THE ROLE OF MATERNAL EDUCATION AND CHILD GENDER ON CHILDREN’S FINE MOTOR SKILL DEVELOPMENT

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ABSTRACT

Maternal education has been found to be a proximal measure of household income and has been directly linked to a child’s cognitive, social, and academic outcomes (Augustine et al., 2009; Harding, 2015; Kalil et al., 2012). Additionally, several studies examining children’s development found that children’s fine motor skills are the skillset that have a higher likelihood of experiencing delays when correlated with household socioeconomic status (Doulabi et al., 2017). The present study examined the relationship between children’s fine motor skills and maternal education and contributes to the literature in that it strictly examined a low-income sample population. The first wave of the 1999 dataset, Welfare, Children, and Families: A Three-City Study, obtained from the Inter-University Consortium for Political and Social Research (ICPSR) was utilized. Maternal education and children’s fine motor skills of children three and younger were the focus of the study while child gender was used as an exploratory variable working to understand whether the relationship between maternal education and fine motor skills varied across gender.

Logistic regression and chi square models were fit to the data to find no statistically significant relationship between a mother’s level of education and her child’s fine motor skill development. However, results of both chi square and logistic regression analyses indicated that girls with mothers who did not complete high school were marginally more likely to have fine motor delays whereas girls with mothers who completed high school were marginally less likely to have fine motor delays. Limitations, future directions, and implications for practitioners are provided.
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CHAPTER 1
INTRODUCTION

According to the National Center on Children in Poverty, in 2018, more than 30 million children (one in five) were living in a low-income family and almost 15 million were living in a poor family (Jiang et al., 2017). According to Jiang and colleagues (2017), a family is considered to be low-income if the household income is less than twice the Federal Poverty Threshold. Furthermore, according to Berger and colleagues (2009), children living in a low-income setting are more likely to have poorer physical environments indicated by the lack of resources, less stimulation, less availability of quality childcare, and the higher likelihood of not being able to play outside for safety reasons. Usually characterized by higher levels of stress in daily life, there is a higher likelihood of a caregiver in a low-income setting developing high levels of toxic stress, depression, and anxiety, which could result in being less nurturing, sensitive, and responsive to their child (Berger et al., 2009; Gross et al., 1999; Morsy & Rothstein, 2019). Studies have shown that a mother’s stress and depression can be just as detrimental as a low-income environment in creating a harsh, inadequate living space for a child (Berger et al., 2009; Gross et al., 1999). All of these factors combined, have the potential to play into a child’s growth and development.

Furthermore, there have been numerous studies that look at the environment a child grows up in and the effect this has on a child’s development and ability to reach age-appropriate milestones. These studies have shown that both the home environment and the relationships within the home can work together to create a higher chance of inhibiting a child’s growth, brain development, social-emotional skill regulation, and has
the potential to affect long-term growth and development (Berger et al., 2009; Bowman et al., 2018; Li & Qiu, 2018; Morsy & Rothstein, 2019). Other studies have shown that a child is significantly influenced by their immediate environment (Sampson et al., 2002). Specifically, if a child does not have adequate space to play inside or outside, lacks adequate relationships with caregivers and family members, or experiences any sort of violence, maltreatment, substance abuse, or chaos within their environment, the child’s development and overall well-being is more likely to be negatively affected (Duncan & Brooks-Gunn, 2000; Sampson et al., 2002). Studies have shown that no matter the severity or level of stress a child experiences in their immediate environment, their brain is negatively affected (Doulabi et al., 2017; Freitas et al., 2013).

The term ‘home environment’ can be broadly defined but is characterized in one of two ways: 1) the physical environment (“where individuals live, learn, work, and play…including both indoor and outdoor spaces” (Physical Environment, n.d. p. 1)) and 2) the relationship with the caregiver (Berger et al., 2009). The environment affordances (“opportunities offering an individual potential for action that consequently leads to learning and development of a skill or development of a biological system”) within the physical environment can directly influence the milestones and development a child experiences (Berger et al., 2009; Freitas et al., 2013, p. 320). Thus, a child’s physical environment is critical for their early development (Freitas et al., 2013).

The second aspect of a child’s environment involves the relationships within the home. Doulabi and colleagues (2017) showed that the relationships within the child’s environment are linked to both their immediate and long-term development. After birth, healthy brain development requires nurturing and safe relationships (Bick & Nelson
A caregiver is responsible for adequate exposure to language, interactive play, emotional feedback, and providing intellectual stimulation (Bick & Nelson, 2017). The behaviors between caregivers and children in a low-income setting may differ in those from more affluent families based on the situational circumstances in each environment. If a child is under constant stress, learning and development can be more difficult to obtain (Bick & Nelson, 2017; Bowman et al., 2018). Because of brain plasticity, a child’s brain is shaped and molded, especially in the first few years of life based on the experiences children have, specifically with their primary caregiver (Bick & Nelson, 2017). In an environment that lacks stimulation and is not adequate for a child’s growth and development, the child is not afforded the chance of strong neural connections and is at a higher risk for developing abnormalities in cognitive, physical, and social health (Bick & Nelson, 2017), in this case, linked to a higher potential of developing a delay in their fine motor skills. While there are external factors influencing fine motor skills, these two aspects (relationships with caregivers and their environment) are critical for a child’s fine motor skill development.

Household income can be a contributing factor to fine motor skill development because it allows a mother to provide physical, and materialistic opportunities and stimulation for her child in terms of toys, and out-of-the-home experiences (Doulabi et al., 2017; Freitas et al., 2013; Giagazoglou et al., 2007; Valadi & Gabbard, 2018; Venetsanous & Kambas, 2010). However, according to Freitas and colleagues (2013), Gottschling-Lang and colleagues (2013), and Valadi and Gabbard (2018), fine motor skill development is significantly influenced by a caregiver’s level of education and household income of the family. This is because maternal education has the ability to influence the
mother’s parenting styles, interactions with her child, and the opportunities she exposes her child to, and studies have shown that mothers with higher levels of education are more knowledgeable regarding her child’s growth, development and how to help them reach age-appropriate milestones (Augustine et al., 2009; Tamis-Lemonda et al., 2002; Way, 2019). More specifically, a number of studies have shown a significant correlation between maternal education and poverty levels indicating a higher level of education decreases the chance of living in poverty (Doulabi et al., 2017). Additionally, studies have shown that a child living in poverty, is 1.3 times more likely to have some sort of general developmental delay due to any number of parental factors: prenatal care, nutrition, toxic stress, poor interparental relationships, and related to the focus of this research: toys and learning materials that promote educational opportunities and help promote the development of fine motor skills, all indirectly or directly influenced by maternal education (Doulabi et al., 2017; Freitas et al., 2013; Valadi & Gabbard, 2018; Venetsanous & Kambas, 2010).

Fine motor skills are defined as “actions involving dexterity to manipulate smaller movements and objects…and require the coordination of small muscles in the fingers, hands, and feet” (Matheis & Estabillo, 2018, p. 467). These skills have been shown to have the ability to influence much larger aspects of a child’s development and later academic success. Fine motor skills allow a child to be able to explore, manipulate, and play with objects or tools in their daily routines and activities (Syafiril et al., 2018) and begin to develop in children as young as a few months of age and play a significant role in a school-aged children’s development and functioning. Studies have shown the longitudinal effects of proper fine motor skill development showing higher achievement
scores in children as old as third grade. For example, Grissmer and colleagues (2010) found that along with attention, and general knowledge, fine motor skills are one of the strongest predictors in a kindergartener’s reading and math skills. Other studies such as Dinehart et al., (2013), Pitchford et al., (2016), and Suggate et al., (2019) support the findings that there are internalized-motor processes stemming from fine motor skill development related to reading and math scores in a young child. Additionally, other studies have found ‘distinct’ correlations between a child’s fine motor skills and their executive functioning, response inhibition, motor control and school readiness (Cameron et al., 2012; Simpson et al., 2019).

Socioeconomic status (SES) is comprised of social, economic, and work status of individuals, and low SES refers to those with low levels of education and/or income (Low Socioeconomic, n.d.). In the present study, all households are considered to be ‘low-income’ due to the status of the finances within the home. Therefore, the term ‘low-income’ will be used to describe the conditions of the population’s environment rather than low socioeconomic status. Maternal education has been extensively studied and has been shown to have a direct impact on her child’s development (Doulabi et al., 2017; Freitas et al., 2013; Valadi & Gabbard, 2018; Venetsanous & Kambas, 2010). As previously mentioned, studies have shown the links between maternal education and parenting styles, relationship quality, prenatal care, and the involvement in a child’s everyday play, and later, their schooling (Augustine et al., 2009; Guryan et al., 2008; Kalil et al., 2012). Other literature has shown the negative influences a low-income environment can have on a child; chaos, possible exposure to substance abuse or negative interpersonal relationships, inadequate educational opportunities and experiences, all
leading to a potentially higher likelihood of falling behind their peers in academic and physical growth and development (Doulabi et al., 2017; Freitas et al., 2013; Miller 2015; Valadi & Gabbard 2018; Venetsanous & Kambas 2013). However, while studies have looked at how fine motor skills develop in young children, and possible links to maternal education, little research has examined fine motor skills in a strictly low-income population. Additionally, there is a lack of literature examining fine motor skills in children under the age of one with an additional lack of literature examining the effects of gender on the development of fine motor skills. Therefore, gender will be examined as an exploratory variable because of the different ways boys and girls biologically develop, adhere to social norms and patterns, and have different genetic make-ups. This study is significant in contributing to the current understanding of fine motor skill development in low-income children, particularly young children, by examining how these skills are developed across gender based on a mother’s level of education. In particular, few of these studies have been conducted in the United States.

This paper will address the overarching topic of how maternal education affects a child’s fine motor skill development. There are two research questions that narrow this focus: 1) Does a primary caregiver’s level of education relate to the development of their child’s fine motor skills within a low-income sample population? and 2) Does this relationship vary based on the sex of the child?

This study will look specifically at infants and toddler-aged children under the age of three. During these development periods, children are learning how to interact with their environment and those within their environment. It is hypothesized that a caregiver’s level of education will influence their child’s fine motor skill development; a
caregiver with no high school completion will be more likely to have a child who is not proficient in fine motor skills when compared to a child of a caregiver who has completed high school. This is hypothesized because it is expected that mothers with higher levels of education will have a better understanding of what their child needs to properly develop, know how to provide support to meet those needs, and what steps should be taken along the way (Augustine et al., 2009; Tamis-Lemonda, 2002). Additionally, mothers with higher levels of education have been shown to spend more time exposing their child to social and natural capital, enhance their child’s development by spending more time with their child, and are more knowledgeable about age-appropriate activities and milestones (Augustine et al., 2009; Tamis-Lemonda et al., 2002; Way, 2019). Furthermore, education can act as a protective factor for families, but what is not understood is if maternal education level works as a protective factor specifically among low-income families, in this case, assisting in a child’s ability to develop proper fine motor skills. Research suggests that boys growing up in low-income environments have more delays in their development than girls (Leaper, 2014; Miller, 2015). Because of this, gender is being used to look at whether there are gender differences specifically in the relationship between maternal education and fine motor skill development within a predominately low-income sample.
Maternal Education

Maternal education is considered to be one measure of socioeconomic status and has a critical impact on both the way a child is raised and on the household income. According to Jiang and colleagues (2017), the National Center for Children in Poverty states that 82% of caregivers (with children) living in low-income conditions have less than a high school degree. With the same level of education, 50% of caregivers (with children) are considered ‘poor’. On average, approximately 79% of mothers with a college degree or higher work full-time while about 42% of mothers with less than a high school diploma have a full-time job (Guryan et al., 2008). In today’s society, maternal employment rates continue to grow but mothers, especially in single parent households, are largely considered to be the primary caregiver (Harding, 2015). Maternal education has been directly linked to a child’s cognitive, social, and academic outcomes based on the rate of involvement a mother has with her child, and the environment she provides for her child. For instance, Guryan and colleagues (2008) indicated that higher levels of education are linked to spending more time with a child. Women with less than a high school diploma were found to spend an average of 12.1 hours per week meeting their child’s basic needs (feeding, playing, bathing) while college educated mothers spent an average of 16.5-17 hours per week with their child (Guryan et al., 2008).

Higher levels of maternal education have also been linked to better prenatal care, authoritative parenting styles, more use of complex language in the household, intellectual outings (museums, zoos, etc.), higher participation in their child’s schooling,
and higher standards of success within the classroom (Augustine et al., 2009). For example, children with caregivers who have a college degree or an advanced education, on average, hear 30 million more words than a child with a caregiver who has a high school education or lower (Way, 2019) which can lead to a richer and larger vocabulary for children who hear more words. Toddlers, for example, from more educated caregivers on average are six months ahead in language development than a toddler from a caregiver with less education (Lundberg & Pollack, 2015). Studies have also shown that a mother’s level of education has long-term effects on her child’s academic success. For instance, according to Way (2019), children who have higher educated parents do better in both math and reading when they reach school-age.

While researchers have noted differences in parental time spent with children based on education level, it has been found that it is not necessarily the amount of time spent with a child that has the potential to affect their development, but rather the quality of the interactions (Guryan et al., 2008; Kalil et al., 2012). Researchers and those who specialize in children and families tend to view education as a human capital investment (Augustine et al., 2009; Guryan et al., 2008; Li & Qiu, 2018). This means investing in a young child’s development has a greater payoff for better outcomes later in life (Lundberg & Pollack, 2015). Mothers with higher levels of education tend to expose their children to natural capital, (“natural resources or natural assets found within one’s ecosystem”) (What is Natural Capital?, n.d.) for instance, bringing their children to museums and/or exposing them to music because mothers with higher levels of education (and a higher chance of increased income) have the ability and resources to do so (Way, 2019). They also afford their child an opportunity to build social capital (“networks of
relationships among people who live and work in a particular society”) (Dictionary.com, n.d.) because they are more likely to bring the child on outings and surround themselves with other people who tend to have similar levels of education (Augustine et al., 2009; Way, 2019). This social network of people also serves as a potential resource for mothers to learn more about child development and have a place to ask questions regarding their child’s development (Augustine et al., 2009; Kalil et al., 2012). Lastly, a child whose mother demonstrates stability and consistency benefit in terms of having their baseline necessities met for optimal development through physical security, health care, nutrition, attention, and opportunities to grow, factors that can best be met when mothers have higher education (Bowman et al., 2018). These aspects of a child’s life are critical for growth and development because they contribute to the overall quality of life of a child. Furthermore, these factors are easier to attain if mothers have a higher level of income and can afford the necessities for their child.

**Fine Motor Skill Development**

A focus was placed on fine motor skill development as a measure of physical development because it has been found that in a low-income household, a child experiences a higher likelihood of having a delay within their fine motor skills (Doulabi et al., 2017). Fine motor skills are a skillset characterized by “the ability to control movement through coordinated activities of the nervous system and muscles such as the movements of fingers and hands” (Syafri et al., 2018, p. 3). These skills are considered to be essential for early learning because according to Pitchford and colleagues (2016), 30-60% of a young child’s daily activities involve this skillset through coloring, copying, cutting, and drawing.
In Western society, typical skills children are tested on when their fine motor skills are examined are the ability to hold a crayon or pencil, draw pictures, stack blocks, string beads, use scissors, brush teeth, manipulate buttons, or turn doorknobs (RISE, 2019). As an infant, babies under the age of one are expected to be able to develop a reflexive grasp, voluntary grasp, controlled reach, putting objects in mouth, pincer grasp, transferring objects from one hand to another, picking up toys, and controlled release of objects (KIDS SENSE, 2019). As a child ages, a toddler between the ages of one and three is expected to manipulate buttons, hold a writing utensil, use a feeding utensil, string beads on a shoestring, manipulate doorknobs, hold scissors, and turn pages of a book (KIDS SENSE, 2019). However, difficulties in fine motor skill development can be linked to neurodevelopmental disorders, specifically developmental coordination disorder which is linked to motor control deficits and executive functioning deficits (Simpson et al., 2017). For example, the ability to hold a writing utensil to draw and to participate in these types of activities that involve fine motor muscles and skills allows a child to develop response inhibition, motor control, and executive functioning skills that aid in overall growth, development, and classroom achievement.

Positive fine motor skill development can aid in a child’s cognitive and physical development and is significantly impacted by household income (Freitas et al., 2013). Coming from a low-income background may limit the ability a child has to grow and flourish based on the resources the family is able to provide. Having a small income can lead to caregivers not having resources to help their child develop those skills, such as the ability to afford toys and materials that can enhance fine motor skill development. Thus, a home environment in which there are low levels of household income can potentially act
as an environmental constraint to fine motor skill development (Freitas et al., 2013). In order to develop fine motor skills, a child must have an environment that is both stimulating and engaging. The physical space a child is provided and the daily activities they partake in stimulates a child’s brain and creates positive neural connections (Tierney & Nelson, 2009).

Maternal education is relevant in fine motor skill development because of the influence a mother’s education can have on the affordances she provides for her child within the home and through the learning experiences and opportunities she provides. A mother’s level of education can be correlated with the development of their child’s fine motor skills because the quality of parent/child interactions are what drive a child’s development (Guryan et al., 2008; Kalil et al., 2012). This means that a caregiver who creates an environment that is conducive to motor development (e.g., playing with her child, doing a puzzle with her child, providing stimulating toys or the use of everyday household objects like pots, pans, and spoons in creative, stimulating ways), has a better chance of their child developing standard fine motor skills (Freitas et al., 2013). With higher levels of maternal education, these higher educated mothers likely have higher levels of household income and have the potential to provide more “sophisticated” toys to assist in learning and in fine motor skill development (puzzles, coloring books, counting games, and blocks) which is important because children learn through exploration, and toys act as tools in the development of fine motor skills (Freitas et al., 2013; Giagazoglou et al., 2007). Furthermore, in the findings that higher levels of educated mothers generally mean higher levels of income, Giagazoglou et al. (2007) found that mothers with higher levels of education (9-12 years of formal education), had bigger homes, play
spaces, and daily activities for their children when compared to caregivers with less education. In Freitas et al.’s (2013) study, any education less than a high school diploma was associated with caregivers providing less materialistic affordances such as toys, specifically age-appropriate toys to help their child’s development due to the household income differences resulting from education levels. Hence the relationship between maternal education and fine motor skills is critical to examine; with a higher level of education, it is thought that the caregiver will provide a more educational, enriching environment, and relationship for their child (Doulabi et al., 2017; Freitas et al., 2013; Valadi & Gabbard, 2018), which in turn will be optimal for their child’s fine motor skill development.

As previously stated, fine motor skills have been found to be correlated with a child’s reading and math achievement measured by test scores, along with a child’s ability to have control over their motor function, and executive functioning skills (Cameron et al., 2012; Pitchford et al., 2016; Simpson et al., 2019). Furthermore, young children’s (children before the age of two) fine motor skills can be used as an assessment of school readiness through their ability to visually map, motor plan, write numbers and letters, and sort objects (Pitchford et al., 2016). Based on previous findings, and what has been examined in fine motor skill development in general, in households and families below the Federal Poverty Threshold, it is thought that mothers with lower levels of education will have a higher likelihood of having a child with a fine motor skill delay and mothers with higher levels of education will have a lesser chance of having a child with a fine motor skill delay.

**Gender**
Studies have shown that no matter the level of stress a child is exposed to in early childhood, there are negative effects on their brain development (Berger et al., 2009; Morsy & Rothstein, 2019). Low-income home environments have a higher chance of having higher levels of stress due to daily circumstances of providing for a family, paying bills, meeting a child’s basic needs, and ensuring a sufficient income to do so (Doulabi et al., 2017). Research, however, suggest potential differences in how girls react to such stressors relative to boys beginning in the womb. However, while fine motor skill milestones are known for each age group, literature is limited in examining fine motor skill development in children under the age of two as most studies use children who are at least two years of age. Moreover, the examination of gender differences in fine motor skills, particularly during infancy and early toddlerhood is even more limited.

Oftentimes, low-income families are comprised of one caretaker (commonly single mothers) and this is important when considering the differences in developmental outcomes between boys and girls (Miller, 2015; Webb et al., 2020). Mothers, especially single mothers, tend to talk to and interact more with their daughters (Miller, 2015). Additionally, studies have shown that boys growing up in low-income settings face more stress, have a lack of male role models in their life, and are less resilient than girls in the same setting (Miller, 2015; Webb et al., 2020). In low-income households, boys are 3.1 times more likely to be less school ready when compared to their sisters in the same environment (Miller, 2015).

Part of the biological reasoning girls are more resilient in dealing with low-income related stressors and challenges is because of their early brain development (Webb et al., 2020). First, a female brain gets 15% more blood flow than a male’s brain
(Gurian & Stevens, 2004). This creates stronger neural connections, especially in the temporal lobe, which gives girls a learning advantage in the classroom as the temporal lobe aids in listening skills, memory storage, and tone discrimination. Second, a female’s corpus callosum, hippocampus, and cerebral cortex are all larger and develop earlier than a male’s brain (Gurian & Stevens, 2004; Masters, 2018). The cerebral cortex and hippocampus influence language development and thus act as a learning advantage. This leads to girls oftentimes developing a larger vocabulary and writing and speaking sooner than boys (Gurian & Stevens, 2004; Masters, 2018). The cortical region of the brain in a male versus a female is used differently. This region is used for verbal and emotive functioning for females and for spatial and mechanical functioning in males suggesting differences in the way boys’ and girls’ brains mature, and what they tend to gravitate towards in terms of play and learning (Gurian & Stevens, 2004). This would lead to females developing better cognition and reaching language milestones earlier than boys. Third, the female brain has a more active prefrontal cortex which is responsible for cognitive behavior, personality expression, making decisions, and social behaviors. This means females tend to make fewer impulsive decisions and engage in more complex thinking (Gurian & Stevens, 2004). These differences in brain development suggest young, school-aged girls have natural learning advantages when compared to their male counterparts.

Another reason for differences in the way males and females deal with low-income circumstances is due to the way they are raised within society. Parents in the study conducted by Dinkel and Snyder (2020) indicated that relatives and friends treat their baby differently based on the sex of the child. However, when interviewing and
observing the parent-child interactions with a sample of babies six-nine months old, researchers found that parents praised, corrected, and spoke to their baby differently based on their gender. More specifically, parents of boys identified the task in which they did well in, as opposed to providing vague praise and encouraged fine motor skill activities for girls but encouraged gross motor activities for boys. Furthermore, the researchers found that baby girls had higher rates of touching and playing with toys whereas baby boys had higher rates of intensity level of play, suggesting further gender differences in the development of fine motor skills (Dinkel & Snyder, 2020). A second study that examined gender differences in motor skill development was conducted by Kokstejn et al. (2017) on a sample population of preschool-aged children in examining general motor skills. While specific fine motor skills were not primarily assessed, they found that girls outperformed boys in manual dexterity, and balance, but these significant differences only lasted through toddlerhood. This suggests potential maturation differences across gender. Specifically, girls were shown to mature sooner than boys, creating differences among motor skills and suggesting a potential for differences in fine motor skills (Kokstejn et al., 2017).

While overall development between girls and boys have been studied, there are habits, patterns, and tendencies in each gender that could indirectly influence the way their fine motor skills are developed. For example, in families with low levels of household income, there have been found to be more gender-stereotyped activities for their children in terms of the activities, and toys they provide for their child (Leaper, 2014) which could contribute to the toys they are exposed to, the educational opportunities, and therefore their development of fine motor skills. While there is a lack
of literature regarding fine motor skills in children under the age of two, studies have found that during infancy, a girl pays more attention to faces and emotions and are more prone to fear. Boys on the other hand pay more attention to movement such as mobiles (Gurian & Stevens, 2004; Webb et al., 2020) indicating potential differences in motor development. On the other hand, there is significant and relevant data regarding fine motor skills in toddler-aged children and how this effect their early learning in school in terms of their ability to complete certain motoric tasks that aid in their schooling such as their focus, turning pages of a book or holding and using writing utensils (Doulabi et al., 2017; Kokstejn et al., 2017; Miller, 2015). Growing up adhering to social norms and socialization patterns, gender development can be seen across all domains (emotional, cognitive, physical, and motor). Females develop more emotions at an earlier age, especially pertaining to empathy whereas males develop more aggression and less empathy (Miller, 2015). Children tend to segregate with their own sex in play groups; boys engage in more rough housing behaviors and engage in imaginary weapon play while girls engage in more grooming and infant care, which would lead to more aggression for boys and more empathy for girls (Miller, 2015). Boys can also have a harder time sitting still at a young age (i.e., sitting still for books and crafts or paying attention to a single toy for a prolonged period of time) (Gurian & Stevens, 2004; Masters, 2018; Miller, 2015). All of these patterns of development such as the differences in boys’ and girls’ neurological and physical development suggest that at least beginning in preschool age (Kokstejn et al., 2017), girls are further along in their maturation and development than boys, suggesting potential differences in fine motor skill development.
Little is known regarding whether these differences can occur prior to toddlerhood, however.

In summary, boys are more likely to fall behind their more affluent peers when they have a more disadvantaged start (Miller, 2015; Webb, 2020). Even in the womb, studies have shown that males respond worse to stress when compared to females (Miller, 2015). Given the lack of literature in this area, the research question regarding gender differences in fine motor skill delays is exploratory and thus no hypotheses are made.

**Present Study**

There is a plethora of studies that investigated the effects that parental levels of education have on the child’s development but limited studies that focus strictly on fine motor skills and even less that focus on this skill development in a population whose income is below the Federal Poverty Threshold and during the developmental period of infancy and early toddlerhood. Moreover, the literature on the influence of maternal education on fine motor skill development, particularly among a predominantly low-income sample, is limited. Additionally, not as much research focuses on early childhood differences between gender in developmental delays, particularly fine motor skill delays, when living in a low-income household. The present study will contribute to this field of study by assessing how a mother’s level of education influences her child’s fine motor skills development, and by looking at gender differences in this association among a sample of low-income families.

**RQ1:** Is a primary caregiver’s level of education associated with the development of their child’s fine motor skills?
**H1**: A primary caregiver’s level of education will be associated with their child’s fine motor skills development. In other words, a primary caregiver who has not completed high school is more likely to have a child with fine motor skill delays.

**RQ2**: Will the association between a primary caregiver’s level of education and fine motor skill development vary across gender?

Due to the lack of literature regarding the development of fine motor skills across gender, no hypothesis was made for the second research question.
CHAPTER 3

METHOD

The data used for the current study is obtained from the Inter-University Consortium for Political and Social Research (ICPSR). The first wave of data was collected between March and September of 1999 with subsequent waves of data being collected in 2001 and 2005. The following three cities were involved in the study with children between 0-4 and 10-14, along with their primary female caregiver: Boston, Chicago, and San Antonio. The purpose of the original study was in response to the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 enacted by President Clinton (New Welfare Law…1996; Welfare, Children, and Families…n.d.). This Act instituted the Temporary Assistance for Needy Families (TANF) and implemented more regulations for those receiving government cash assistance (New Welfare Law…1996). The purpose of the original study was to understand the well-being of low-income children and families in the post-welfare reform era by better understanding the use of families’ strategies of employment, schooling, training, residential mobility, fertility, and the impact these responses to welfare had on their child, the child’s health and development, and the use of social services. Data was collected via in-person interviews, ethnographic interviews, and developmental assessments (Welfare, Children, and Families…n.d.). The current study focused on children up to the age of two and their primary female caregiver. In the present study, based on the research questions, there are three variables: 1) maternal education, 2) child’s fine motor skills, and 3) child’s gender. Fine motor skills are the outcome and maternal education levels act as the
predictors. Gender is used as an exploratory variable in the role it plays in a child’s development of fine motor skills due to the lack of literature surrounding the topic.

Participants

This study used wave 1 of the 1999 longitudinal dataset Welfare, Children, and Families: A Three-City Study (Angel et al., 1999). Since the focus of this study is on female caregivers and their infant/toddler ($N = 2,400$ families), all other participants were filtered out to create a subsample of children two years of age or younger who had the ASQ administered to them and their caregivers, resulting in an analysis sample of 432 families. The families were located in one of the following three cities: 1) Boston ($n = 147$), 2) Chicago ($n = 118$), and 3) San Antonio ($n = 167$). Participants were recruited based on their participance in two categories of receiving food stamps and/or Medicaid, an income below 200% of the Federal Poverty Threshold, and identified as non-Hispanic African American, Non-Hispanic White, Hispanic, or other and 73% of the households were headed by a single female (Angel et al., 1999). At the time of data collection in 1999, 40% of the families were receiving cash assistance from the government and all households were below 200% of the Federal Poverty Threshold according to the 1999 guidelines with a mean monthly income of $552.35 ($SD = 499.10$) (see Table 1) based on earnings, food stamps, Social Security income, welfare assistance, child support, security disability, help from friends and family, pension income, or ‘other’ (Welfare, Children, and Families….n.d.). In 1999, the Federal Poverty Threshold was approximately $16,700 for a family of four and for reference, the FPT in 2021 is $26,500 for a family of four (Prior HHS Poverty Guidelines…2021). According to the National Center for
Children in Poverty, families need to make an income that is equal to or two times the FPT to meet family basic needs (Jiang et al., 2017).

The analysis sample of children ranged from 0 months to two years old with 36.8% of the analysis sample being less than one year old, 60.2% of the analysis sample were one year old, and 3.0% of the analysis sample were two years old ($M = 8$ months; $SD = 6$ months) ($N = 432$). Among the analysis sample population, 49.1% were girls ($n = 212$) and 50.9% were boys ($n = 220$). In terms of race/ethnicity, 4.9% of the children were Non-Hispanic White ($n = 21$), 41.4% were identified as Non-Hispanic Black ($n = 179$), 52.1% of the population were identified as Hispanic ($n = 225$), and 1.6% were identified as other ($n = 7$) (see Table 2).

Caregivers’ race/ethnicity was comprised of 7.6% identifying as Non-Hispanic White ($n = 33$), 40.5% identifying as Non-Hispanic Black ($n = 175$), 0.2% of the sample were Non-Hispanic Asian ($n = 1$), 50.2% identifying as Hispanic ($n = 217$), and 1.4% of respondents identified as ‘other’ ($n = 6$). Of this population, 37.3% of the population reported less than a high school diploma or GED ($n = 161$), 11.8% reported a GED ($n = 51$), 27.1% reported a High School Diploma ($n = 117$), 19.4% of the population reported a vocational tech diploma ($n = 84$), 0.1% possessed an R.N. diploma ($n = 1$), 2.3% possessed an associate’s degree ($n = 10$), 1.2% had a Bachelor’s degree ($n = 5$), 0.2% had a Master’s degree ($n = 1$), and 0.2% had a Ph.D. ($n = 1$) (see Table 1).

**Measures**

**Education**

The female primary caregiver’s level of education was a discrete variable and was self-reported in the initial questionnaire. For analytic purposes, the nine education
categories were collapsed into two groups: 1) No High School Completion and 2) High School Completion or Higher. With the recoded variables, 37.3% \((n = 161)\) reported no high school completion while 62.7% \((n = 271)\) reported a high school diploma or higher.

**Fine Motor Skills**

In the United States, fine motor skills are generally measured using standardized assessment tools such as the *Ages and Stage Questionnaire* (ASQ), *Alberta Infant Motor Scales*, *Bruininks-Oseretsky Proficiency, Assessment of Motor and Process Skills*, and the *Bayley Scales of Infant Development* (Matheis & Estabillo, 2018). In Western society, typical milestones assessed in examining a baby’s fine motor skills (less than 12 months) include reflexive grasp, controlled reach, voluntary grasp, putting objects in mouth, controlled release of objects, pincer grasp, and transferring objects from one hand to another (KIDS SENSE, 2019). As a child ages, their motor skill milestones and expectations change. Between the ages of 12 and 36 months, milestones include self-feeding with minimal assistance, turnings pages in a book, scribbling, turning doorknobs, building small towers of blocks, developing a dominant hand, ability to use scissors, and the ability to manipulate an object like play dough (KIDS SENSE, 2019). A formal fine motor skill assessment for an older toddler-aged child includes the ability to string beads, hold a crayon, copy shapes or basic drawings, work with buttons, or pick up (and use) a utensil (RISE, 2019).

In the original study, fine motor skills were assessed in the children by using the *Ages and Stages Questionnaire* (ASQ) (Angel et al., 1999) developmental screening tool to identify potential delays in children’s development. The ASQ screening tool is the most widely used child demographic questionnaire and is designed for children from
birth to six years old (About ASQ, 2018; Doulabi et al., 2017). The ASQ’s sensitivity is 75% in a high-risk group, and 100% in the community group while specificity is 95% and 90% respectively (Doulabi et al., 2017). The screening tool works to assess a child’s development and to identify any potential delays such as within communication, physical development, and social skills (About ASQ, 2018). The tool has 19 different individual questionnaires pertaining to five different developmental domains (communication skills, gross motor skills, fine motor skills, problem-solving skills, and personal-social skills) (Doulabi et al., 2017; Lamsal et al., 2018). Each section has six questions in which the caregiver can say ‘yes’ their child possesses the skill, ‘no’, or ‘not yet’ (Doulabi et al., 2017). Each section is scored separately and summed together and compared to specific standards of the age group and skill (Angel et al., 1999). In this particular study, the ASQ was administered for children in infancy and toddlerhood (Angel et al., 1999) and only the fine motor skills were taken into account. The child’s ASQ score was coded as a dichotomous variable by the interviewer. Children’s delay or lack thereof in fine motor skills were reported by their caregivers. In this analysis sample, 8.3% of the children were reported to have a delay in their fine motor skills \( (n = 36) \) and 91.7% of the children were reported to have no delay in their fine motor skill development \( (n = 396) \).

**Gender**

About half (50.9%; \( n = 220 \)) of the subsample of children are boys and 49.1% (\( n = 212 \)) are girls.

**Plan of Analysis**

SPSS version 26 was used to complete the analyses for this study. For this particular study, a cross-sectional research design was used since only the first wave of
the dataset was examined. Fine motor skills were assessed by the original researchers in children during their infancy and early toddler years.

Logistic regression was used to examine the research questions. Using logistic regression allows for the examination of the likelihood of a caregiver with no high school completion having a child who has a fine motor skill delay. Furthermore, this also looks at the likelihood of a caregiver who completed high school having a child without a fine motor skill delay. As for examining gender, due to the small number of participants who were indicated to have delays in their fine motor skills, an interaction term between maternal education and gender cannot be fit to the model. Therefore, when examining gender differences, the SPSS file was split across gender to examine whether the relationship between maternal education and fine motor skill development varied between boys and girls. Since logistic regression analyses were largely not significant, follow-up chi-square analyses were conducted to further examine the potential relationship between maternal education and fine motor skill delays.
CHAPTER 4
FINDINGS

The relationship between maternal education and fine motor skill delays was first examined. The results of the Pearson correlation indicated there was not a significant relationship between maternal education and a child’s development of fine motor skills ($r = -.06, p = .20$). In other words, fine motor skills were not related to maternal education. The file was then split by child gender, and a Pearson correlation between maternal education and fine motor skills was examined by child gender. The results of this analysis indicated there was no relationship between maternal education and fine motor skills for boys ($r = -.01, p = .94$). The relationship between maternal education and fine motor skills for girls was approaching significance ($r = -.13, p = .06$) suggesting that mothers with at least a high school education were marginally less likely to have girls with fine motor skill delays. Further examination regarding gender differences revealed that mothers with high school completion were more likely to have girls whereas mothers with no high completion were more likely to have boys ($\chi^2 (1) = 7.78, p < .01$). However, reports of fine motor skill delays did not differ across gender ($\chi^2 (1) = .01, p = .91$).

**Logistic regression between maternal education and fine motor skills**

A logistic regression model was fit to examine whether no high school completion predicted membership in the fine motor skill delay group. Results indicated that there was not a significant relationship between maternal education and fine motor skills. In other words, maternal education levels had no effect on a child’s development of fine motor skills ($B = -.45, SE = .35, p = .20$) (see Table 3).

**Logistic regression between maternal education and fine motor skills by gender**
In examining gender, due to the small sample size in the current study, an interaction term could not be fit between maternal education and gender. Instead, the SPSS file was split across gender to examine whether the relationship between maternal education and fine motor skill development varied between boys and girls. Results indicated that there was no significant relationship between maternal education and fine motor skills for boys ($B = -.04$, $SE = .50$, $p = .94$). However, results indicated that the relationship between maternal education and fine motor skills for girls were approaching significance ($B = -.90$, $SE = .50$, $p = .07$). Thus, mothers of girls who completed high school marginally had a 59% lower likelihood of having a child with fine motor delays (see Table 3).

**Chi square analysis between maternal education and fine motor skills**

Since non-significant findings were predominantly shown in the logistic regression analyses, the hypotheses were further examined by fitting a chi-square model to examine if maternal education was related to children’s fine motor skills. In this analysis, maternal education, did not predict membership in the fine motor skill delay group ($\chi^2(1) = 1.66$, $p = .20$). In other words, there was no relationship between a child’s fine motor skill delay and their caregiver’s level of education (see Table 4).

**Chi square analysis between maternal education and fine motor skills by gender**

Similar to the logistic regression analysis, the SPSS file was split across gender and a chi-square model was fit for both groups to further investigate the relationship between maternal education and fine motor skills across gender. Further analyses indicated that there was not a statistically significant relationship between maternal education and fine motor skills for boys. In other words, being a boy did not influence
whether or not there were fine motor skill delays according to maternal education ($\chi^2(1) = .00, p = .94$). However, results indicated that the relationship between maternal education and fine motor skill delay was approaching significance for girls ($\chi^2(1) = 3.46, p = .06$) (see Table 4). Specifically, mothers with no high school education were marginally more likely to have girls with fine motor delays. On the other hand, mothers with a high school education were marginally less likely to have girls with fine motor delays.
CHAPTER 5
CONCLUSION

The purpose of the present study was to address the topic of child development as it pertains to low-income households. Thus, two variables of interest were maternal education and children’s fine motor skill development with a third variable, child gender, used for exploratory value. There were two research questions: 1) Does a primary caregiver’s level of education relate to the development of their child’s fine motor skills within a low-income sample population? and 2) Does this relationship vary based on the sex of the child? It was hypothesized that a primary caregiver’s level of education would be associated with their child’s fine motor skill development such that a primary caregiver who had not completed high school would be more likely to have a child with fine motor skill delays. It was important to examine gender differences because there is a lack of literature regarding how fine motor skill development varies across boys and girls.

Two statistical tests were run, logistic regression and chi square analyses and the results of each were similar. Across the entire sample, it was found that maternal education and children’s fine motor skill development were not related. Therefore, it was determined that the present study’s hypothesis was not supported. The sample population was then examined for boys and girls separately and it was found that maternal education and children’s fine motor skill development were not related for boys. However, both the logistic regression and chi square models approached significance for girls. Specifically, both indicated that mothers with no high school education were marginally more likely to have girls with fine motor delays whereas mothers with at minimum a high school education were marginally less likely to have girls with fine motor delays.
For this particular study, the focus was on children under the age of three years old and those who had their fine motor skills assessed by the researchers. Therefore, a subsample of 432 low-income families were analyzed. Among this sample, 91.7% \( (n = 396) \) of the children were reported to not have a delay in their fine motor skills, while only 8.3% \( (n = 36) \) were reported to have a fine motor skill delay. The results revealed that girls were more affected by their mother’s level of education than boys were. More specifically, mothers with less than a high school education had a marginally higher chance of having a daughter with a fine motor skill delay whereas a mother with a high school education or higher was marginally less likely to have daughter with a fine motor skill delay. This could be because in families with an income below the Federal Poverty Threshold, mothers tend to interact less with their sons relative to their daughters and boys have been found to be more sensitive to a disadvantaged start than girls (Miller, 2015). Along with the idea that mothers interact with their daughters more often and differently, it was found that parents tend to praise their sons more often and encouraged fine motor skill play for their daughters (Dinkel & Snyder, 2020). Thus, these differences in interactions may remain even when low-income mothers attain more education, which may be an advantage for their daughters in their development of fine motor skills. Additionally, results may not have reached significance because only 8.3% of children had fine motor skill delays. With a sample that had a higher number of children with possible fine motor delays, there is a higher likelihood that there would have been a significant relationship between maternal education and fine motor skill development, particularly among daughters.
The present study was driven by the research conducted by Doulabi and colleagues (2017) who indicated that in a low-income setting, children experience delays in their fine motor skills. Not only are household income and toys within the environment the top two predictors of fine motor skill development (Valadi & Gabbard, 2020), fine motor skills are found to be influential to reading scores, math scores, executive functioning, and motor control later in life (Cameron et al., 2012; Simpson et al., 2019). Dinkel and Snyder (2020) specifically looked at infant motor skills, assessing fine motor skills by gender and found differences and Kokstejn et al. (2017) found motor skill differences across gender at least until school-age. Dinkel and Snyder (2020) is one of the only studies to examine differences in infant fine motor skill development across gender. This was done through observation, interviews, and interactions with the infants to better understand the differences between boys’ and girls’ development. It was found that parents interact differently with children based on gender and encourage different activities (gross versus fine motor skills) based on gender. These findings stress the need to examine gender differences in fine motor skills in a young population. Additionally, Kokstejn and colleagues (2017) looked at toddler development in terms of their functional motor skills in general. They found that there are maturational differences in boys and girls which could contribute to girls being developmentally more advanced than boys, at least through preschool. These studies are important because it supports the idea that there are differences between boys and girls and how they develop and that girls can be more developmentally advanced than boys at least for a period of time. This is critical in better understanding the development of fine motor skills and working to understand that this development is not linear nor is it the same across all demographics and
populations. However, while child development specialists have noted infant fine motor skill milestones, there is a lack of research regarding the development of this skillset in children under one year of age as only one study was found to assess these skills in infants (Dinkel & Snyder, 2020). Most of the literature examined fine motor skill development among children over the age of two and examined the longitudinal effects of these skills on school readiness and classroom achievement from kindergarten through third grade (Augustine et al., 2009; Cameron et al., 2012; Simpson et al., 2019; Syafril et al., 2018). The present study contributes to this gap in previous literature by examining an age population that is understudied within a strictly low-income population.

Although understanding fine motor skill development during infancy is beneficial, it may also be too early to detect advancement in these skills during this developmental period. The average age of the present study’s subsample was 8 months old with the maximum age being two years old. An infant learns through exploration, and a baby under the age of one is developing basic skills such as sitting up, holding a bottle, and learning to crawl (KIDS SENSE, 2019; RISE, 2019) and in terms of fine motor skill development, transferring objects between hands, holding a utensil, and putting objects in their mouth to explore (ASQ-3, 2019; KIDS SENSE, 2019; RISE, 2019). It is not until after one year old that infants are more mobile in their exploration and taking part in more active play and manipulation of objects and toys (Freitas et al., 2013; Giagazoglou et al., 2007). These milestones are important and can be relevant to the present study’s findings because there were no statistically significant relationships between maternal education and fine motor skills. This could suggest that the population was too young for fine motor skills to be relevant. It could be that maternal level of education is not as
influential to a child’s development until later in early childhood when the child is learning to talk, becomes more mobile and active, and requires more supervision and interaction from a caregiver. An alternative explanation is that on average, mothers of all education levels are in fact meeting children’s basic needs (feeding, bathing, changing). Thus, delays in fine motor skills are less likely to be detected.

Prior literature works to understand fine motor skills but in doing so, compares affluent children to low SES children. By doing this, it causes further discrepancies and does not account for an extensive look at external factors such as home environment, parental marital status, and relationship qualities, in summary, factors that are more vulnerable to low SES families and can greatly contribute to the development of fine motor skills. By strictly examining low-income populations, specifically children, these factors can be examined as potential influences of child development. By using data regarding children in a low-income population such as this, there are more of such factors to examine closely. It is important for future studies to closely examine various contributing factors in a child’s development not just to fix an immediate gap such as a heightened risk of developmental delays, psychological diagnoses, behavioral issues, or health implications, but to eradicate long-term effects such as an increased chance of involvement in crime, and decreased chance of academic success (Dearing, 2008).

The present study also aimed to contribute to the field by examining gender differences in the relationship between maternal education and children’s fine motor skills in a low-income population. Prior research shows the drastic differences not only in brain development between boys and girls, but in how they are treated (Gurian & Stevens, 2004; Masters, 2018; Miller, 2015; Webb et al., 2020). There is a lack of
literature regarding how fine motor skills vary between boys and girls and how fine motor skills develop among a population under 24 months of age. However, findings from the chi square and logistic regression analyses indicated that mothers without a high school education were marginally more likely to have girls with fine motor delays. These findings suggest that with a larger sample size of children with fine motor delays, there is a higher likelihood that these findings would have been significant. This is also important to recognize because in future studies, having proportionate numbers in each group (fine motor delay vs. no fine motor delay) would make for more justifiable comparisons.

**Contributions**

Though the hypothesis was not supported, this study nevertheless remains important to this area of research. To the author’s knowledge, only one study was found to examine fine motor skills in children under the age of one (Dinkel & Snyder, 2020), and an additional study was found to compare boys and girls’ development of functional motor skills only briefly without a specific focus on fine motor skills (Kokstejn et al., 2017). The present study contributes to the current literature in that it examines a strictly low-income population and uses a young population of children averaging a few months of age. The present study also contributes to the current research by examining the relationship between maternal education and children’s development within such a population. Prior literature has not focused solely on low-income populations but rather compared low-income to higher income. It is important to analyze low-income children without comparisons across SES because of the additional barriers and risks these children may face in their everyday lives. Future studies should also examine outside factors such as household income, access to resources, and access to food to further
understand fine motor skill development and how these outside factors can contribute to fine motor skill development, particularly among low-income children. Furthermore, this study was important because of the use of gender as an exploratory variable. Gender has not been a focal point in many prior research studies. There currently is a lack of research examining gender differences in the relationship between maternal education and fine motor delay. Understanding gender differences in fine motor skill development may assist teachers, child specialists, and those who work directly with children better understand their children’s needs and implement good practices to help in children’s growth and development.

Limitations and Future Directions

One limitation to the current study is that it uses a cross-sectional design, meaning only one wave of data was used disallowing for long-term examinations. Data on fine motor skills were collected for younger aged children rather than long-term effects of maternal education on fine motor skills among older aged children. Thus, this prevented the study from determining causality.

Another important factor of the study was using mothers has focal participants. This is because previous literature has shown that regardless of demographics, women spend more time with their child(ren) than male caregivers (Guryan et al., 2008). On average, mothers spend at least 45 hours per week actively caring for a child whereas fathers spend approximately 30 hours per week (Guryan et al., 2008). Additional research has shown that although the rates of maternal employment are increasing, mothers are still considered to be the primary caregiver (Harding, 2015). Other literature has shown a mother’s level of education significantly influences her child’s home environment,
learning opportunities, cognition, social skills, and academic outcomes (Augustine et al., 2009; Freitas et al., 2013; Harding, 2015, Kalil et al., 2012). Nevertheless, the need to examine the effects of both partners’ levels of education on children’s fine motor skill development in a two-parent household is necessary. Studies such as Cabrera and colleagues (2007) have shown that while mothers are typically primary caregivers, father-child interactions can still significantly impact a child’s cognition, language, and emotional regulation. Not many studies examine the effects of a father’s education level on his child’s development, however Duursma et al. (2008) demonstrated that low-income fathers who completed high school typically read to their child more often than a father who does not have a high school diploma. Studying child interactions with a second caregiver figure, other than a primary female caregiver, can provide additional insight into parent-child relationships, and the influence a second caregiver could have on their child’s development. This can also be important in working to better understand home environments of children and in understanding the effect of a second caregiver’s level of education and how this can impact their child’s fine motor skill growth and development.

While the study did strictly use a sample whose income was below the Federal Poverty Threshold, only two attributes of maternal education were used. This was because of the lack of variance across the levels of education; there was not enough of a range in education levels to have more than two attributes to make more comparisons. It would be of importance for future studies to have a wider range of education levels to examine the differences in fine motor skill development across these levels.
Another limitation of the study involves the lack of distribution across race. Race was not used as an exploratory variable nor was it used as a variable of interest. The majority of the analysis sample, 92.4% \((n = 399)\) of caregivers and 95.1% \((n = 411)\) of children, were identified as a minority race (any race other than White). Due to this imbalance in variance of race, fair assumptions by race and ethnicity could not be made. However, in future studies it would be important to have a more ethnically diverse population to examine in addition to how fine motor skills vary by maternal education and gender but also how they vary across different races and ethnicities.

The use of the *Ages and Stages Questionnaire* (ASQ; Angel et al., 1999) can be considered a limitation to the present study. While the ASQ is a reliable, and accurate screening tool (ASQ-3, 2021; Doulabi et al., 2017), it is self-reported by the caregiver and is designed to identify potential delays in development. In particular, the fine motor skill portion of the questionnaire is comprised of six questions asking if a child can perform certain tasks such as turning pages of a book, use a writing utensil, or stack blocks with answers saying ‘yes’, ‘no’, or ‘not yet’ (About ASQ, 2018; Angel et al., 1999; ASQ-3, 2021). This is important because tools such as the *Bayley Scale of Infant Development* (BSID) is an extensive assessment of development in children one to 42 months of age in cognition, motor, and language skills designed to diagnose a delay in development (DelRosario et al., 2020). This is a more reliable tool in assessing children’s development because it must be performed by a licensed professional trained in the BSID and includes various evaluations and takes up to an hour to administer (DelRosario et al., 2020). In future studies, it would be important for the dataset to include other reliable
evaluation tools of children’s fine motor skills as opposed to solely using a screening tool that suggests a potential for a delay.

Lastly, a limitation of the study was the sample size. The results, specifically for girls suggested that should there have been a larger sample population of children with fine motor delays, there is a likelihood that the results would have been significant. Using a dataset in which there is a larger number of children reported to have fine motor skill delays and/or with a wider spread of race and education may lead to significant results within a more representative sample.

**Conclusion and Implications**

The message from the present study is that even among low-income families, there were limited fine motor skill delays. Furthermore, the present study did not show that lower levels of maternal education predicted children’s fine motor skill delays. The results differed from previous literature in that it did not show significant differences in how fine motor skills develop across gender, and there were not significant differences in the development of children’s fine motor skills by levels of maternal education. While the results differed from previous literature, the present study’s findings are not definitive and other sample populations, or age groups may find different results. Though the findings were not significant, this does not take away from the significance of the present study. It is critical that professionals who work with children understand each child’s background and demographics. Studies have shown that low-income children face more risk factors on a daily basis such as inadequate space to play, inadequate relationships, maltreatment, substance abuse, chaos within the home, and interparental stress (Doulabi et al., 2017; Freitas et al., 2013; Valadi & Gabbard, 2018; Venetsanous & Kambas,
This is especially supported by Doulabi and colleagues (2017), Freitas and colleagues (2013), and Duncan and Brooks-Gunn (2000), whose research indicates that confounding aspects of low-income environments have been found to inhibit child development, including, but not limited to, precarious health, nutrition, less environment stimulation, stress, treatment, and playtime.

Furthermore, Freitas et al. (2013) have demonstrated that the home environment is a critical indicator of early childhood care and education. As previously discussed, the home environment and parent-child relationships are significant in a child’s development and well-being and when stress is present in the home, there is an increased chance of strained parent-child relationships, and harsher parenting practices (Morsy & Rothstein, 2019). Additionally, Doulabi and colleagues (2017) found high correlations between maternal education, low income, and negative effects on a child’s development. These factors have each been shown to take a toll on various aspects of a child’s development including cognition, social-emotional, physical, and their ability to thrive in the classroom setting (Augustine et al., 2009). These factors of a child’s background status contribute to a 1.3 greater likelihood of developing a disability or delay and boys being less school ready (Doulabi et al., 2017; Miller, 2015) which is why it is important to better understand and examine the gaps and disparities in a child’s life in order to best help them learn and succeed.

This study provides implications for those who work closely with children. According to Syafril and colleagues (2018), 30-60% of a child’s daily activities involve fine motor skills and it is suggested that teachers keep children active by providing motoric tasks to the students. These tasks would keep the children engaged, and as school
age approaches, help their ability to learn and succeed in the classroom (Syafril et al., 2018). For example, if a teacher understands the mechanisms of writing, and the movements the task requires, they can break down the task further by creating an activity or game that uses those same movements to aid in a children’s writing ability, their fine motor competency and skill (Syafril et al., 2018). Teachers and childcare workers can work to understand each child’s background and individual motor needs. For example, if a child is not regularly exposed to educational, stimulating toys in their environment at home, a childcare worker can work to ensure at school that the child has access to these resources or can provide resources such as crayons to help the child develop their fine motor skills. Additionally, keeping developmental differences by gender in mind would be useful in better understanding each gender’s respective needs. Lastly, having resources on hand for the child and family can work to aid a child’s development and well-being and push them towards success, regardless of their background.
Table 1. *Maternal Characteristics (N = 432).*

<table>
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<th>Demographic Characteristics</th>
<th>% (n)</th>
<th>Mean (SD)</th>
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<tbody>
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<tr>
<td><strong>Education Level</strong></td>
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<td>GED</td>
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</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>White</td>
<td>7.6 (33)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>40.5 (175)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>50.2 (217)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0.2 (1)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.4 (6)</td>
<td></td>
</tr>
<tr>
<td><strong>Site</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boston</td>
<td>34.0 (147)</td>
<td></td>
</tr>
<tr>
<td>Chicago</td>
<td>27.3 (118)</td>
<td></td>
</tr>
<tr>
<td>San Antonio</td>
<td>38.66 (167)</td>
<td></td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td>552.4 (499.10)</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Maternal age was not reported by original investigators.
Table 2. Child Characteristics ($N = 432$).

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>% (n)</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>8 mos (6 mos)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>49.1 (212)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50.9 (220)</td>
<td></td>
</tr>
<tr>
<td>Fine Motor Skill Delay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Motor Delay</td>
<td>91.7 (396)</td>
<td></td>
</tr>
<tr>
<td>Motor Delay</td>
<td>8.3 (36)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>4.9 (21)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>41.4 (179)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>52.1 (225)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.6 (7)</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* ‘mos’ is an abbreviation for months.
Table 3. Logistic Regression between Maternal Education and Child Fine Motor Skills (N = 432).

<table>
<thead>
<tr>
<th>Fine Motor Skills</th>
<th>B</th>
<th>(SE)</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td>-.45</td>
<td>(.35)</td>
<td>.64</td>
</tr>
<tr>
<td><strong>Boys</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>-.04</td>
<td>(.50)</td>
<td>.97</td>
</tr>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>-.90</td>
<td>(.50)</td>
<td>.41</td>
</tr>
</tbody>
</table>

**Note.** 0 = No High School Completion, 1 = High School Completion; 0 = No Fine Motor Delay, 1 = Fine Motor Delay

\~p < .10, *p < .05, **p < .01, ***p < .001.
Table 4. *Chi Square Analysis between Maternal Education and Child Fine Motor Skills.*

<table>
<thead>
<tr>
<th>Cross-Tabulation Results</th>
<th>Fine Motor Delay</th>
<th>No Fine Motor Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$(n = 36; 8.3%)$</td>
<td>$(n = 396; 91.7%)$</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No HS Completion</td>
<td>47.2%</td>
<td>36.4%</td>
</tr>
<tr>
<td>(37.3%)</td>
<td>52.8%</td>
<td>63.6%</td>
</tr>
<tr>
<td>HS Completion (62.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys (50.9%)</td>
<td>$(n = 18; 8.2%)$</td>
<td>$(n = 202; 91.8%)$</td>
</tr>
<tr>
<td>No HS Completion</td>
<td>44.4%</td>
<td>43.6%</td>
</tr>
<tr>
<td>(38.2%)</td>
<td>55.6%</td>
<td>56.4%</td>
</tr>
<tr>
<td>HS Completion (61.8%)</td>
<td>$(n = 18; 8.5%)$</td>
<td>$(n = 194; 91.5%)$</td>
</tr>
<tr>
<td>Girls (49.1%)~</td>
<td>50.0%</td>
<td>28.9%</td>
</tr>
<tr>
<td>No HS Completion</td>
<td>50.0%*</td>
<td>71.1%</td>
</tr>
<tr>
<td>(35.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS Completion (64.3%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.*  

~$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.  

\(\overset{o}{\text{over-represented}}\), \(\overset{u}{\text{under-represented}}\)


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