and writing speed may be particularly crucial prerequisites. Breaking it down even further, Berninger et al. (1992) found that measures of low-level development are strong predictors of handwriting, spelling, and composition abilities. They define “low level” as the rapid and automatic production of alphabetic letters, quick encoding of orthographic information, and the speed of

sequential finger movement. The significance of automaticity in handwriting cannot be overstated, as it directly impacts a child's ability to write effectively. If foundational skills remain underdeveloped, and there is a lack of fine motor development necessary for writing, then higher-level skills, such as complex sentence construction, essay composition, and critical analysis, would consequently be compromised, hindering academic progress and overall literacy development.

The Power of Math

The foundational importance of early math skills in predicting long-term academic success is underscored by both research and recent national assessment data. Duncan et al. (2007) confirmed that both early reading and math skills are powerful predictors of later academic achievement, with mathematics demonstrating a particularly significant influence. However, the 2022 National Assessment of Educational Progress (NAEP) data indicate a significant decline in mathematics proficiency among fourth and eighth-grade students compared to 2019. According to NAEP (2022), of the fourth and eighth grade students who participated in the nationwide assessment in math, there was a decline in scores between 2019 and 2022, one of the largest since 1990 (NAEP, 1990, 2019, 2022). Only 37% of students in the fourth grade and 27% of students in the eighth grade scored in the *proficient* range on the 2022 NAEP math assessment. Whereas, in 2019, 41% of students in the fourth grade and 34% of students in the eighth grade scored in the *proficient* range. Therefore, the consistent predictive power of early math skills, coupled with the alarming recent decline in national proficiency, creates an alarming focused and sustained effort to strengthen early mathematics education and ensure future academic success.

Subsequently, Duncan et al. (2007) research indicates strong predictive power of early math and reading skills on later academic achievement, with math skills showing a particularly significant influence. To explore this, the research team conducted six studies examining school readiness across three domains: academic skills, attention, and social-emotional development. Recognizing the ongoing debate about kindergarten readiness—whether to prioritize academic/behavioral skills or social-emotional development—the researchers focused on isolating factors contributing to later academic success. During this study, early childhood programs have faced complexities due to two contrasting views of kindergarten readiness where one emphasizes academic or behavioral readiness and the other focusing on social-emotional preparation. The researchers concentrated their efforts on isolating factors contributing to the later academic success of students. Their findings identified math skills as the most predicative of academic success. In a replicated study, Romano et al. (2010) reported not only similar findings, but also that kindergarten math skills emerged as the most significant predictors of socioemotional behaviors. Consequently, the evidence strongly suggests that investing in early mathematics education is paramount, as it lays a vital foundation for both academic achievement and the development of essential social-emotional skills.

The Power of Literacy

The intricate relationship between early reading skills and later writing proficiency is a subject of interest for educators, with research consistently demonstrating the predictive power of foundational reading abilities. This is particularly evident when examining the role of phonological awareness and orthographic knowledge as precursors to successful literacy development. As a predecessor of writing, the predictive power of reading which is evident as reported by Furnes and Samuelsson (2009), who investigated 906 same-gender twins from the

United States, Austria, and Scandinavia to analyze the influence of preschool cognitive and language abilities on reading and spelling skills at the end of first grade. Their results indicate that phonological awareness and print knowledge are the strongest predictors of early reading and spelling across language orthographies. As discussed previously, orthographic process, which includes conventions and spelling, is a strong predictor of writing. Similarly, orthography in reading is a strong predictor of later reading and writing success. Hooper et al. (2010) found that the level of prereading skills and core language abilities just before entering kindergarten significantly predicted the rate of growth in written language during grades 3-5. Therefore, there is evidence across studies that focuses on the foundational importance of early reading skills, particularly phonological awareness and orthographic knowledge, in laying the basis for both reading and writing proficiency.

The Power of Cognitive Development

The foundational relationship between motor skills and cognitive development, particularly in early childhood, is a critical area of study for understanding how children learn and develop. Research consistently highlights the interconnectedness of these domains, suggesting that enhancing motor skills can positively influence cognitive functions and, subsequently, academic achievement.

To begin, Fels et al. (2014) conducted a comprehensive systematic review, analyzing 21 studies involving children aged four to sixteen. Their findings revealed a moderate correlation between motor skills and higher-order cognitive functions, though the strength of this connection varied across individual studies. Building upon this, Hooper et al. (2019) explored the role of executive functioning in three-year-olds, demonstrating its significant contribution to pre-literacy skills such as print knowledge, phonological awareness, and pre-writing abilities, even after

controlling for potential confounding factors. This study underscores the direct impact of executive functions, a key component of cognitive development, on the acquisition of foundational academic skills.

Further solidifying this theoretical link, Gandotra et al. (2022) conducted a meta-analytic study, confirming the relationship between motor skills and executive functions, specifically response inhibition, working memory, and cognitive flexibility. Diamond's (2002) neuroimaging research provides a neurological basis for this connection, suggesting that motor and cognitive tasks share brain activation pathways, reinforcing the idea that these domains are deeply intertwined.

Adding a unique perspective to this discourse, Shimomura et al. (2020) hypothesized that the use of chopsticks could enhance cognitive skills through improved hand-brain coordination. While their study focused on brain activity during non-dominant hand chopstick learning, they observed a significant increase in premotor cortex activity, highlighting the cognitive benefits derived from fine motor skill practice. Although the study specifically targeted chopstick manipulation with the non-dominant hand, it provides evidence of the connectedness between fine motor skills, brain activity, and cognitive development. Finally, Cheung et al. (2021) emphasized the reciprocal relationship between gross and fine motor skills, noting that improvements in one area positively influence the other. This bidirectional interaction suggests that nurturing both gross and fine motor skills is essential for maximizing cognitive growth in early childhood.

Nurturing both gross and fine motor skills simultaneously not only enhances each skill set individually but also creates an intricate and important positive effect on cognitive growth.

Therefore, the emphasis on motor skill development in early childhood is critical to maximize cognitive potential in the early years to lay a strong foundation for future learning.

The Power of Fine Motor Development

The development of fine motor skills serves as a fundamental prerequisite for early learning, directly impacting academic success. In the United States children in kindergarten, second, and fourth grade engage in fine motor activities 37.1% to upwards of 60.2% of their school day (Caramia et al., 2020). Learning letter and number formation, control of writing utensils, and moving small items around are prevalent activities in kindergarten classrooms all over the United States. In addition, fine motor skills encompass rapid, automatic production of alphabetic letters, rapid coding of orthographic information, and speed of sequential finger movement (Berninger et al., 1992) as a foundation for kindergarten and first grade writing. Numerous studies have concluded positive relationships between fine motor skills and student achievement (e.g., Cameron et al., 2012; Grissmer et al., 2008; Luo et al., 2007). Grissmer et al. emphasized their predictive power between fine motor skills and academic achievement, identifying them as a significant predictor of future math and reading performance, unlike gross motor skills, which were less predictive. This predictive significance for math persists even when controlling reading acquisition and supports math resilience despite cognitive challenges (Pitchford et al., 2016). The integration of fine motor skills consistently exhibits a positive relationship with math performance. Between 1973-1986, Tramontana et al. (1988) reviewed 74 studies where over half considered fine motor skills as a predictor of mathematical academic achievement. In a more recent study in Singapore consisting of 1,248 kindergarten students, fine motor skills and executive function together were statistically significant predictors of math, reading, and spelling skills at the start of kindergarten (Khng & Ng, 2021). It is

important to note that even though the study was based in Singapore, schooling is based in the language of English. Thus, fine motor skills are consistently shown to be a powerful predictor of early academic performance, with a notable impact on mathematics.

While the link between motor skills and academic performance is well-established, their influence extends beyond cognitive development, significantly impacting the social-emotional well-being of young children. Specifically, Cheung et al. (2021) explored this connection in a study involving 250 preschool and kindergarten students, including both typically developing children and those with disabilities. Their findings revealed a significant correlation between the development of fine and gross motor skills and the acquisition of social-emotional competencies. This suggests that fostering motor skill development during these crucial early years can yield dual benefits, enhancing both academic performance and social-emotional growth. Furthermore, Romano et al. (2010) provided additional support for the significant influence of motor skills on academic achievement. Their research indicated that fine motor skills were a stronger predictor of second-grade math and overall achievement than kindergarten receptive language skills. This highlights the enduring impact of early motor skill development on later academic outcomes.

Building upon this, it is critical to address the specific role of fine motor skills in literacy development. Fine motor skills, particularly speed and coordination, are foundational for writing (Hooper et al., 2011). They enable the automaticity necessary for higher-order writing skills. Moreover, Hooper et al. (2010) demonstrated that spelling ability can be predicted from first-grade fine motor, language, and executive functioning skills, highlighting their concurrent and longitudinal impact. Simply put, children need fine motor skills to form letters before they can progress along the writing continuum.

The influence of fine motor skills extends beyond literacy, demonstrating a clear association with mathematics proficiency. Luo et al. (2007) found a positive correlation with mathematics proficiency upon kindergarten entry which continued over time, indicating a continuous impact on mathematical development. Furthermore, the positive association between fine motor skills impacts the progression of mathematical abilities over time, underscoring their critical role in early education.

Influences of Chopsticks on Fine Motor Development

The complex skill of using chopsticks highlights the intricate relationship between fine motor skills and cognitive development. Building on research by Luo et al. (2007), fine motor skills include precise hand and finger movement, visual perception skills, and hand-eye coordination. Using chopsticks requires concentration, coordination, and attention to move the two thin sticks in sync to pinch, scoop, and move food, particularly small or slippery items. Kuraichi et al. (2024) research team reports specifically on the impact of intrinsic and extrinsic hand muscles developments when using chopsticks. While proficiency in chopstick use demands the development of various skills such as visual-motor coordination, gross motor skills, and attention, it could be argued that fine motor skills are the primary requirement. Carlson et al. (2013) and Yost (1998) reinforced the established connection between visual-spatial integration, fine motor skills, and academic abilities in math and writing. Therefore, the act of using chopsticks requires and builds fine motor skills.

Studies indicate a possible link between fine motor skills and mathematical achievement, with some research highlighting higher initial math scores among Asian American students. For example, Luo et al. (2007) observed this trend and attributed it to stronger fine motor skills developed during early education. While their research focused on the correlation between ethnic

groups, fine motor skills, and mathematics, it did not specifically examine the role of cultural practices such as chopstick use. Therefore, further investigation into the potential impact of such practices on academic performance is warranted.

Early childhood presents a critical window for developing fundamental motor and cognitive skills, with lasting implications for later development. Diamond (2002) points out that specific opportunities for fine motor, gross motor and cognitive development are only present at certain stages of life. For example, crawling, gripping a pencil and food are all critical prerequisites for later development. Adults typically do not return to crawling in the later stages of life, and it would be difficult to find the opportunity to learn how to crawl or skills that are linked to crawling, at a later stage in life. Deliberate and targeted opportunities, such as introducing chopsticks early as a part of utensil learning, can significantly influence a child's cognitive and fine motor development (Sawamura et al., 2019). Thus, intentional early exposure to activities that builds fine motor skills, like chopstick use, could provide a significant advantage in later cognitive and motor development.

Studies indicate that children can achieve proficiency in chopstick manipulation at a relatively young age, demonstrating the development of essential visual motor skills. After randomly interviewing 445 typically developing children who ethnically identified as Chinese in Hong Kong, Wong et al. (2001) concluded that children can achieve proficiency in chopstick manipulation, defined as completing most of their meal successfully, by an average age of 4.6 years. Nonetheless, the study provides evidence that children can achieve some level of proficiency in chopstick use before kindergarten age. This suggests that children can develop visual motor skills, a component of fine motor skills, before kindergarten, which can translate into academic readiness. Furthermore, neuroscientific studies provide evidence that using

chopsticks stimulates unique brain activity, suggesting a distinct cognitive benefit (Acuña, 2021; Sawamura et al., 2019). Acuña (2021) reports a significant the relationship between the cortical hemodynamics in prefrontal cortex response while young adults are using chopsticks as compared with forks and spoon with a *p*-value of 0.007. In a separate study including 24 participants between the ages of 22 to 27, researchers compared chopsticks, fork, and hand usage to cortical hemodynamics. They reported a significant positive difference in brain activity when chopsticks are used compared to fork and hand usage, sparking development in different parts of the brain. Therefore, proficiency in chopstick use demonstrates the potential for children to develop complex fine motor skills that support academic development.

While the research directly linked to chopstick usage to fine motor and cognitive development is limited, Sawamura et al. (2019) examined the use of chopsticks at a later age to increase fine motor skills and cognition for people who have experienced trauma such as strokes, paralysis, or other medical needs that would require retraining the brain and muscles. This six-week study involved 32 participants using their non-dominate hand with chopsticks to provide additional muscle development and brain activity. Brain and muscle mapping revealed significant improvements in movement and increased brain activity to the bilateral premotor cortex. Although using a non-dominate hand may not be as easy to integrate into everyday practices, it can be a springboard to exploring other options of developing cognitive or motor growth. While direct evidence of early childhood chopstick use is scarce, the potential in this study suggests that further research into the benefits of chopstick usage and brain activity, fine motor and cognitive development across all groups is warranted.

Influencing Factors

When examining the potential impact of activities like chopstick use on children's early learning, it's crucial to acknowledge and consider alternative factors that could influence early academic outcomes. Although direct studies on the connection between using chopsticks and academic success are scarce, the research presented here examines the impact of three variables that have been shown in the literature to relate to a child's academic performance: maternal education, gender, and age. In addition, in keeping with this study's focus, I will also examine potential relationships between chopstick hold and a child's academic performance.

Mother's Education

Maternal education plays a significant role in shaping children's trajectories in academics, language development and early learning (Crosnoe et al., 2021; Shaheen & Awan, 2020; Dunsmuir & Blatchford, 2024). Dunsmuir and Blatchford (2004) concluded that mother's education level, experiences upon entry to school, and season of birth the impacts of writing for children ages four to seven. The mother's role in a child's learning at home is significant and can provide pathways that encourage children in their journey in academic achievement. Aligning with this research, Shaheen and Awan (2020) ran a longitudinal study spanning six years with a cohort of 61 African American students, gathered data on language abilities, prereading skills, and maternal education. Their findings indicated that a mother's level of education predicts her children's proficiency in writing language skills. Additionally, Hooper et al. (2010) found that parenting skills and other language abilities can act as mediators in the relationship between maternal education and the risk of later academic achievement delays in early education. Circling back to how children learn how to use chopsticks, Osera et al. (2018) states that children often learn from the influence of their mother.

Age

Early childhood development is rapid and varies greatly, even with a few months. The National Center for Health Statistics (2024) highlights the developmental milestones. These milestones serve as benchmarks for typical development in various domains, including cognitive, social, emotional, and physical. The benchmarks are numerous and close together in the early years means that age is a critical factor in research. Confounding variables, such as age, can influence research findings, requiring the use of appropriate control measures.

Gender

Research suggests that gender differences in academic outcomes can be influenced by different learning environments. Lyons et al. (2022) conducted a meta-analysis that included two studies. The first was an experimental study involving the randomization of 178 fifth-grade students in Chicago, where the impact of high versus low stakes learning environments was manipulated for both boys and girls. The second study was non-experimental, including 386 fifth and sixth-grade participants, where pressure was not manipulated. The results concluded that in a high stakes condition, both boys and girls had similar learning outcomes. However, when pressure increased, the gender disparity resulted in boys exhibiting higher engagement outcomes. In low stakes conditions, girls not only had increased learning, but also higher engagement outcomes. Additionally, females outperform boy in upper elementary school (Anjum, 2015). Social constructs, the ratio of female to male teachers, and maturation of children may impact student achievement in writing and mathematics, notwithstanding a child's use of chopsticks. Females performed higher in writing than males (Gambell & Hunter, 2000). Both studies were conducted with older students, however, consideration of this perspective will be important in

my research. Consequently, researchers must consider the complexity of biological, social and environmental factors that contribute to gender experiences in academic outcomes.

Chopstick Hold

Chopstick holds may account for some level of fine or gross motor development due to their different hand mechanisms. There are predominately two types of holds with variation in between: pinching or scissor hold (see Figure 1). When using a pincher hold, the pivot point is at the tip of the thumb. In the scissor hold, the top and bottom chopsticks touch like scissor blades, and there is no fixed pivot point at the tip of the thumb. In a study examining the engagement of five different muscle groups while using the two different holds, the pincher group showed significantly more muscle groups engaged than the scissor group (Shimomura et al., 2020). Different chopsticks hold could potentially affect motor development, with pincher holds showing greater muscle usage.

Figure 1

Most Common Two Chopstick Holds

Pincher	Scissor
	

CHAPTER III

METHOD

The Study

The purpose of this study is to investigate whether chopstick proficiency prior to entering kindergarten is related to the academic writing and mathematical achievement of children in first and second grade. Currently, there are no peer-reviewed articles that examine this question.

Research Question:

What are the relationships between chopstick proficiency prior to kindergarten and academic achievement in writing and math for children in first and second grade?

Hypotheses of Study

My hypothesis is that there is a positive significant relationship between chopstick proficiency prior to kindergarten and academic achievement in writing and math for children in first and second grade. Moreover, due to the evidence in the literature, maternal education, child's age, and child's gender are anticipated to demonstrate significant associations with academic outcomes and will be included as control variables in the analysis. However, the potential for interrelationships among these covariates may limit the ability to fully isolate their contributions to the observed results.

Design

To gain an in-depth understanding of this topic, I decided to use an embedded mixed method descriptive research design (Creswell & Clark, 2017). An embedded mixed method design allows me to combine both quantitative and qualitative data within the umbrella of the quantitative research design (Creswell & Clark, 2017). Qualitative data collection can occur before, during, or after collecting quantitative data. The researcher analyzes the data. In addition,

descriptive research will allow me to collect data without influencing the participants while also providing me with stronger control over sampling and research methods (Creswell & Clark, 2017). The quantitative data collected will be used to analyze the relationship between chopstick proficiency and academic math and writing performance, whereas qualitative analysis will provide insight into children's home environments, which can enhance the empirical understanding of early-childhood chopstick use.

In addition, documenting children's fine motor exposure and caretakers' roles in supporting their children's learning will provide more understanding of the potential for other home influences, aside from the use of chopsticks, that might influence a child's writing and math performance. Collecting data on possible alternate explanations for the relationships being studied can increase the internal validity of the research, by providing information about the potential impact of the influences of home experiences on my findings. Each research methodology provides challenges, but I hope to deepen my understanding of the topic by following a mixed methods approach (Glesne, 1998).

Researcher Positionality

I am a school district office administrator whose focus is on curriculum, instruction, and professional development related to students from preschool through twelfth grade. My professional teaching experience includes preschool, elementary, and high school. I have also served as an instructional coach specializing in English Language Development, literacy, and math instruction. I identify as an Asian female who is a first generation Asian American and the child of immigrants. As a child, I used chopsticks before any other utensil. I was proficient in chopstick use prior to kindergarten and qualified for Talented and Gifted in the area of math. In addition, I have two children who used chopsticks proficiently prior to the age of one and have

high academic achievement, especially in mathematics. My personal and family experiences with chopsticks prompted my interest in this topic, and my professional experiences supporting the learning of students from a variety of backgrounds further cemented my interest in exploring the possible connection between early proficiency in chopsticks use and later academic performance.

Researcher-Participant Relationship

In relation to the sample population, I have worked at some of the schools from which I recruited participants, but I have not worked directly with current first and second grade students. With that said, the Asian community is quite small in the Pacific Northwest school district. My personal community involvement intersects with these communal gatherings and activities; some have overlapped. For instance, I attend a Chinese speaking church; I have been a principal of schools with a higher Asian population; and I am involved in many community service organizations specifically reaching out to support Asian families. I recognize that my connection to this community may impact this study, both through the perspectives I bring to the work and through the potential participants that might alter their behavior or the information they share because of the roles I have had in the community. To help account for these potential biases, it is essential that I be aware of how they might impact my gathering and interpretation of the data. Regular and deliberate self-reflection about the beliefs I bring to the study helped to reduce the potential that my background biased the study.

Participants and Other Data Sources

This study took place in a school district in the Pacific Northwest serving approximately 15,000 students. The demographic of race identity, within the social construct of the U.S. Census Bureau (Census Reporter, 2022), included the following approximations: 20% Hispanic or

Latino, 10% Asian, 5% Black or African American, 55% White, and less than 1% of American Indian or Alaska Native, or Native Hawaiian or Pacific Islander (*U.S. News & World Report*, n.d.). Approximately 25% of the students had been identified as Ever English Learners, 15% of students had a diagnosed disability, and 25% received free or reduced-price lunch. Close to 80 languages were spoken in students' homes in the school district.

I used the term" caregiver" when referring to the guardian of the children. I did not specifically collect information about who the caregiver was in relation to the child. They could be a parent, grandparent, relative or someone else. In addition, in this study, I used the words "child" and "student" interchangeably, depending on whether the setting was the home with caregivers or the school with students.

Participant Recruitment

I sent emails to schools with at least 25% of students who identified as Asian origin, as reported by the caregiver when registering for school, which should have included a substantial number of children who used chopsticks at home. Participants were recruited from at least three schools where the combined total included about 200 first grade and 200 second grade students. Within the schools, I recruited students' caregivers to answer a brief survey. Prior to the first week of school, an invitation to complete the online survey was sent to all first and second-grade students' caregivers, the target population, which included participants who had used chopsticks prior to kindergarten and students who had not. The primary goal was to only include data from families of students who identify as Asian origin; however, if there were not enough participants, then data from non-Asian origin families would also be included. Recruiting multiple participants from one school was critical to increase reliability within the study because students who experience the same teachers or at least teachers at the same school are more likely

to have the same grading systems. When students are from the same classrooms it is more likely they have had similar school experiences. My hope was to be able to disaggregate data by race, with a perspective specifically with Asian-origin students and families as reported by the person completing the survey, however, my sample size was not robust enough.

Quantitative Participant Sampling

To be effective and efficient in collecting data within a short time frame and avoid selection maturation, I used a non-probability or purposeful sample. This allowed the opportunity to access the settings, groups, and/or individuals who are conveniently available and willing to participate in the study. Purposeful sampling is used in identifying and selecting specific populations for qualitative research (Patton, 2002). Even within this sampling, Bernard (2017) reiterates that it is important to recognize that the participants will be voluntary, which may introduce sampling bias within the study.

Within the participating population, I used a stratified purposeful sample method. Patton (2002) explains that stratified purposeful sampling is used to identify major variations within homogeneous samples. I was able to initially look at the influencing factors of age, gender, and mother's education.

Sample Size and Power

I administered independent t-tests, one-way ANOVAs, correlation models, Chi Square and linear regressions to analyze the hypothesis of a relationship between chopstick proficiency and academic achievement. To meet the requirements for statistical power, I needed to have a sample size of at least 25 participants. While I had collected 78 surveys partially and fully completed, only 52 of the surveys had fallen within the criteria of participant demographics or

had enough information for me to use in the results. While this was not a large data set, it was enough for this preliminary study.

Measures

My study included three different proficiency scores: (a) proficiency in using chopsticks, (b) academic proficiency in writing, and (c) proficiency in mathematics. The independent variable in my study was the child's proficiency in chopstick usage, whereas the dependent variables included academic proficiency in writing and mathematics at first and second grades. I also collected data on potential covariates in my study, including maternal education, child age, and child gender. In each multiple-choice answer set, the options of "don't know" and "preferred not to answer" were options. In addition, open ended questions were asked to run theme for the qualitative analysis.

Proficiency in Chopsticks

Proficiency in using chopsticks was reported by each child's caregiver within the survey (table 1). No other measures were used to determine a child's proficiency in using chopsticks prior to kindergarten. Data about chopstick proficiency were collected in the survey on a Likert scale of 0-5 as displayed in table 1. To strengthen the power of the data, the responses were coded into a binary of 0 and 1 respectively as noted in Table 2. Data was also collected in the survey from caregivers regarding student's preferred style of holding chopsticks; either using scissors (0), pincher (1) or other (2) hold.

Table 1

Proficiency in Chopsticks Measure

Measures	Person Responsible for Scoring	Scoring Method
Survey question: How proficient at using chopsticks was your child prior to starting school?	Caregiver	Likert Scale: 0 = not at all 1 = minimally; not really able to maneuver, but had the concept 2 = able to maneuver, but needed supports 3 = able to maneuver and pinch, but not efficient 4 = able to eat and grab most medium to large foods 5 = able to maneuver, eat, and grab small foods 6 = don't know 7 = prefer not to answer

Table 2

Proficiency in Chopsticks Measure Recoded

Measures	Person Responsible for Scoring	Scoring Method
Survey question: How proficient at using chopsticks was your child prior to starting school?	Caregiver	Likert Scale: 0 = not at all 0 = minimally; not really able to maneuver, but had the concept 1 = able to maneuver, but needed supports 1 = able to maneuver and pinch, but not efficient 1 = able to eat and grab most medium to large foods 1 = able to maneuver, eat, and grab small foods 6 = don't know 7 = prefer not to answer

Subsequently, the data was re-coded to increase the number of participants in each section; therefore, increasing the power to the data. Ultimately, the data was recoded a third time to create a dichotomous variable, which allowed a t-test to be utilized. At this point, any

participant who was rated a 1 or 2 became a “Yes, I used chopsticks” and participants who was rated at a 0 was a “No, I do not use chopstick”.

Proficiency in Writing

Proficiency in writing was measured with two different assessments (table 3). Student writing samples were collected within a month of the report period and were scored independently by the researcher using a developmental writing rubric developed by the participating school district. Additionally, the school district shared the teachers’ assessments of each child’s writing, as reported on the students’ report cards.

Scoring for Writing Sample and Report Card

Independent of the teachers’ scoring, I scored all student writing samples using the district writing score guide (Appendix C). However, I narrowed it to a four-point scoring rubric: significantly below proficient (0), below proficient/progressing (1), at grade level (2) and above proficient/exceeds (3).

I analyzed students’ writing grades, as reported on their school report cards. Student received scores based on five different categories on their report card with a varied numbered of fields filled in. The writing report card had the following values (table 3): not making expected progress toward grade level standards (N), progressing towards grade level standards at expected rate (P), meeting grade level standards (M), exceeding grade level standards (E), and not assessed (NA). I did not include NA as a part of the scoring. Since there were multiple standards with scores, I summarized with a score between 0 and 6; all N (0 points), some N and some P (1 point), all P (2 points), some P and some M (3 points), all M (4 points), some M and some E (5 points), and all E (6 points).

Table 3

Measuring Proficiency in Writing Measures

Measures	Person responsible for scoring	Scoring method
Writing Sample (WritingSample)	Researcher	0 = significantly below proficient 1 = below proficient/progressing 3 = at grade level 4 = above proficient/exceeds
Grades on report card (WritingReportCard)	Classroom Teacher	Likert scale: 0 = not making expected progress toward grade level standards 2 = progressing towards grade level standards at expected rate 4 = Meting grade level standards 6 = Exceeding grade level standard

Note. No scores were entered if students were not assessed in the specific area.

Proficiency in Mathematics

Mathematics skills were measured in two different ways (see Table 4). I recorded the scores given to me by the school district of student performance on the Fastbridge assessment, a universal screener in mathematics used by all schools within the district. The Fastbridge assessment system was used as research-based universal screening and progress monitoring assessment for literacy and mathematics (Illuminate Education, 2024). The first-grade assessments included subtests that included decomposing, place value, and story problems. The second-grade math assessments included two subtests: CBMmath Automaticity and aMath, both individual computer-based assessments. CBMmath assessed students' automaticity in numbers and fluency while aMath, an adaptive math assessment aligned with the Common Core Standards (2010), assessed student's math understanding.

Scoring for Math Fastbridge and Math Report Card

The FastBridge assessment uses scaled scores to determine student risk levels of high risk, some risk, low risk and exceeds benchmark. I used the following continuous point values to score the levels: high risk (1 point), some risk (2 points), low risk (3 points) and exceeds benchmark (4 points).

I analyzed students' math grades, as reported on their school report cards. Student received scores based on five different categories on their report card with a varied numbered of fields filled in. The report card had the following values: not making expected progress toward grade level standards (N), progressing towards grade level standards at expected rate (P), meeting grade level standards (M), exceeding grade level standards (E), and not assessed (NA). I did not include NA as a part of the scoring. Since there were multiple standards with scores, I summarized with a score between 0 and 6; all N (0 points), some N and some P (1 point), all P (2 points), some P and some M (3 points), all M (4 points), some M and some E (5 points), and all E (6 points).

Table 4

Proficiency in Mathematics Measures

Survey Question	Person responsible for scoring	Scoring method
FastBridge	Classroom teacher using FastBridge assessment	FastBridge assessment 1 = high risk 2 = some risk 3 = low risk 4 = exceeds
Grades on *report* card	Classroom Teacher	Likert scale: 0 = not making expected progress toward grade level standards 2 = progressing towards grade level standards at expected rate 4 = Meting grade level standards 6 = Exceeding grade level standard

Note. No scores were entered if students were not assessed in the specific area.

Measures of Covariates

The caregiver survey included questions about two covariates identified in this study: maternal education and child age. The school district provided data for child gender as reported in the demographic data.

Table 5

Covariates Measures for Child Age, Child Gender, and Mother's Education

Measures	Respondent	Response choices
Survey question for Mother's Education: *What is the highest level of education the child's mother or primary caregiver has completed?*	Caregiver	0 = don't know 1 = high school or less 2 = some college or bachelor's degree 3 = graduate degree or higher 4=don't know 5=prefer not to answer
Survey question for age: *What month was your child born?*	Caregiver	1 = January, February, March 2 = April, May, June 3 = July, August, September 4 = October, November, December
Demographic Data Child gender	District	1 = Male 2 = Female 3 = Non-binary 4 = Other

Additional Perspectives from Caregivers

To gain deeper insights into caregivers' experiences, the survey's third section employed open-ended questions. These responses, after de-identification, were analyzed using ChatGPT to identify recurring themes. Given the AI's involvement, detailed coding was essential where names and experiences are not identifiable, and no identifiable personal experiences were saved. Subsequently, the extracted themes were organized into Chi-square tables to explore potential trends and predictability.

Quality of Measurements and Masking

To provide a more accurate source of information, caregivers were aware of the criteria of the survey upfront; however, they did not know the specifics of the intricacies of the study.

Assessments, answers and writing work samples were coded with a number when the researcher scored the writing, a technique to reduce biases. The researcher was trained in using the district's writing scoring guide (Appendix A). Time was dedicated to calibration of the scoring to ensure accurate scores. The scoring was conducted within a month's timeframe. Each student writing sample was independently scored by one person.

The survey was created in consultation with colleagues and professors. It was piloted with several groups of people who are not participants of the study where feedback was gathered to ensure questions were clear. The participants chosen for the pilot the study were caregivers of children who were in first or second grade, but not at the target schools. Within the participants, there were speakers of Chinese, English, and Vietnamese, specifically to test out the translation, context and features in the three languages. Within my classes, the professors gave me multiple perspectives of how questions could be asked or what result may yield from the questions. For both the pilot and the actual survey, the transcripts from the open-ended questions were first de-identified, then coded by ChatGPT and finally the researcher reviewed for accuracy (Open AI, 2023).

The district shared teachers' evaluations of student achievement in writing and mathematics based on their report cards. The school district had, in the past, trained staff on grading and provided teachers with a framework for grading with the intention of calibration across teachers for greater reliability of grades, regardless of the person doing the grading.

Trustworthiness

Family culture, experiences, and practices was a consideration as an influence on student achievement. Although, as stated previously, qualitative questions were an attempt to address these differences, including a variety of students of different race and ethnicity may alleviate

these differences (Patton, 2014). Furthermore, I looked at other influencing factors including chopstick use, gender, maternal education, and chopstick hold. Shaheen and Awan (2020) summarize the impact of mother's education on the academic achievement of their children. The mother's role in a child's learning at home is typically significant and can provide pathways that encourage children in their journey in academic achievement. Anjum (2015) found that children born of the female gender outperform boys in upper elementary school. Social constructs including the ratio of female to male teachers, and maturation of children by gender may impact student achievement in writing and mathematics, notwithstanding a child's use of chopsticks. In Gambell and Hunter's study (2000), females performed higher in writing than males. While both studies were conducted with older students, there's merit to considering the impact. However, I wanted to consider this perspective in my research as well.

Multiple additional strategies were used to increase the trustworthiness of the findings, including using a mixed method design (Creswell, 2017). To mitigate the threats to internal validity of history and recall bias, the qualitative questions in the survey were specifically crafted to ask caregivers to recall influences on the development of fine motor skills outside of chopsticks.

The Fastbridge (Illumination Education, 2024) math data was collected using fall data, which was closest to the end of the fall quarter, the nearest grade reporting window. Although there was room for error with this assessment instrument, triangulating with student grades reduced this possible threat. Equally, grades are an inherently subjective evaluation by the teacher, who might be impacted both by their environment and their perception of a student's ability (Van Ewijk, 2001).

Selection maturation could create a disparity between different age groupings. For example, at the age of six or seven, with a difference of three months in age, children will have a noticeable gap in maturity and development that seems much more significant than that of adults who are also three months apart. To help mitigate this issue, I disaggregated the data set by age in three-month intervals to bring an additional perspective to the math and writing proficiency.

Piloting the data collection methods was intended to help identify and address potential instrumentation problems before implementing the full survey. Problems with the questions were identified and revised prior to the official administration (Patton, 2014). Prior to implementation, I administered the survey to seven people who were not a part of the recruited population to see if the answers were supportive of the direction of the research. I asked participants of the pilot to debrief me after completing the survey. Participants used a think aloud protocol as defined by Wolcott and Lobczowski (2001), where they voiced aloud all of their thoughts, which allowed for real-time insights into their thought process and comprehension of the questions. With this process, I was able to reword the open-ended questions to more accurately capture the children's experiences. I was also able to then go back to the translators to refine the question in the other two languages to be more aligned.

Data Diagnostics

In analyzing survey responses, when I had any questions or ambiguity, I followed up with the caregivers to verify or explain their answer or I omitted the participant. In the end, I followed up with three of the participants specifically demographic data. There was a discrepancy between student age and data provided. In addition, I followed up with 12 participants because at the beginning of my survey, I had not added a field to add student name to the questionnaire, which was critical to link the data. Since caregivers gave their contact information, after an approval

from the IRB to revise my survey and contact caregivers, I was able to ask for student names. My intention was not to exclude any data unless I had a severe outlier whose responses indicate that they do not fit within the parameters of my study. After I had already excluded 23 participants because they did not fall under the criteria, 3 additional participants were excluded due to missing or incomplete data, resulting in a recruitment total of 52 participants.

Plan for Quantitative Analyses

To explore the potential association between chopstick proficiency and academic achievement, as well as the potential influences of covariates of maternal education, child gender, and child age, I initially planned to conduct various chi-square analyses, using different dependent variables, such as utensil types and assessments, with chopstick proficiency as the independent variable. However, after gathering and coding the data, I realized that chi-square tests would be helpful for a different purpose including frequencies for the factors including mother's gender, age and mother's education. However, I additionally performed independent t-tests, given the binary nature of the chopstick usage data. Additionally, correlation tests were applied to examine the relationship between age and assessment outcomes, while ANOVA (Welch's) were utilized to assess the impact of factors such as mother's education and independent t-test to identify the significance of gender. Due to the nature of uneven groups, I opted to use Welch's ANOVA for more accurate data. Finally, I ran linear regression analyses in a stepwise fashion to estimate the impact of the different variables that are identified as significant in preliminary tests on student achievement.

Plan for Qualitative Analyses

Multiple methods of coding can give a researcher a different lens to analyze and organize the data. I used three types of coding to analyze the data: descriptive, thematic, and frequency

coding. Descriptive coding was used to identify topics and ideas that were talked about. Saldaña (2013) used descriptive coding to answer the question, *What is going on here?* (p. 88). With a lens of thematic coding, I focused on the major themes emerging from the conversation. Lastly, frequency coding was used to listen to what specific fine motor experiences caregivers remember providing for their child.

To gather information from caregivers about their child's additional fine motor skill experiences, I used the following open-ended survey question: a) *Prior to kindergarten, if your child played with toys with small pieces, what were they and what did they look like? Please describe; b) Before Kindergarten, what kind of support did your child have at home in writing or drawing? What did this look like? Who was involved?* After coding and de-identifying the data, I used ChatGTP to help code the data into top themes (OpenAI, 2023). The de-identified and coded data was inputted through multiple passes using carefully designed prompts to enhance the effectiveness of the platform in thematic analysis (Zhang et al., 2023). Zhang et al. delve into the criticality of implementing ethical AI practice which includes trust in the AI process and transparency on the usage. When using ChatGPT, all information continued to be de-identified to preserve data security and confidentiality of the participants. Any identifiable data was excluded or coded by an identifying number that matched the main family list. Lastly, I ran frequency counts to determine the impact between chopstick proficiency possible impacts of additional fine motor experiences and opportunities.

Data Collection

The University of Oregon Institutional Review board (IRB) granted approval in August 2024 to begin research. Immediately, I submitted my application to the school districts for permission to conduct my study to request an opportunity for research, prior to the return of

teachers. I was granted permission in August 2024. I began the multi-method data collection process, which included distributing flyers with a QR code to the consent forms and a survey to caregivers, and gathering writing samples, report card grades, and screening assessment data, such as Fastbridge scores (Illuminate Education, 2024), from the most recent grading quarter.

I reached out to caregivers during fall of 2024, with the goal of distributing the flyers in the early months of the school year. Flyers were provided at each school's open house, sent through school information systems, given out by staff, and included in school communications. The survey instrument, distributed electronically using Qualtrics (see Appendix B), included questions using a Likert scale and open-ended short answer questions. All questions were available in the languages of the target populations; Chinese, Vietnamese, and English. I first used ChatGTP for the translation (OpenAI, 2023). Then, a third-party person who is proficient in both English and Chinese or Vietnamese language reviewed the translation for accuracy. The district provided me with extant student data, such as student grades from the most recent grading period and performance data from the Fastbridge mathematics assessment. All data was de-identified and I assigned them a numeric code to preserve the confidentiality of the participants. The main family list linking personally identifiable information and participant codes was kept on my computer which is password protected and kept behind two typically locked doors, one of the research centers and the second to my office, when I was not physically present.

Caregiver Survey

I collected data from caregivers through an online survey (Appendix B), using the Qualtrics survey and data system. The first section, which took approximately 10 minutes to complete, asked the caregivers about their child's experiences with fine motor skills and

chopsticks before kindergarten. When caregivers indicated that the child did not use chopsticks prior to entering school, the survey bypassed the second section. When caregivers responded with previous chopstick exposure, they continued onto the second section. All participants answered section three.

CHAPTER IV

RESULTS

The purpose of this study was to examine if relationships exist between chopstick proficiency prior to kindergarten and academic achievement in writing and math for children in first and second grade. Included in this section are the results of the data collected.

Demographics of Participants and Recruitment

Surveys were sent to three schools where at least 25% of families identified as Asian-origin. Table 6 displays the sociodemographic characteristics of the three schools where recruitment took place. Table 7 displays the recruited participants in first and second grade students. Schools sent surveys through various online family information systems and handed out flyers at school events to all 566 families with children enrolled in first and second grade over a span of four months. Even with several attempts at recruitment, ultimately only 78 families participated in the survey. Of the 78 participants, only 55 fell within the participant selection requirements of being a current first or second grade student who attends one of three identified schools. The 55 students are described in table 8 by grade level including their sociodemographic characteristics. In the end, three additional participants were excluded due to missing or incomplete data, resulting in a recruitment total of 52 participants.

Table 6

Sociodemographic Characteristics of Students Invited to Participate

School	A		B		C	
	n	%	*n*	%	*n*	%
Total population	501		505		572	
First Grade	82		78		93	
Second Grade	91		97		125	
Race/ethnicity						
Asian	127	25%	141	28%	185	32%
Black or African American	17	3%%	17	3%	17	3%
Hispanic	35	7%	77	15%	68	12%
Native Alaskan or Native American	1	<1%	0	<0.01	1	<0.01
White	271	54%	210	42%	221	39%
Two or more	50	10%	56	11%	80	14%
Gender						
Female	240	48%	240	48%	277	48%
Male	261	52%	265	52%	295	42%
Nonbinary	0	0.00	0	0.00	0	0.00

Note. Caregivers were able select multiple responses options for race/ethnicity. All caregivers of students in first and second grades were provided with opportunities to participate *(n*= 566).

Table 7

Recruited Participants by Grade and School

n=55

School	A		B		C	
	n	Percentage	*n*	Percentage	*n*	Percentage
First Grade	7	8%	9	12%	5	5%
Second Grade	10	11%	19	23%	5	4%
Total	17	19%	28	35%	10	9%

Table 8

Sociodemographic Characteristics of Recruited Participants

School	A	
	n	%
Total Participants	55	
English Learner	10	18%
Race/ethnicity		
Asian	21	36%
Black or African American	1	2%
Hispanic	4	7%
Native Alaskan or Native American	0	<1%
Native Hawaiian or Pacific Islander	3	5%
White	18	32%
Two or more	8	18%

Note. Caregivers were able select multiple responses options for race/ethnicity.

Proficiency in Chopstick Usage

Data was re-coded from the survey on a 5-point Likert scale to a 3-point scale. The purpose of this was to increase the number of responses for each given level to bring more power to the data. Table 9 groups the data into three proficiency levels: not proficient (0), somewhat proficient (1), and proficient (2). Chopstick proficiency, based on the three-point scale split by math and writing scores. Three participants did not answer, so their data was removed, resulting in 52 participants. Additionally, after running the descriptives for the three levels, the sample size of each group was vastly different, and insufficiently large to support planned analyses. To increase the sample size to a number with sufficient power, I recoded the data once more to reflect dichotomous variables of Yes (student used chopstick) and No (student did not use chopsticks) as shown in Table 10.

Table 9

Frequency for Chopstick Proficiency

	Group	Counts	% of Total
Chopstick Proficiency	0	33	60%
	1	7	13%
	2	12	22%
	No Answer	3	5%

Table 10

Descriptives of Math and Writing Scores by Chopstick Proficiency

N=52

	No Usage or Ineffective			Able to Maneuver			Efficient Effective		
Assessments	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
MathReportCard	33	2.12	0.78	7	1.86	1.07	12	1.92	0.79
MathFastbridge	30	2.73	0.91	7	2.43	1.40	12	2.75	0.87
WritingReportCard	33	1.85	0.67	7	2.00	0.58	12	2.08	0.67
WritingSample	33	2.03	0.88	7	2.14	1.21	12	2.58	0.67

Participants by Chopstick Usage

By recording students who do not use chopsticks as “No” and students who use chopsticks as “Yes” in the frequency table 11, the participant sizes are more similar than when coded by proficiency levels, which provides a stronger data set. Table 12 reveals the average student score on four measures: math (MathReportCard) and writing (WrtingReportCard) as reported on the 2024 report card, FastBridge math score (MathFastbridge), and student writing samples (WritingSample). The descriptive statistics show that the mean scores for MathFastbridge, WritingReportCard and WritingSample are higher for students who use chopsticks as opposed to students who do not use chopsticks.

Table 11

Frequency for Chopstick Usage Yes/No

N=52

	Group	Counts	% of Total
ChopYes	No	33	63%
	Yes	19	37%

Table 12

Descriptives of Math and Writing Scores by Chopstick Usage Yes/No

	No			Yes		
	n	Mean	SD	*n*	Mean	SD
MathReportCard	33	2.06	0.83	19	2.00	0.82
MathFastbridge	31	2.61	1.02	18	2.83	0.86
WritingReportCard	33	1.79	0.70	19	2.16	0.50
WritingSample	33	1.97	0.95	19	2.53	0.70

Results for Student Math Achievement by Chopstick Usage

Descriptives for the data set for MathReportCard and MathFastbridge by chopstick usage (table 13). The independent t-test results using the data set MathReportCard in table 14, represented visually in figure 2, shows findings for the 33 students who did not use chopsticks (M=2.06, SD=0.83) compared to the 19 students who did use chopsticks (M=2.00, SD=0.82), who did not significantly differ in achievement on math scores as reported on the report cards. In agreement, MathFastbridge, represented visually in figure 3, indicated that there was no significant difference in the student scores for students who used chopsticks (M=2.83, SD=0.86) and students who did not use chopsticks (M=2.61, SD=1.02); $t(47.00)=-0.77$, $p=.445$. Both MathReportCard and MathFastbridge would suggest that chopstick usage may not have a positive impact on math achievement for students.

Table 13

Descriptives for MathReportCard and MathFastbridge by Chopstick Use

	No				Yes			
	n	Mean	Median	SD	*n*	Mean	Median	SD
MathReportCard	33	2.06	1.77	0.83	31	2.00	2.00	0.82
Math Fastbridge	31	2.61	2.24	1.02	18	2.83	3.00	0.86

Table 14

Independent Sample T-Test for ChopYes to MathReportCard and MathFastbridge

	No		Yes				
	M	SD	M	SD	t	df	*p*
MathReportCard	2.06	0.83	2.00	0.82	0.26	50.00	0.799
Math Fastbridge	2.61	1.02	2.83	0.86	-0.77	47.00	0.445

Note. $H_a\ \mu_0 \neq \mu_1$; *p <.05.

Figure 2

Independent Sample T-Test for ChopYes to MathReportCard

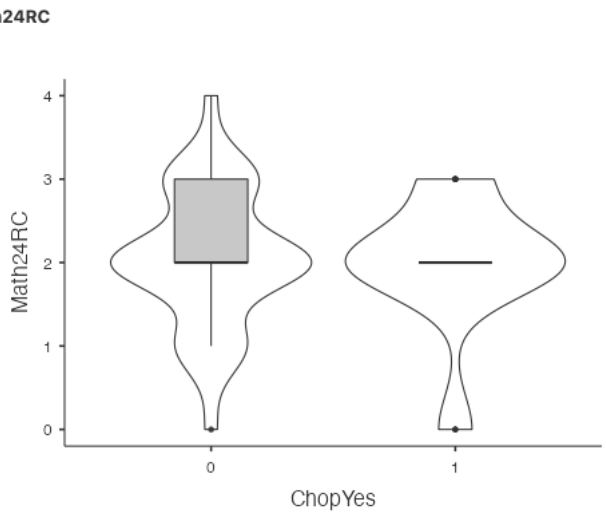
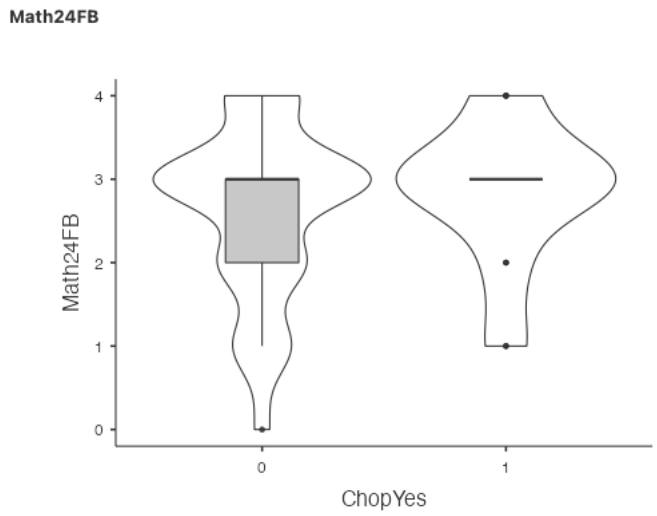


Figure 3

Independent Sample T-Test for ChopYes to MathFastbridge



Results for Student Writing Achievement by Chopstick Usage

Descriptive statistics for Writing Report Card and Writing Sample scores are presented in Table 15. Independent samples t-tests, detailed in Table 16, revealed statistically significant differences in writing achievement between students who use chopsticks and those who do not. Specifically, for Writing Report Card scores, students who use chopsticks (M = 2.16, SD = 0.50) scored significantly higher than those who do not (M = 1.79, SD = 0.70); t(50.00) = -2.03, p = 0.048. Similarly, for Writing Sample scores, students who use chopsticks (M = 2.53, SD = 0.70) also scored significantly higher than those who do not (M = 1.97, SD = 0.95); t(50.00) = -2.03, p = 0.031. Visual representations of these findings are provided in Figure 4 (Writing Report Card) and Figure 5 (Writing Sample). These results suggest a positive relationship between chopstick usage and writing achievement.

Table 15

Descriptives for WritingReportCard and WritingSample

	No				Yes			
	n	Mean	Median	SD	*n*	Mean	Median	SD
WritingReportCard	33	1.79	1.79	0.70	19	2.16	2.00	0.50
WritingSample	33	1.97	0.17	0.95	19	2.53	3.00	0.70

Table 16

Independent Sample T-Test for ChopYes to WritingReportCard and WritingSample

	No		Yes				
	M	SD	M	SD	t	df	*p*
WritingReportCard	1.79	0.70	2.16	0.50	-2.03	50.00	**0.048***
WritingSample	1.97	0.95	2.53	0.70	-2.03	50.00	**0.031***

Note. $H_a\ \mu_0 \neq \mu_1$; *p <.05.

Figure 4

Independent Sample T-Test for ChopYes to WritingReportCard (Writing24RC)

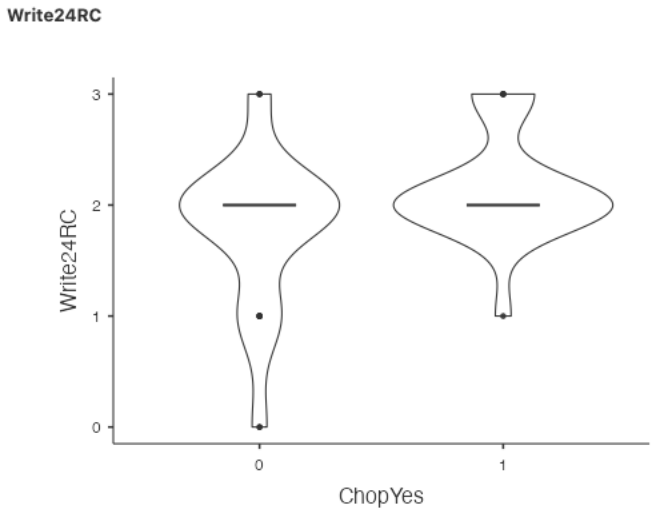
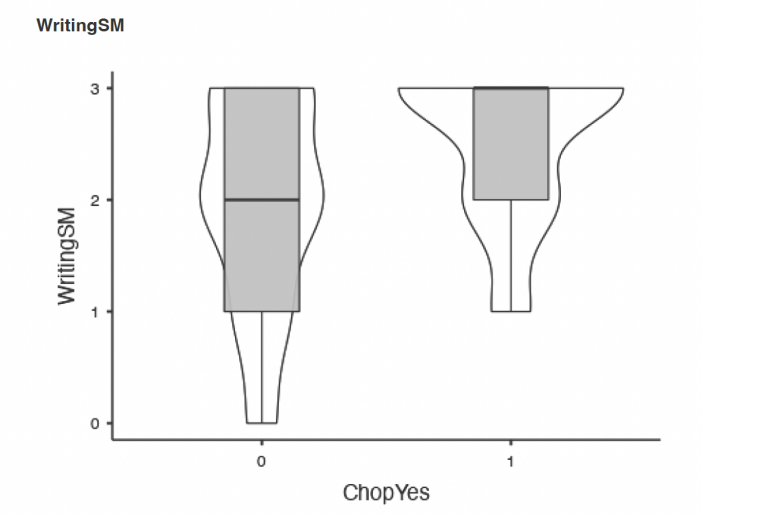


Figure 5

Independent Sample T-Test for ChopYes to WritingSample (WritingSM)



Qualitative Results

The qualitative data came from the open-ended questions number specially asked caregivers for information on fine motor experiences of their child. Some caregivers did not answer the open-ended questions. For questions 16, 17 and 18, I separately ran the de-identified answers through ChatGPT for the top themes, then went back to code each response to see if they included the themes. In addition, I ran the responses through ChatGTP as a whole and separately between children who used chopsticks and children who did not. Finally, the data was inputted in three different Chi Square tables and tests.

When caregivers responded to the question, “Prior to kindergarten, if your child played with toys with small pieces, what were they and what did they look like? Please describe”. The following were the top three experiences that were mentioned and their frequency: Legos (29), puzzles (6), and beads (5). I went back and coded the data with Yes (caregiver mentioned experience Legos, puzzles, beads) or No (caregiver did not mention Legos, puzzles, or beads. Table 17 represents regardless of experience with chopsticks, similar number of students had

experiences with LBP and chopsticks use was not associated with the likelihood of caregiver reporting LPD ($X^2(1) = 0.44$, p =.507. It is important to note that some participants did not answer all the open-ended questions.

Three themes that emerged from the question, "Before kindergarten, what kind of support did your student have at home in writing or drawing? What did this look like? Who was involved?" included drawing, coloring or painting (DCP) and writing or workbooks (WW). To decide if there is a possible impact from the experiences and support from home, I decided to look through the data with the lens of who had experiences and did they use chopsticks as shown in the Chi Square tables for DCP (table 18) or WW (table 19). More students who had experiences with DCP also had used chopsticks, however, chopstick use was not associated with the likelihood of a caregiver reporting DCP (X^2 (1) = 1.45, p =.228). Whereas almost equal number of students had experiences with WW had experiences with chopsticks. In line with the other experiences, chopstick use was not associated with the likelihood of a caregiver reporting WW (X^2 (1) = 0.00, p =.968) Similarly, not all participants answered all the open-ended questions. From the results of a test of Chi Square tests, there were no significant results.

Table 17

Chi Square Table for Number of Children whose Caregiver Reported Experiences with Legos, Beads and Puzzles (LBP)

		LBP		
ChopYes		No	Yes	Total
No	N (%)	6 (23%)	30 (77%)	36
Yes	N (%)	2 (14%)	12 (86%)	14
Total	N (%)	8 (20%)	32 (80%)	40

Table 18

Number of Children whose Caregiver Reported Experiences with Drawing, Coloring and Painting (DCP)

		DCP		
ChopYes		No	Yes	Total
No	N (%)	8 (36%)	14 (64%)	22
Yes	N (%)	2 (17%)	10 (83%)	12
Total	N (%)	8 (29%)	24 (71%)	34

Table 19

Chi Square for Table Chi Square Table for Number of Children whose Caregiver Reported Experiences with Writing or Workbooks (WW)

		WW		
ChopYes		No	Yes	Total
No	N (%)	12 (55%)	10 (45%)	22
Yes	N (%)	7 (54%)	6 (46%)	14
Total	N (%)	19 (54%)	16 (46%)	35

All, except one, of the caregivers reported that their children met their developmental milestones. Some provided specific examples of how their child met or exceeded milestones. 34 out of the 52 participants answered the question about milestones while 18 did not answer. This is consistent with the other open-ended questions.

Potential Covariates

Age

Child age ranged from 6 to 9 years old. The survey initially requested what year and month range the child was born. From there, I calculated the child's age by assigning students by quarter years. For example, a child born 2018 in July would be the approximate age of 6.5 years old. Descriptives of age by math and writing assessments are laid out on table 20. Table 21 indicates the birth years of students while table 22 shows the descriptives by grade level.

A Pearson correlation coefficient was computed to assess the linear relationship between MathFastbridge, MathFastbridge, WritingReportCard and WritingSample by reported age. The results showed a statistically significant correlation between each of age and MathReportCard ($p < 0.46$), and age and Writing 24RC ($p < .033$) as represented on table 23.

Table 20

Descriptives for Child's Age for First and Second Grade Students by Math and Writing N=21

	Age 6			Age 7			Age 8		
Assessments	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
MathReportCard	10	2.30	0.48	27	2.04	0.90	15	1.87	0.83
MathFastbridge	10	2.80	0.42	25	2.60	1.00	14	2.79	1.19
WritingReportCard	10	2.40	0.52	27	1.85	0.60	15	1.73	0.70
WritingSample	10	2.10	0.74	27	2.33	0.83	15	1.93	1.10

Table 21

Descriptives for Child's Birth Year for First Grade Students n=21

	Count	
Birthyear	First Grade	Second Grade
2015	0	0
2016	10	0
2017	10	17
2018	1*	14

Note. *Student outside of typical age

Table 22

Descriptives for Child's Age by Grade

	N	Mean	Median	SD
First Grade	21	7.04	7.00	0.54
Second Grade	31	7.86	7.75	0.44

Table 23

Correlation for Child's Age by MathReportCard, MathFastbridge, WritingReportCard and WritingSample

	Pearson's r	df	*p*-value
MathReportCard	-0.28	50	**0.046***
MathFastbridge	-0.02	47	0.909
WritingReportCard	-0.30	50	**0.033***
WritingSample	-0.12	50	0.391

Note. *p <.05.

Mother's Education

The survey results indicated that mothers' education levels varied from high school to graduate degrees. These levels were assigned numeric values ranging from high school or less (1), some college (2), graduate degree or higher (3). The Chi Square comparisons for ChopYes are displayed in table 24 and descriptives are shown in table 25. More caregivers reported mother's education include some college; however, chopstick use was not associated with the likelihood of a caregiver reporting Mother's Education (X^2 (2) = 1.87, p = 0.392). A one-way ANOVA (Welch's) analysis, table 26, revealed no relationship between the mother's education level and student scores. A Welch's analysis was used because the groups being compared were uneven.

According to the one-way ANOVA (Welch's) for the four dependent variables, MathReportCard, MathFastbridge, WritingReportCard and WritingSample, there was not a significant effect of Mother's education on MathReportCard as $p < 0.05$. However, WritingReportCard does identify a trend.

Table 24

Chi Square for Table Chi Square Table for Number of Children whose Caregiver Reported Mother's Education and Chopstick Usage

		Mother's Education			
ChopYes		High School or Less	Some College	Graduate or Higher	Total
No	N (%)	5 (16.1%)	16 (51.6%)	10 (32.3%)	33
Yes	N (%)	1 (5.3%)	13 (68.4%)	5 (26.3%)	19
Total	N (%)	6 (12.0%)	29 (58.0%)	15 (30.0%)	50

Table 25

Descriptives for Mother's Education by MathReportCard, MathFastbridge, Writng24RC and WritingSample

	High School or Less			Some College			Graduate Degree of Higher		
Assessments	*n*	Mean	SD	*n*	Mean	SD	*n*	Mean	SD
MathReportCard	6	2.17	0.75	29	2.00	0.76	15	2.13	0.99
MathFastbridge	5	2.40	1.52	29	2.66	0.90	13	3.08	0.76
WritingReportCard	6	2.00	0.63	29	1.93	0.53	15	2.00	0.76
WritingSample	6	1.50	1.05	29	2.31	0.66	15	2.40	0.99

Note. Preferred not to answer $n = 2$

Table 26

One-Way ANOVA (Welch's) on Mother's Education by MathReportCard, MathFastbridge, WritingReportCard and WritingSample

	F	df1	df2	*p*
MathReportCard	0.18	2.00	13.44	0.838
MathFastbridge	1.33	2.00	9.83	0.309
WritingReportCard	3.44	2.00	9.94	**0.073****
WritingSample	1.70	2.00	11.78	0.224

Note. **p <.1 trend

Gender

Student demographics indicated child's preferred gender; male (31); female (21); and non-binary (0). I coded students who identified as male with a "1" and female with a "2". The Chi Square comparisons for ChopYes are displayed in table 27. More caregivers reported that less boys used chopsticks than girls; however, chopstick use was associated with the likelihood

of a caregiver reporting gender (X^2 (1) = 6.45, p = 0.011). The mean score in the descriptive table 28, in all assessments, girls scored higher than boys.

According to the independent sample t-test, there were no significant differences in Math between genders. In the data sets (table 29) for MathReportCard, MathFastbridge and WritingReportCard, there was no significant difference in scores between gender as follows; MathReportCard males (M = 2.03, SD = 0.71) and females (M = 2.05, SD = 0.97), t(50) = -0.07, p = 0.951, MathFastbridge males (M = 2.54, SD = 1.04) and females (M = 2.90, SD = 0.83), t(47) = -1.34, p = 0.173 and WritingReportCard males (M = 1.84, SD = 0.69) and females (M = 2.05, SD = 0.59), t(50) = -1.14, p = 0.247. However, a significant difference was found in WritingSample scores between males (M = 1.87, SD = 0.92) and females (M = 2.62, SD = 0.57), t(50) = -3.19, p = 0.002. Females scored significantly higher than males on the WritingSample measure.

Table 27

Chi Square for Table Chi Square Table for Number of Children whose Caregiver Reported Gender and Chopstick Usage

		Gender		
ChopYes		Boy	Girl	Total
No	N (%)	24 (72%)	9 (27.3%)	33
Yes	N (%)	7 (36.8%)	23 (63.2%)	19
Total	N (%)	31 (59.6%)	21 (40.4%)	52

Table 28

Descriptives for Academic Achievement by Gender

	Male			Female		
Assessments	*n*	Mean	SD	*n*	Mean	SD
MathReportCard	31	2.03	0.71	21	2.05	0.97
MathFastbridge	28	2.54	1.04	21	2.90	0.83
WritingReportCard	31	1.84	0.69	21	2.05	0.59
WritingSample	31	1.87	0.92	21	2.62	0.57

Table 29

Independent Sample T-Test on Gender by MathReportCard, MathFastbridge, WritingReportCard and WritingSample

	t	df	p
MathReportCard	-0.07	50.00	0.951
MathFastbridge	-1.34	47.00	0.173
WritingReportCard	-1.14	50.00	0.247
WritingSample	-3.19	50.00	**0.002***

Note. $H_a\ \mu_0 \neq \mu_1$; *p <.05.

Chopstick Hold

In the survey, 28 participants indicated their child's chopstick hold (ChopHold); scissor or pincher style, however, two indicated they used both, so I removed their data for this purpose. I coded the 5 children who used scissor style as (1) and the 21 children who used the pincher hold as (2) as represented in table 30. One student who used the pincher hold did not have a MathFastbridge score. In table 31, the mean scores for both WritingReportCard and WritingSample are greater for children reported using the pincher style opposed to children who use the scissor hold. According to the independent sample t-test, there were no significant differences in Math or Writing by chopstick hold (table 32).

Table 30

Frequency Table for ChopHold

	Type	Count
Hold	pincher	21
	scissor	5

Table 31

Descriptives for Academic Achievement by ChopHold

	Pincher			Scissor		
Assessments	*n*	Mean	SD	*n*	Mean	SD
MathReportCard	21	1.95	0.80	5	2.20	0.45
MathFastbridge	20	2.75	0.91	5	2.75	0.89
WritingReportCard	21	2.10	0.54	5	2.00	0.00
WritingSample	21	2.48	0.75	5	2.20	0.84

Table 32

Independent Sample T-Test on ChopHold by MathReportCard, MathFastbridge, WritingReportCard and WritingSample

	t	df	p
MathReportCard	-0.66	24.00	0.517
MathFastbridge	-1.00	23.00	0.327
WritingReportCard	0.39	24.00	0.701
WritingSample	0.73	24.00	0.475

Note. $H_a\ \mu_0 \neq \mu_1$; *p <.05.

Predictability

Another way to look at the data is through a lens of multiple linear regressions using a stepwise regression. Stepwise regressions involve adding and subtracting variables to disaggregate potential influencing factors. Furthermore, linear regressions can predict one outcome whereas stepwise regressions can factor in additional outcomes (Statistics Solution, 2025). I strategically added factors to the stepwise regressions that were statistically significant or trend findings according to independent t-tests or Anova run previously.

For participants in the WritingReportCard dataset alongside of ChopYes, the initial R^2 was 0.08 (table 33 and table 34). Age (previous t-test; p =.033) was then added to the stepwise regression model. This inclusion increased the R^2 to 0.14 (table 35 and table 36). At this point, ChopYes no longer is significant. Lastly, MotherEd (previous t-test trend score p = 0.229). increased the R^2 to 0.16 (table 37 and table 38). ChopYes continues not to relate. However, after including Age and MotherEd, the model predicts 16% of the variance of academic achievement.

Table 33

Model Fit Measures for WritingReportCard by ChopYes

Model	R	R^2
Yes Chop	0.28	0.08

Table 34

Linear Regression of WritingReportCard by ChopYes

Predictor	Estimate	SE	t	p
Intercept[a]	1.79	0.11	16.22	<.001
ChopYes:				
1-0	0.37	0.18	2.03	0.048

Note. [a] *Represents reference level*

Table 35

Model Fit Measures for WritingReportCard by ChopYes and Age

Model	R	R^2
Yes Chop	0.38	0.14

Table 36

Linear Regression of WritingReportCard by ChopYes and Age

Predictor	Estimate	SE	t	p
Intercept [a]	3.91	1.08	3.60	<.001
ChopYes:				
1 - 0	0.32	0.18	1.79	0.080
Age	-0.28	0.14	-1.97	0.055

Note. [a] *Represents reference level*

Table 37

Model Fit Measures for WritingReportCard by ChopYes, Age and Mother's Education

Model	R	R^2
Yes Chop	0.38	0.16

Table 38

Linear Regression of WritingReportCard by ChopYes, Age and Mother's Education

Predictor	Estimate	SE	t	p
Intercept [a]	3.91	1.08	3.60	<.001
ChopYes:				
1 - 0	0.27	0.17	1.58	0.120
Age	-0.30	0.13	-2.25	0.030
MotherEd	0.03	0.13	0.25	0.808

Note. [a] *Represents reference level*

In the WritingSample data set, the ChopYes produced an initial R^2 of 0.09 (table 39 and 40). A previous independent t-test of p =.002, an already established a significant relationship between gender and WritingSample scores. When added to the stepwise regression (table 41 and 42), the Model fit increased R^2 to 0.20.

Table 39

Model Fit Measures for WritingSample by ChopYes

Model	R	R^2
Yes Chop	0.28	0.09

Table 40

Linear Regression of WritingSample by ChopYes

Predictor	Estimate	SE	t	p
Intercept[a]	1.79	0.15	13.03	<.001
ChopYes:				
1-0	0.56	0.25	2.23	0.031

Note. [a] *Represents reference level*

Table 41

Model Fit Measures for WritingSample by ChopYes and Gender

Model	R	R^2
Yes Chop	0.44	0.20

Table 42

Linear Regression of WritingSample by ChopYes and Gender

Predictor	Estimate	SE	t	p
Intercept [a]	1.80	0.16	11.32	<.001
ChopYes:				
1 - 0	0.33	0.25	1.30	0.201
Gender:				
2 - 1	0.63	0.25	2.55	0.014

Note. [a] *Represents reference level*

CHAPTER V

DISCUSSION

The initial intent of the study was to examine the relationship between chopstick proficiency prior to kindergarten and academic achievement in writing and math for children in the first and second grade. While I was unable to recruit enough participants to examine chopstick proficiency at different levels, I was able to look at the usage of chopsticks. Therefore, my revised study examined the relationship between chopstick usage prior to kindergarten and academic achievement in writing and math for children in the first and second grade. The evidence for this study included multiple data points such as report card data from teachers for math and writing, scores from Fastbridge math assessment (Illuminate Education, 2024), and a writing sample scored independently from the students' teachers using the district's writing rubric (Appendix A). The cumulative data brings up some important discussion around why the impact of chopstick use in pre-school years on writing is more significant than math and some opportunities for additional research.

The preliminary results of the research study emerged from descriptive (e.g., mean, median, frequencies) and inferential statistical analyses (e.g., independent t-tests, one-way ANOVAs) comparing the independent variable of chopstick usage with writing and math assessments. Analyses yielded statistically significant results for writing but not for math. The analysis of the MathReportCard and MathFastbridge dataset revealed that there was no significant difference in math achievement between students who used and did not use chopsticks. This suggests that chopstick usage, in this context, did not appear to relate to student performance on math scores as reported on their report cards nor on the Fastbridge assessment in first or second grade.

Independent sample t-tests revealed statistically significant differences in writing scores between students who used chopsticks and those who did not ($p < 0.05$ for both WritingReportCard and WritingSample variables). Both variables--Writing25RC and WritingSample--were shown to significantly and positively relate with pre-kindergarten chopstick usage. The consistency of these findings across two independent outcomes reflecting students' writing abilities strengthens the validity of the results. It would suggest that children who used chopsticks in early learning may have increased skills that have benefits for writing. It is important to note that there were many limitations to the study including not specifically studying the impacts on fine motor skills in children. This would require an additional more direct study in observing children and their progress in control groups. However, a hypothesized benefit of chopstick use in this study aligns with prior research suggesting that chopstick usage can improve hand-eye coordination and precision, which are critical for effective writing (Hooper et al.; 2010, Costa et al, 2018; Berninger et al, 1992). Further research is required to refine the data and eliminate potential factors that may have affected the outcomes. At this point, I would love to say that all children should use chopsticks prior to kindergarten to boost academic writing, however, there is more to consider including the qualitative data from caregiver open ended responses as well as results from the stepwise regression in relation to the main outcomes of student writing scores.

When diving into the qualitative data, there were a few roadblocks. While I thought the open-ended questions would draw more information, the answers from caregivers consist of short clauses and in some places, just a few words. This limited my understanding of the child's lived experiences prior to kindergarten. I was not able to conclude any trend or significant data from the questions I had posed other noting patterns. There were slightly more children who had

experiences with Legos, beads, and puzzles (LBP) and drawing, coloring and painting (DCP) who used chopsticks than children who did not use chopsticks. The experiences with fine motor support writing and workbooks (WW) were distributed almost evenly between those who used chopsticks and children who did not. It could be argued that additional fine motor experiences, as reported by caregivers, may have confounded the data for children who used chopsticks.

After running Chi Square comparison tables, there were no significant results from the data. Legos, by far, were the most mentioned fine motor activities within families as reported by caregivers. Painting surprised me by being one of the top three supports when asked, "Before kindergarten, what kind of supports did your student have at home in writing and drawing? What did this look like? Who was involved?" However, the most interesting quote from a caregiver included, "We would use chopsticks at home, but he would give up easily. It wasn't until he went to school where he was inspired to learn to use chopsticks after seeing his friends at school use them and then he was more interested to learn" (Family 43). While this is not related to this study itself, it was great to hear about the inspiration of culture and excitement from peers.

Due to the limitations of this study, I was unable to interview caregivers for additional insights into their child's experiences or retroactively observe the children's use of chopsticks and fine motor activities. Furthermore, the survey data depended on the caregivers' recollection. Although there is no specific reason to suspect inaccuracies, the potential for the data to be unreliable remains.

Mother's Education, Age and Gender

The statistically significant main results became less significant when run in a stepwise regression to consider additional factors (covariates) that may have influenced relationships between variables. Since we are working with tiny humans and their experiences, confounding

variables are an inevitable factor in any study. Furthermore, because this study was not experimental and lacked controlled participants or environments, I explored additional variables that may have influenced the outcomes (Creswell, 2017). I investigated the variables of maternal education, child age, and child gender that have been shown in the literature to influence academic achievement. First, I will speak to each variable I explored, then conclude with a discussion on how they influenced my findings. Maturation often is defined as the natural progression of changes within a subject over time during an experiment (Cresswell, 2007). Although the data was gathered over a relatively short period, the children involved were between the ages of six and nine. During these stages, development, maturity, and growth can vary significantly due to the rapid pace of their learning and experience. It is crucial to examine whether children's writing and math proficiencies vary with age. For instance, an older student may have had more exposure to and opportunities for developing math or writing skills compared to a younger student. When looking at the correlation table for age, the correlations were not prevalent in MathFastbridge or WritingSample, which would suggest that there were no statistically influencing factors. However, the p value of 0.046 was statistically significant for MathReportCard and $p < 0.033$ for WritingReportCard, all significant with a negative Pearson's r value. An interesting point to note is that student's scores decreased as age increased, which may be due to increased rigor.

According to Shaheen and Awan (2020), the experiences and education of a mother have significant impacts on a child's academic pathways. A one-way ANOVA conducted on the dataset revealed no statistically significant differences in math or writing sample scores. While the analysis of writing report card scores also did not produce statistically significant result ($p>0.073$), a potential trend was observed. Findings from this research study align with Shaheen

and Awan's (2020) conclusion that children's academic trajectories align with their mothers' academic pathways. Further, Osera et al. (2018) found that a child's chopstick usage also relates to the chopstick usage of their mother.

In addition, the work of Lyons et al. (2022) underscores the significant role gender plays in early childhood learning outcomes, particularly in writing, where girls consistently demonstrate more academic learning within school settings. An independent t-test conducted on the WritingSample data in this study confirms these findings (p <0.002), further highlighting a gender disparity. Further, there was a notable gender imbalance in chopstick usage including a disproportionately higher percentage of girls (57.1%) who used chopsticks in pre-kindergarten compared to boys (22.6%). This disparity raises the possibility that gender, acting as a potential covariate, may influence the relationship between chopstick use and writing scores.

This observation prompts a critical examination of potential cultural or social expectations imposed upon females from an early age. While the direction of this study did not intend to study the different experiences between boys and girls, it does make me wonder more about what the underlying cause or experiences may contribute to girls demonstrating both higher chopstick usage and stronger writing scores. In addition, what societal, cultural, or inherent factors contribute to this gender gap in early skill development? Are there implicit gender expectations that shape these developmental trajectories? For instance, could it be possible that girls are encouraged towards activities that require fine motor skills and precision, such as using utensils or engaging in crafts, while boys are steered towards activities deemed more physically active? While I have more questions than answers, further research is necessary to fully understand the complex interplay of gender, cultural influences, and early learning

outcomes, and to determine whether unspoken gender expectations are indeed shaping these developmental trajectories.

As I continue to see significant variables and their relationships when running the inferential statistical analyses, the stepwise regressions provided the most insightful results. The analysis was run using the factors that resulted with statistically significant and trend results from the inferential analysis. Initially, the model, only using ChopYes, explained 8% of the variance in WritingReportCard scores. Interestingly, when including age in the analysis, the predictability improved ($R^2 = 0.14$) and when MotherEd was added, $R^2 = 0.16$. This increase in R^2 highlights the impact of age and possibly MotherEd in predicting WritingReportCard scores, which emphasizes the importance of multiple regressions and developmental factors. I suspect the experiences and fine motor abilities of children who are older, even if it is just a little bit older, is quite discrepant. It is interesting given the strong significant *p* value with gender and WritingSample that gender did not significantly relate to WritingReportCard, reinforcing the importance of using multiple measures. A future study could compare students who are all relatively similar in age to chopstick usage to gain a more accurate analysis.

A stepwise regression analysis for WritingSample reveals that chopstick usage was no longer predictive when gender was added to the regression. Initially, the model using only ChopYes explained 9% of the variance in the WritingSample scores. However, incorporating gender as a covariate significantly improved the model, raising the R^2 to 0.20. The low variance explained by chopstick usage alone, and the fact that gender was also identified as a significant predictor in this study, raises more questions than answers. For further studies, I would suggest a critical evaluation of the intricate relationship between chopstick usage and academic achievement by examining the impact of gender on the results. Although a direct prediction of

WritingSample scores from chopstick usage couldn't be confirmed, the previously mentioned connection between girls, chopstick use, and writing is still relevant. In future studies, a more comprehensive dataset is crucial to examine both the overall population and gender-specific effects. While there is a strong influence of gender, it does not rule out that chopstick usage might also be a contributing factor.

It is important to note that these are preliminary findings and that the study will need to be replicated with a larger and more diverse sample set to come to any conclusions. Subsequently, I was also not able to gather enough participants that were from Asian-origin families, nor did I ask the depth of questions needed to run a data set separately to dive into how cultures and ethnic experiences, specifically those of Chinese and Vietnamese families who are the demographic majority of Asian origin families in the target school district, may impact the study.

Influencing Factors and Limitations Addressed

While analyzing the data, I did not delineate data on the ten students who were learning English and the possible impact to their understanding of the test questions or expressive language, which includes writing. Although I had data indicating that certain students were receiving English language services, I was unaware of their specific learning stage. Similarly, I lacked information regarding which students, if any, qualified for Special Education services. Depending on the area of disability, it may have affected students' ability to fully access the assessment, report card, or writing scores. This data would have been important for the study because I speculate there may have been a relationship between assessment data and teacher reporting where multilingual learners and students receiving Special Education services may

score lower due to factors including access, understanding the vocabulary, the natural progression of learning English, or a learning disability.

New Math Curriculum

There were no significant findings in the math results, however, there were limitations to the collection of data. During my research, the district had stated that they were undergoing the first year of a new math curriculum implementation and that teachers did not know how to align the scope and sequence with the old report card format. In addition, since students and staff were learning a new curriculum, the first few months of school were spent on learning the curriculum, not necessarily the math.

Researcher Bias and Relationship to Participants Addressed

Throughout the study, I made a conscious effort to stay objective. I removed all student and family identifiers, using coded numbers to ensure anonymity throughout the disaggregation and analysis process. I regularly checked myself, asking whether I was looking at the results without bias. While I believe I remained fair in my approach, I'm only human. If this research were to be replicated, it would probably be best in a setting where I was further removed from the data to enhance objectivity.

Possible Next Steps for Research

Initial observations suggesting a link between early chopstick use and later academic achievement pointed to the development of fine motor skills. However, the connection may extend beyond mere dexterity. The very act of learning to use chopsticks is a significantly more complex task than proficiency in utensils like forks or spoons due to the greater number of muscles involved, the intricacy of maneuvering the two-part chopsticks system as one unit, and the extended period of perseverance required. This extended effort might not only strengthen

hand and wrist muscles and cultivate persistence but also foster the development of neural pathways in the brain, potentially laying a foundation for enhanced cognitive engagement and academic success in later years. A Chinese study by Wong et al. (2002) indicated that children achieved the visual motor skills for using chopsticks by around 4.6 years old. It would have been valuable to investigate the learning time for various utensils, the number of muscles involved and the average developmental stage for proficiency. As a child perseveres and cultivates a growth mindset (Dweck, 2008), the brain forms new neural pathways. Similarly, as a child perseveres and grows multiple muscle groups, motor skills are developed as well. The motivation to eat and get food into our mouths is quite strong. Could the complexity of using chopsticks, the perseverance it requires, and the motivation to eat taken altogether offer an opportunity for children to develop new neural pathways that enhance academic success? Also possibly related, does a mother's or caregiver's support create a necessary degree of supported discomfort for a child to continuously develop their chopstick skills and influence how they learn (Vygotsky, 1978)? How might the required grit to master chopsticks, and related physiological changes, as well as behavioral development through support and modeling of a new skill by a trusted adult, play a role in student achievement?

Beyond this initial research, subsequent research could involve comparing experimental groups of children who are taught to use chopsticks during preschool as an intervention with a control group of children who are not. Researchers could monitor their academic progress from preschool through upper elementary school, and potentially into high school, conducting pre- and post-learning assessments to explore a potential causal relationship between learning to use chopsticks and academic performance. Within the study, researchers could examine multiple facets of mathematics and writing. For mathematics, an example could include studying the

impacts of chopstick use in terms of understanding patterns, number association, algebraic thinking, procedural fluency, problem solving, and geometry. For writing, researchers could study the differences in letter formation, ideas and content, conventions, vocabulary and organization. Furthermore, the research could gather data to eliminate potential factors, such as students eligible for English language services, specialized instruction, multilingual learners, and potentially factors related to home culture. Lastly, a big barrier in this study was the lack of participants. In a future study, if there were more participants, findings from the current study might be further reinforced and explored with greater detail in relation to disaggregated sociodemographic variables, such as ethnic origin, home experiences, child's experiences in formal preschool, and primary caregiver education level.

Conclusion

The present study was to examine if there was a relationship between chopstick proficiency prior to kindergarten and academic achievement in writing and math for children in first and second grade. Both outcomes of WritingReportCard and WritingSample were significantly and positively related to pre-kindergarten chopstick usage. The consistency of these findings across two independent outcomes measuring writing ability strengthens the validity of the results. It would suggest that children who use chopsticks in early learning may benefit their writing achievement. After applying stepwise regression, it became evident that several variables could impact the outcomes, including child gender, mother's education, and child age, however, the confounding variables were not consistent in relation to both writing outcomes. No statistically significant relationships were found between chopstick usage and math performance. Further research is necessary to refine the data and control for protentional confounding factors that may have influenced study findings.

APPENDIX A

District Writing Scoring Guide

K-2 Writing Trait Scoring Guide

Ideas & Content	
5 Writing is clear, focused, and interesting. • The main idea is clear and the topic is narrowed and well developed. • Supporting details are strong, accurate and relevant. • Focus: stays on topic.	4 (Goal by the end of 2nd Grade) Writing is clear and focused • The main idea is clear. • Supporting details are logical, mostly accurate and relevant. • Focus: on topic.
3 (Goal by the end of 1st grade) Reader can understand the main idea, although it may be overly broad or simplistic, and the results may not be effective. • There is a main idea. • Supporting details are minimal and may be irrelevant. • Focus: generally, on topic	2 Main idea present, but underdeveloped. • There is a main idea. • Supporting details are minimal and may be irrelevant. • Focus: generally, on topic
1 A purpose is beginning to emerge. • An idea is present or multiple unrelated ideas are present. • Supporting details are missing.	

Organization	
5 Order and structure are strong. • The structure is easy to follow. • Transitions are somewhat varied. • Sequencing is sound, with 3 or more events. • An inviting lead and a concluding sentence are present. • Clear beginning, middle, and end. • Pictures (if present) support the text.	4 (Goal by the end of 2nd Grade) Organization is clear; may seem formulaic. • Structure is clearly present and complete, even if predictable. • Transitions work in a predictable fashion (e.g., first, second, next). • Sequencing can be easily followed, with a short sequence of two or more events. • A beginning, middle and ending are present. • Pictures (if present) show thoughtful placement of elements.
3 (Goal by the end of 1st grade) Some evidence of organization is present. • Structure is present: a 'list' story. • Recounts two or more appropriately sequenced events. • Transitions based on time order. • A beginning, middle and end are present. • Picture elements (if present) are placed logically.	2 Writing lacks clear organization and structure. • Topic evident. • Format shows randomness in placement of events. • Transitions missing. • Sequencing: not present or confusing. • Bare beginning and middle are present—no end.
1 Writing lacks coherence. • Structure is starting to emerge. • Transitions & sequencing: not present. • A bare beginning is present—no middle or end. • Left–to-right, top-to-bottom orientation is evident. • Pictures (if present) are random, lack	

Sentence Fluency	
5 Writing has an easy flow and rhythm. • Several sentences are present and employ multiple sentence patterns. • Sentence beginnings are varied. • Rhythm is more fluid than mechanical—easy to read aLuod. • Connectives do not interfere with the fluency.	4 (Goal by the end of 2nd Grade) Writing flows; however, connections between phrases or sentences may be less than fluid. • The writing shows multiple sentence patterns. • Sentences do not always begin the same way. • Rhythm is more mechanical than fluid, approximating natural language. • Connectives show some variation.
3 (Goal by the end of 1st grade) Writing tends to be mechanical rather than fluid. • The writing provides a limited sampling of sentence patterns. • Sentences often begin the same way. • Rhythm is choppy and repetitive. • Connectives may be present: and, but.	2 Writing attempts or uses short simple sentences. • Writing attempts or uses short simple sentences.. • A word or phrase may be repeated. • Rhythm is not present or is at a beginning stage. • Connectives are not used.
1 Writing is difficult to follow. • Writing attempts short, simple sentences. • Rhythm and flow are not present.	

Conventions	
5 Writing demonstrates exceptionally strong control of standard writing conventions. • Capitalization: in addition to conventions below, names of books, magazines, newspapers, and the first word in quotations. • Punctuation: accurate use of end punctuation, commas in series, dates, greeting and closing of letter. • Spelling: Spells correctly roots (un necessary), inflections (care/careful/caring), suffixes and prefixes (-ly, -ness, -mis, un-), homophones (e.g., to, two, too, hear, hear). • Grammar and Usage: uses irregular verbs correctly (swim/swam, ride/rode); uses conjunctions correctly (and, or, but).	4 (Goal by the end of 2nd Grade) Writing demonstrates strong control of standard writing conventions. • Capitalization: in addition to conventions below, geographical names, holidays, special events. • Punctuation: uses commas in dates and items in a series. • Use commas in dates and to separate single words in a series. • Spelling: correctly spells most high frequency words; one syllable words that have blends. • Grammar and usage: subjects and verbs are in agreement; correctly uses verb tenses.
3 (Goal by the end of 1st grade) Writing demonstrates control of standard writing conventions. • Capitalization: accurate for sentence beginnings, proper nouns, greetings, months, days of week, titles, initials. • Punctuation: accurate use of end punctuation (periods, question marks, exclamation points). • Spelling: correctly spells most frequently used words (was, were, says, who, what, why), words with short and long vowel sounds, most controlled vowels (ar, er, ir, or, ur), and consonant blends. • Grammar and usage: Subjects and verbs agree; identifies and begins to write a few contractions correctly.	2 Writing demonstrates some control of standard writing conventions. • Capitalization: Capitalizes the first word of a sentence, names of people and the pronoun I. • Punctuation: Uses periods at the end of sentences. • Spelling: Spells correctly 3 and 4 letter vowels words; uses spelling/phonics-based knowledge to spell independently. • Grammar and usage writes singular and plural nouns correctly; uses simple possessive pronouns correctly (my/mine, his/hers).
1 Writing demonstrates and emerging understanding of standard writing conventions. • Capitalization: capitalizes names and the first word of a sentence. • Punctuation: inconsistent use of periods at the end of sentences. • Spelling: Uses phonemic and letter knowledge to spell independently (reader able to ‘decode’ some words); spells CVC	

APPENDIX B

Online Survey

I am trying to learn about the relationship between chopstick proficiency prior to kindergarten and the academic achievement in writing and math for children in first and second grade. By completing this survey, I will be learning from you. Please answer this survey with your most accurate answers. There are no right or wrong answers. **Your answers are confidential.** Your individual, personal responses to survey questions are confidential and not shared with anyone. All survey responses are combined before reporting any results to ensure confidentiality. **This survey is voluntary.** You do not have to answer any question you do not want to, but I hope you will answer as many questions as possible.

Caregiver Survey

Section one:		
Question #	Question	Response Options
1	Please type your child's full name	Constructed response
2	What grade is your child currently enrolled in this fall?	1 = 1st grade; 2 = 2nd grade
3	What moth was your child born?	1 = January, February, March 2 = April, May, June 3 = July, August, September 4 = October, November, December
4	What is your child's birth year?	1 = 1015 2 = 2016 3 = 2017 4 = 2018 5 = 2019
5	What is the highest level of education the child's mother or primary caregiver has completed?	0 = don't know; 1 = high school or less; 2 = some college or bachelor's degree; 3 = graduate degree or higher 4=don't know 5=prefer not to answer
6	At what age did you feel like your child was able to efficiently grab and pinch food with their hands?	0 = prior to 1 years old; 1 = 1 years old; 2 = 2 years old; 3 = 3 years old; 4 = 4 years old; 5 = 5 years or older 6 = don't know; 7 = prefer not to answer
7	What utensils did your child use at home for eating prior to school age? (Click all that apply)	1 = spoon; 2 = fork; 3 = chopsticks; 4 = hands; 5 = other; 6 = don't know; 7= prefer not to answer
8	Currently, what utensils does your child prefer to use (or use the most) at home? (Click all that apply)	1 = spoon; 2 = fork; 3 = chopsticks; 4 = hands; 5 = other; 6 = don't know; 7= prefer not to answer
9	At what age did your child first use chopsticks?	0 = prior to 1 years old; 1 = 1 years old; 2 = 2 years old; 3 = 3 years old; 4 = 4 years old; 5 = 5 years or older 6 = don't know; 7 = prefer not to answer

If participant does not include answer 3 = chopsticks, skip section two of the survey. Section two:		
10	How often did your child use chopsticks prior to starting school?	0 = not at all; 1 = not often; 2 = approximately half of the time; 3 = often; 4 = almost always
11	How proficient at using chopsticks was your child prior to starting school	0 = not at all;1 = minimally; not really able to maneuver, but had the concept; 2 = able to maneuver but needed supports; 3 = able to maneuver and pinch, but not efficient 4 = able to eat and grab most medium to large foods; 5 = able to maneuver, eat and grab small foods; 6 = don't know; 7 = prefer not to answer
12	What type of chopsticks did your child use most often	0 = none; 1 = plastic, 2 = wooden, 3 = bamboo, 4 = metal, 5 = other; 6 = don't know; 7 = prefer not to answer
13	What support did your child receive while learning how to use chopsticks?	0 = none, 1 = help from adult, 2 = chopsticks trainers, 3 = others; 6 = don't know; 7 = prefer not to answer
14	Currently, how often does your child use chopsticks per week?	0 = never; 1 = less than a quarter of the time (less than 25%); 2 = about than a quarter (25%) of the time; 4 = about half (50%) of the time; 5 = about three quarters (75%) of the time; 6 = almost always; 7 = don't know; 8 = prefer not to answer
15	What type of chopstick hold does your child currently use? (See photos below) Figure 1  Figure 2 	0 = scissor; 1 = pincher; 2 = other; 3 = don't know; 4 = prefer not to answer
Section three:		
16	Prior to kindergarten, if your child played with toys with small pieces, what were	Constructed response option

	they and what did they look like? Please describe.	
17	Before Kindergarten, what kind of support did your student have at home in writing or drawing? What did this look like? Who was involved?	
18	The following questions relate to typical age-appropriate milestones in early childhood related to fine motor skills. The following are examples of age-specific milestones related to fine motor skill development (Squires & Bricker, 2009): -3 years old: Child can string small items on a string", draw a circle or lines like yours after you draw one, hold a pencil or crayon between finger and thumb like adults can. -4 years old: Child can color mostly within the lines in a coloring book, draw a 2-inch circle, or button and unbutton a shirt. -5 years old: Child can copy a child's own name by letters (letters can be backwards or reversed) or copy letter without tracing. Did your child meet these age-specific milestones? Were there other things your child did when they were younger than kindergarten related to fine motor skills? What, if anything, did you do to help your child learn fine motor skills prior to kindergarten? Please be specific when describing the activity or activities	
19	Please share anything else you want to share with me about your child's learning experiences that might help me with my research.	
20	How does YOUR CHILD identify?	0 = American Indian/Alaskan Native; 1 = Asian; 2 = Black/African American; 3 = Native Hawaiian/Pacific Islander; 4 = White; 5 = other; 6 = prefer not to answer

21a	Who is primarily responsible for taking care of your child?	0 = myself; 1 = spouse; 2 = sibling 3 =mother or mother-in-law; 4 = father or father-in-law; 5 = other relative; 6 = non-relative; 7 = other; 8 = prefer not to answer
21b	How often does the primary caretaker use chopsticks per week?	0 = never; 1 = less than a quarter of the time (less than 25%); 2 = about than a quarter (25%) of the time; 4 = about half (50%) of the time; 5 = about three quarters (75%) of the time; 6 = almost always; 7 = don't know; 8 = prefer not to answer
21c	What is the primary caretaker's nation of origin?	Constructed response
22a	Who is secondary caretaker responsible for taking care of your child?	0 = myself; 1 = spouse; 2 = sibling 3 =mother or mother-in-law; 4 = father or father-in-law; 5 = other relative; 6 = non-relative; 7 = other; 8 = prefer not to answer
22b	How often does the secondary caretaker use chopsticks per week?	0 = never; 1 = less than a quarter of the time (less than 25%); 2 = about than a quarter (25%) of the time; 4 = about half (50%) of the time; 5 = about three quarters (75%) of the time; 6 = almost always; 7 = don't know; 8 = prefer not to answer
22c	What is the secondary caretaker's nation of origin?	Constructed response
23a	Who is tertiary (3rd) caretaker responsible for taking care of your child?	0 = myself; 1 = spouse; 2 = sibling 3 =mother or mother-in-law; 4 = father or father-in-law; 5 = other relative; 6 = non-relative; 7 = other; 8 = prefer not to answer
23b	How often does the tertiary (3rd) caretaker use chopsticks per week?	0 = never; 1 = less than a quarter of the time (less than 25%); 2 = about than a quarter (25%) of the time; 4 = about half (50%) of the time; 5 = about three quarters (75%) of the time; 6 = almost always; 7 = don't know; 8 = prefer not to answer
23c	What is the tertiary (3rd) caretaker's nation of origin?	Constructed response
24	Thank you for your participation! If I have additional questions, may I contact you? If so, what is your phone number and email?	Constructed response option

Appendix C

Consent Form

The researcher, Dianna Ngai, from the University of Oregon is asking for your consent to this research. Please send any questions pertaining to the researcher Dianna Ngai at dngai@uoregon.edu).

Introduction and Background

The purpose of this study is to investigate the relationship between chopstick use before entering kindergarten and academic writing and math achievement of grade K-2 children. Many people in the Asian and Non-Asian community in the United States teach their young children to use chopsticks, which possibly increases their fine motor skills and cognitive development. We will investigate possible relationships between pre-school chopstick use and early elementary academic achievement. There are already 1.2 billion people who are already using chopsticks around the world (Eating Utensils, 2024). The potential positive relationship between chopstick usage and academic achievement at an early age could change the rate of how children learn and develop.

You are being asked to participate because your child has had a valuable life experience that may have implications for later academic achievement. Whether your child used or did not use chopsticks, their experience will contribute to my research. About 130 people will be asked to take part in this research.

What happens if I agree to participate in this research?

We expect your participation will last six to nine months, however, you will only need to answer an online survey with 24 questions that will take 20-30 minutes. Within the nine months, if there are any follow-up questions, you will be contacted.

If you agree to be in this research, your participation will include answering an online survey that includes questions about your child's experiences with fine motor activities, chopstick proficiency, and their writing and math proficiency. You are also giving consent for the research team to access your child's social demographic and academic data; which includes demographic data, district test scores, report cards and writing samples. There will be nothing your child will need to do.

What happens to the information collected for this research?

Information and data collected for this research will be used to study the relationship between chopstick proficiency and writing and mathematics academic achievement. The analysis of the data provided by the school district and the participants will: 1) inform educational practices; 2) contribute to a dissertation publication; 3) contribute to professional development and early learning practices.

How will my privacy and confidential data be protected?

The following measures will be taken to protect your privacy:

- All data will be de-identified and assigned a numeric code by the researcher or research assistants to preserve the confidentiality of the participants.
- The main list of information linking personally identifiable information and participant codes will be kept on the researcher's computer, which is password protected and kept behind two typically locked doors when she is not physically present.

- Data will be stored on the "Qualtrics" and "Microsoft" where the data will be password protected and accessible through dual authentication.
- Despite these precautions to protect the confidentiality of your information, we can never fully guarantee your privacy will be protected.
- Only the principal investigator will have access to the identifiable data, which will be password protected and accessible through dual authentication.
- Participants can request a copy of the educational records disclosed for research. Information that will be disclosed includes Fastbridge math data, writing samples, report cards and social demographic data.

What are the risks if I participate in this research?

The research has no more than minimal risk to the participants. The minimal foreseeable risks or discomforts of your participation may include information risks. There could be possible emotional risk if answering questions may bring up any past experiences, or a possible breach of confidentiality or data breach. These risks are minimal; however, you can stop the survey at any time. All data collected will be coded, de-identified, and secured.

What if I want to stop participation in this research?

Taking part in this research study is your decision. Your participation in this study is voluntary. You do not have to take part in this study, but if you do, you can stop at any time. You have the right to choose not to participate in any study activity or completely withdraw from continued participation at any point in this study without penalty or loss of benefits to which you are otherwise entitled. Your decision whether to participate will not affect your relationship with the researchers, the University of Oregon or the school district.

What benefit will I receive from this study?

There is no direct benefit to the participants, but the researchers hope to gain ideas to support the academic achievement of students. I hope your experience can benefit future children!

Who can answer my questions about this research?

If you have questions, concerns, or have experienced a research related injury, contact the research team at:

Dianna Ngai
dngai@uoregon.edu

Dr. Heather McClure
Director, Center for Equity Promotion
hmcclure@uoregon.edu

An Institutional Review Board ("IRB") is overseeing this research. An IRB is a group of people who perform independent review of research studies to ensure the rights and welfare of participants are protected. UO Research Compliance Services is the office that supports the IRB. If you have questions about your rights or wish to speak with someone other than the research team, you may contact:

Research Compliance Services
5237 University of Oregon
Eugene, OR 97403-5237
(541) 346-2510
ResearchCompliance@uoregon.edu

STATEMENT OF CONSENT

I have had the opportunity to read and consider the information in this form. I have asked any questions necessary to make a decision about my participation. I understand that I can ask additional questions throughout my participation.

I understand that by signing below, I volunteer to participate in this research. I understand that I am not waiving any legal rights. I have been provided with a copy of this consent form. I understand that if my ability to consent or assent for myself changes, either I or my legal representative may be asked to re-consent prior to my continued participation in this study.

I consent to participate in this study and to allow the research team to access my child's student data.

_____	_____	_____
Name of Adult Participant	Signature of Adult Participant	Date

Appendix D

Letter of Agreement

Contact:

DISTRICT WRITING SCORING GUIDE
Dianna Ngai, Doctoral Student, University of Oregon
dngai@uoregon.edu

This document serves as an agreement between the school district and Dianna Ngai to provide identifiable data for my dissertation research within the Educational Leadership program at the University of Oregon. The data will fall under the following parameters:

Participant Information:

- I am requesting records from participating students
- I will only be requesting information from students whose caregivers have given consent.
- I am asking to contact all 2023-2024 kindergarten and 1st grade families to recruit participants.

Agreement with the district:

- Data will be collected that could benefit our early learners in their later academic achievement in math and writing.

Secure Data Sharing:

- Data will be shared via a secure database, Qualtrics, provided by the University of Oregon and has been determined as secured.
- I will provide the district with a list of all participating students in each school as confirmation that they are within the agreement specified.

Data requested:

1. Personal Contact Information of student caregivers
    a. Personal email addresses
    b. Phone numbers, if provided.
2. Social demographic data
a. Fast Bridge math data
3. Writing samples
b. Report cards.

_____ _____

Dr. Shay James, Superintendent Dianna Ngai, Researcher

Appendix E

Dissertation Timeline

1. IRB Application completed June 10, 2024
2. Proposal Meeting June 18, 2024
3. Survey sent to Participants August 26, 2024
4. Close survey responses November 30, 2024
5. Quantitative results coded December 15, 2024
6. Qualitative coding analysis completed December 30, 2024
7. Results Section completed January 30, 2025
8. Discussion Section completed January 30, 2025
9. Application for Advanced Degree completed January 30, 2024
10. Application for Defense completed January 30, 2024
11. Abstract completed February 28, 2024
12. ProQuest Dissertation account created February 28, 2024
13. Dissertation Defense meeting April 18, 2024
14. Post-Defense Committee approval May 2, 2025
15. Final Committee Approval of Dissertation May 2, 2025
16. Statement of Completion May 2025
17. Graduation June 16, 2025

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