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An ounce of prevention: The effects of a kindergarten visual motor integration intervention

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AN OUNCE OF PREVENTION: THE EFFECTS OF A KINDERGARTEN VISUAL MOTOR INTEGRATION INTERVENTION

A Project

Presented to the

Faculty of

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In Partial Fulfillment

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ABSTRACT

Current kindergarten classroom and curricular demands require incoming students to have sufficient visual motor integration skills in order for them to participate immediately in learning activities. Those children that do not, are susceptible to poor school adjustment and academic difficulties. Research has shown the current intervention of retention, transitional classes, and delayed entry to ineffective and advocates for programs that reach children as soon as possible. Research on perceptual motor interventions of varying duration has shown them to be effective in increasing skills but in generally, these programs were designed to be spread over a period of time. The program studied here is an intensive, three week long (3 hours and 25 minutes five days a week) program implemented at the beginning of the school year in order to aid children that are deficient in visual motor integration skills quickly before they have experienced too much failure and a negative cycle begins.

This study employed a multiple subject case study design and the research questions were, "Will a short-term, developmental visual motor integration and basic school functioning skills of the treatment group?" and "Will the

treatment group demonstrate levels of school adjustment in the middle of the second trimester similar to students who met study requirements but did not demonstrate low average or below, visual motor integration skills." The dependent measures were pre- and post-tests for the Beery-Buktenica Developmental Test of Visual-Motor Integration and supplementary test of visual perception; non-standardized assessments of cutting and letter copying accuracy; observational assessments of scissor and pencil grip; and the Teacher Rating Scale of School Adjustment scores.

7 children ranging in age from 5 to 5.9 years old, with low average or below, visual motor integration skills attended the intervention program and are included in the data analysis. Analysis of the results of the dependent measures demonstrated overall improvement for all participants in visual motor integration and basic school functioning skills. As well, the participants' school adjustment was found to be similar, and in some instances higher, than classmates that met study requirements but did not begin the school year with the same deficiencies. This program provides schools with a preventative alternative to the ineffective remedial interventions currently in use.

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DEDICATION

To my husband, Sean, and daughter, Iliana.

I love you both, always and forever.

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CHAPTER ONE

INTRODUCTION

Children's life experiences prior to entering school, in large part, determine the ease with which they adapt to an academic environment (Bart, Hajami, & Bar-Haim, 2007 and Zill, Loomis, & West, 1997). Academic difficulty early on is often predictive of later school success and failure (Zill, Collins, West, & Hausken, 1995), which in turn is predictive of success in life or lack thereof (West, Denton, & Reaney, 2001). Before children can be expected to learn complex skills such as calculating, reading, and writing, they must acquire basic skills and capabilities (Zill & West, 2001). Therefore, it is imperative that children begin school with the learning skills that enable them to take advantage of the academic fundamentals taught in kindergarten immediately. Children without the requisite capabilities are likely to have extreme difficulty navigating through their first year of schooling (Zill, Loomis, and West, 1997). Unfortunately, as Zill and West (2001) have so aptly noted, ". . . many children are already behind when they open the classroom door" (p. 31).

One such requisite capability needed to begin school ready is visual motor integration. Visual motor integration refers to the ability to correctly perceive an item (such as a letter or geometric shape) and to accurately replicate that item through the use of fine motor skills (drawing the letter or shape); commonly referred to as hand-eye coordination, sensory motor integration, or visual motor integration. The most basic way to conceptualize this is that the eyes must lead the hands (Skinner, 1979). It requires three separate abilities: the ability to visually perceive correctly, the ability to produce accurate fine motor movements, and the ability to integrate the two. Children deficient in any of these three abilities may be lacking in visual motor integration skills and, due to current demands, will likely be unable to easily participate in the activities required of them to become proficient in kindergarten skills or to master kindergarten content (i.e., writing letters).

As visual motor skills are tied to early school success, an intensive, developmentally appropriate, kindergarten intervention focusing primarily on the development of visual motor integration skills should be implemented in order to prevent these children from facing immediate failure upon entering school. The present study will examine the effects of a three-week intervention (totaling approximately 36 and a half hours of instructional/practice time) conducted two weeks after the beginning of kindergarten. The program will serve students who have not attended more than a year of preschool and who have been identified as having low visual motor integration skills as determined by standardized testing procedures.

The intervention proposed herein is a "preparatory-developmental program" (Zaichkowsky, Zaichkowsky, & Martinek, 1980, page 80) aimed at preparing the children to learn in a diverse array of situations. The curriculum will consist of a developmentally appropriate visual motor integration, fine motor, and visual perception activities. Its structure is based on Vygostsky's concept of 'scaffolding' and combines direct instruction, directed activities, and free play. The activities are introduced in order of increasing difficulty during the three-week period and for each activity, the level of support provided to the students will start with full support and gradually be reduced until the students are independent.

CHAPTER TWO

REVIEW OF LITERATURE

Kindergarten in 2009

In the past, kindergarten served as a bridge between the home and formal schooling by placing children in a child-centered environment that prepared them for first grade by nurturing their development as a whole (Spodek, 1988 and Vecchiotti, 2001). Four and five year olds were given the opportunity to adjust to an academic environment and become equipped with the skills necessary to meet the challenges of first grade. Learning was achieved through various manipulative-type activities and productive play while teachers gradually introduced academics (Spodek, 1988). Therefore, thoughts of kindergarten for most adults will elicit memories of finger painting, playing in pretend kitchens, and building with blocks. These types of memories, however, are no longer an accurate representation of kindergarten curriculum.

Despite not being compulsory, kindergarten has assumed the status of a formal grade and teachers introduce the curriculum once reserved for first grade (Spodek, 1988, Shepard & Smith, 1988, and Vecchiotti, 2001). The nature of the learning has become more didactic, focusing on academic skills such as reading, writing, and math, losing much of its developmental nature (Spodek, 1988). Also relevant is the inclusion of academic standards which children are expected to meet before moving on.

For example, California State Content Standards (California State Board of Education, 1997) for language arts in kindergarten include items such as,

> Count the number of sounds in syllables and syllables in words; Read simple one-syllable and high-frequency words; Identify characters, settings, and important events; Write consonant-vowel-consonant words; and Write uppercase and lowercase letters of the alphabet independently, attending to the form and proper spacing of the letters. (pp. 1-3).

Sample items from California State Standards (California State Board of Education, 1997) for mathematics include,

> Count, recognize, represent, name, and order a number of objects (up to 30); Identify, sort, and classify objects by attribute and identify objects that do not belong to a particular group;

> Compare familiar plane and solid objects by common attributes (e.g., position, shape, size, roundness, number of corners); and Make precise calculations and check the validity of the results in the context of the problem. (p.p. 1-3)

Rigorous standards such as these leave kindergarten teachers with little or no time to ensure that all children are developmentally ready as they must begin to work on academics immediately. Kindergarten no longer acts as a service to get children ready for school. In contrast, today, children are expected to be ready for kindergarten. Given the expectations our educational system has placed on all kindergarten students and the fact that a child's success in kindergarten is key to future accomplishments (West, Denton, & Reaney, 2001), it is not surprising that school readiness has become an area of intense interest. Indeed, The National Education Goals Panel set as the first goal of its 1993 report, "By the year 2000, all children in America will start school ready to learn". This begs the question, "What exactly does ready to learn mean?"

School Readiness

According to Kazdin (2000) school readiness is defined in terms of a child's activity level, social competence and psychological preparedness, basic cognitive abilities, and family support. This is, of course, general and rather vague, offering little in the way of identifying what specific skills, characteristics, and/or knowledge are crucial to Kindergarten readiness. Basic reading concepts (such as knowing letters), basic math concepts (such as one-to-one correspondence), general knowledge of themselves and the world, attitudes toward learning, social maturity, physical health, and motor skills are some of the aspects of school readiness that are often proposed (Zill & West, 2001). However, there is no true consensus as to the specifics involved.

Carlton and Winsler (1999) have characterized school readiness as a combination of two concepts of readiness, "readiness to learn and readiness for school" (p. 338). Readiness to learn indicates that a child is at a point in development where he/she is able to learn a particular skill or content. Readiness for school refers to those abilities a child must have in order to be successful in a school environment (Carlton & Winsler, 1999).

Taken together, school readiness is a quality a child possesses that allows him/her to successfully participate in school curriculum (May et al., 1994). In other words, school readiness indicates that a child is capable of learning the required content as presented through the adopted curriculum and must be defined in terms of its relationship to the expectations of the kindergarten classroom and demands of the curriculum (Zill, Loomis, & West, 1997). As these expectations and demands change, so will the characterization of the capacities a child must possess in order to be considered ready for school. Therefore, we must approach the issue in terms of what the demands are currently and what a child must know and be able to do in order to meet them.

Curricular and Classroom Demands in 2009

Mc Hale and Cermack (1992) explored the prevalence of fine motor activities in the daily work of elementary school classrooms. Six classes (two second, fourth, and sixth grade) were used in the study. They found that the percentage of activities requiring fine motor skills consumed 31 to 60% of an average day. 85% of these activities were paper and pencil tasks. Inherent in these types of paper and pencil tasks are visual motor integration abilities, either in the current task or underlying the learning of such tasks such as one would learn in kindergarten (for example, writing letters). It was also found that the percentage of activities requiring fine motor skills did not increase with grade level, but was higher in the lower grades, indicating that primary grade teachers depend more highly on these types of activities as a learning modality (Mc Hale & Cermak, 1992).

A study of fine motor activities in kindergarten classrooms found that children were involved in activities requiring fine motor skills (such as writing, cutting, gluing, and reading a book) for 46% of their day, 42% of which were paper and pencil tasks (Marr, Cermak, Cohn, and Henderson, 2003). Taken together, these two studies highlight the importance of fine motor skills and visual motor integration skills for students to fully participate in classroom learning activities. A look at current curriculum further highlights the crucial nature of visual motor integration skills to kindergarten success.

The Houghton-Mifflin language arts series (2009) (a nationally sold curriculum and one adopted by 80% of the school districts in California) requires children on the first day of kindergarten to draw a picture of a classmate and after a brief introductory lesson on the letter a, circle lowercase and uppercase letters on a worksheet from within a jumble of other letters, as well as write an uppercase and lowercase a without the aid of lines to trace or even guiding lines often seen on handwriting worksheets (upper and lower solid lines and a dotted middle line). The Scott Foresman-Addison Wesley EnVision math curriculum, a commonly adopted series (Pearson, 2009), requires within the first several lessons of the kindergarten year, that children manipulate small objects (for example counters and cubes) for the purposes of sorting and to use pencils and crayons in a variety of ways (to include circling and bubbling in answers, tracing dotted lines, and drawing various shapes).

It is clear from the first days worth of expectations in current curriculum, that new kindergarteners must possess certain skills, namely visual motor integration and fine motor skills prior to entering school. Those without these skills will most certainly struggle with the initial demands of the classroom and thus, may be categorized as unready. Shepard and Smith (1988) characterize this as,

" . . . to say that 5-year-olds or 6-year-olds are unready to learn must mean they are unready for the specific curriculum that the school is prepared to teach" (p. 141).

Along these same lines, Carlton and Winsler (1999) argue that it is school's responsibility to be flexible enough to provide appropriately for all children, regardless of their perceived readiness. Whether this is true or not, the case remains that currently most Kindergarten programs are academic and do place specific demands on their incoming students.

Due to the diverse nature of the United States population, children arrive at Kindergarten with a wide range of abilities and knowledge (Zill, Collins, West, & Hausken, 1995). This includes a wide range of fine motor and visual motor integration abilities. The National Household Education Survey conducted in 1993 found that while most 4 year olds were prepared for the rigors of school, some were not. For example, 6% could not hold a pencil properly and 22% could not write or draw versus scribble. It is clear that there exists a population of children that are unready for kindergarten in regards to their visual motor integration abilities and for whom intervention is needed.

Teachers must attempt to provide adequate help to those with little skills while at the same time encourage growth in those that arrive well prepared (Zill, Collins, West, & Hausken, 1995). Although, assumedly, teachers make every effort to meet this challenge and bring all students to grade level by the end of kindergarten, inevitably, some children do not progress sufficiently. This is especially true of those children that start without adequate preparation. The difficulty in implementing the language arts and math curriculum discussed above with a class in which some children already know how to write their letters and can expertly manipulate small objects while others do not know how to hold a pencil and fumble when handling manipulatives is obvious.

Listening to what kindergarten teachers conceive of as pertinent school readiness skills further supports the argument that a visual motor integration intervention would be a valuable tool in the fight to give all students a chance at school success from the very beginning. Johnson, Gallagher, Cook, and Wong (1995) surveyed 176 kindergarten teachers, from three different school systems (one urban, one suburban, and one rural) on the importance of 149 skills to a child's success in kindergarten. The participants had an average of 8.6 years of experience with the majority holding Master's degrees or above, and so can be deemed reasonable experts on the issue.

The skills were categorized under five skill domains: gross motor, fine motor, general knowledge and readiness, language, and social. For each of the 149 individual skills, the teachers gave a rating of very important, important, less important, or not important. They also picked from within each domain the five skills they thought most important and the ten most essential skills overall from the entire pool of skills. The five skills that these teachers picked as most important from the fine motor skills domain were as follows: "draws /, 3, *X*, with demonstration; traces thick lines to form a circle, square, triangle, rectangle; cuts on a straight line, circle; draws vertical, horizontal, and intersecting lines with demonstration; and stacks 5-6 blocks" (p. 319). All of these skills require visual motor integration.

When the answers from the three different ranking systems were triangulated, nine skills were ranked within the top ten, thus demonstrating a high degree of consistency. These skills are as follows: "engages in meaningful dialogue; uses 5-6 word sentences; toilets independently; follows simple rules and procedures in classroom, with reminders; feeds self with fork; separates easily from primary caregiver; can say own birthday, telephone number, complete address and name of primary caregiver; names red, blue, green, yellow, orange, purple, brown, black, white, when shown model; reads, prints, and spells own first name; and, cuts on a straight line, circle" (pp. 323-324). Reads, prints, and spells first name was ranked within the top ten using two of the methods.

At first glance, this does not seem to place high importance on visual motor integration skills; however, as the authors point out, it does indicate that teachers feel that skills enabling independence are most crucial. It can be hypothesized that these are skills that the teachers feel a child must have at the very least to function in the classroom environment. Two of these skills do require fine motor skills - toilets by themselves and feeds self with fork. Two require visual motor integration skills - cuts on a straight line, circle and reads, print, and spells first name.

In all, teachers' opinions on what is most pertinent to school readiness support an intervention focusing on visual motor integration skills. It must be noted also that, though the intervention proposed here does focus primarily on visual motor integration and its component skills, the way it is constructed (to be further discussed) will likely bolster many of these other fundamental skills; for example, engages in meaningful dialogue; uses 5-6 word sentences; follows simple rules and procedures in classroom, with reminders; separates easily from primary caregiver; and names red, blue, green, yellow, orange, purple, brown, black, white, when shown model. And though, for research purposes, content such as the child's birthday and address will not be included, in practice these could be easily integrated.

While the vast majority of children, prepared or not, progress throughout the kindergarten year, the gap between these groups actually widens as at-risk children concentrate on basic skills and those entering with the required capacities, progress to more sophisticated knowledge and skills (West, Denton, & Reaney, 2001). In most cases, those that start behind, stay behind. A kindergarten, visual motor integration intervention early on could potentially do much to narrow the gap and though it would not mean that the children who participated would necessarily be able to match the proficiency level of more prepared students, it would give them the opportunity to participate in classroom activities with ease and thus, allow them access to the curricular content. The goal is not necessarily to enable these children to excel in kindergarten, but to help them pass it.

Without intervention, children with low visual motor integration and fine motor skills will be concentrating on holding a pencil and handling the manipulatives, not on the concepts being taught. The intervention presented in this study is one way that schools, even in the current environment of rigorous standards, can be flexible enough to provide for unready youngsters.

Theoretical Frameworks

Contextualism presents a perspective from which all behavior must be understood within the context of interactions between individuals and their physical and social environments (Lerner, Theokas, & Bobek, 2005). Bronfenbrenner's Ecological Systems is a useful model to utilize in understanding the context of this intervention. This model can most easily be conceptualized as the child being in the center of a series of concentric rings. Each ring represents a part of the child's environment, with those closest to the child having the most direct influence but with each ring also being impacted by the rings surrounding it. The most influential sphere is the child's immediate environment composed of such elements as the family, teacher, peers, and physical factors (i.e., toys). After this is the social/economic sphere, which is essentially society with its particular beliefs and standards (Vockell, 2009).

Looking through the lens of contextualism we see that when children enter kindergarten, they are enmeshed in a complex web of interacting factors, determining their immediate environment and their place within it. The school the child attends is influenced by society's expectations; for example, what is to be taught, what a child should know, what level they should be at at what age, etc. These expectations influence the school's policies including the curriculum it chooses to adopt and how it is implemented. This in turn, affects the teachers in terms of the demands they place on the child.

As discussed above, current demands within kindergarten classrooms are rather rigorous and are based on the assumption that children arrive with certain skills and knowledge. Indeed, current curriculum is demanding even for children who have been afforded rich experiences prior to school (National Association for the Education of Young Children, 1995).

Before entering kindergarten, children have already been involved in bidirectional, dynamic exchanges with their families, daycare providers, peers, and physical environment. Their developmental level is heavily influenced by the opportunities that have been made available to them. So in regards to visual motor integration, children may be behind their peers for a multitude of reasons (such as nutrition, disease, etc.) but assuming normal health, the primary reason is lack of experience and social support (Zaichowsky, Zaichkowsky, and Martinek, 1980).

Though this does not discount the child's natural proclivities, it does emphasize the dynamic interactions that occur between the child and his environment, ultimately helping to shape development. Keogh and Sugden (1985) explained this well when they wrote:

> If a child chooses to participate often and makes a strong effort, which is supported by others, the child's movement skill should

> improve. A child participating without positive support has a less favorable circumstance for improvement, and a child who does not participate is not likely to improve. Using the same reasoning, children will improve more in the types of movement skills that are part of the movement experiences in which they participate. The overall picture is that children become somewhat specialized in their movement skill development. They become better in those movement skills that they experience (practice) to a greater extent and in more favorable conditions. Lack of participation and unfavorable participation will limit skill development. Personal-social influences are important determinants of participation effort, which will limit or enhance movement skill development. (p. 385)

For example, a child from an economically disadvantaged home may not, due to lack of funds, be provided with the toys such as blocks, Legos, and a diverse array of writing utensils that promote visual motor integration skills (Haywood, 1986). Those children that are provided with these types of objects but do not have an adult that is willing or able to sit, demonstrate their use, and play with them, are not likely to spend large amounts of time on these activities (Keogh & Sugden, 1985). So, the child's environment and people within it prior to school entry, influence his/her ability to meet the classroom and curricular demands.

The target population and timing of the intervention studied here, are based on these contextual factors. As will be discussed in more depth later, children that have not attended preschool are more likely to have poor visual motor integration skills, arriving at school unprepared. Schools often do not have access to this population of children until kindergarten registration, generally a few months before and up until the day school starts. Therefore, this study targeted those children identified at the beginning of kindergarten as not having attended more than a year of preschool and had low visual motor integration skills. The training was scheduled to begin only two weeks after the beginning of the school year in order to provide help before the children experienced too much failure.

Contextualism provides a general framework from which to understand this intervention but more specific theories need to be employed in examining the complex set of interactions between children and the classroom environment (heavily influenced by their development levels) that occur once they enter school. Keogh and Sugden's movement development perspective and elements of the information processing model give insight into the effect a lack of visual motor integration skills can have on a child's initial school experience.

The movement development perspective focuses on the level of demand required by an individual to execute a movement. This level of demand is determined by the interplay between the following three elements: 1) the mover and his/her resources 2) the task and what it requires and 3) the environment and the conditions present within it. The level of demand is determined by a basic equation (p. 16),

$$\frac{\text{Conditions \& Requirements}}{\text{Resources}} = \text{Level of individual demand}$$

As a basic example, take climbing a rock. If a person (mover) does not possess the needed muscular strength to pull his own weight (resources) he will be unable to climb the rock (accomplish the task) because the physical task is too hard for him (level of individual demand). Another person (mover), who possesses sufficient strength (resources), though just barely, will accomplish the task but with a greater expenditure of energy than will a mover that has ample strength (level of individual demand).

Even the mover who is equipped with all the necessary resources to climb the rock in optimal conditions, may not be able to do so or do so with as great an ease, when conditions in the environment change. Perhaps a new rock is attempted that is more steep (conditions). This alters the requirements needed to accomplish the task and therefore, the mover may not be able to scale the rock because, now, the level of individual demand is too great.

In other words, each person has a unique set of resources with which they enter a situation entailing movement to accomplish a task. Inherent in any task is a set of basic requirements (influenced by the conditions of the environment) that must be met in order for it to be successfully completed. This model is useful because it gives a systematic way to conceptualize how even when considering the same task, the level of demand can differ among individuals. This is pertinent since all children arrive at kindergarten with their own unique set of resources. What these resources are will partially determine what they are able to learn.

The information processing model allows us to understand this more fully; it posits that the human brain processes information in specific ways, within specific parameters. The general model consists of three stages of memory: Sensory memory (memory for information incoming through the senses held for only seconds), Short-term/Working memory (what is being thought about at the moment and unless repeated, lasts for 15 to 20 seconds), and Long-term memory (permanent memory lasting for long lengths of time). Information flows through these memory systems in order.

If the stimulus in the sensory memory is attended to, it should enter working memory. Information should be transferred to long term memory if it has been repeated enough while in short term memory or is assigned meaning connected to other information already stored (Huit, 2003). The ultimate goal in schooling is to have students process information in such a way that it ends up in long term memory. Crucial to the present discussion is the stage through which the information must pass to reach this point, working memory.

Working memory allows us to hold information and work on it. The capacity perspective holds that the amount of attention available for a task is limited and therefore, working memory is limited (Kahneman, 1973). Generally, a person is capable of holding 5 +/-2 units of information (Huitt, 2003). Tasks that are easy require less effort than those that are difficult (Kahneman, 1973). Thus, different levels of difficulty tax the working memory differently and of course, easy and difficult are relative terms. Many times, we engage in multi-tasking, attempting to pay attention to more than one thing at a time.

This is common in schoolwork; for example, when one is required to write something and make meaning of the information (learn) at the same time. This is the case when a child must employ visual motor integration skills to copy a letter and at the same time attempt to remember what the letter is called and/or what sound it represents or when a child is handling manipulatives such as buttons while doing a sorting activity. While these examples of multi-tasking do not seem difficult to the average adult, given that the child is still refining motor skills, visual motor integration skills, and attempting to acquire new concepts at the same time, it becomes obvious that for children the individual level of demand can be great.

When two tasks are handled simultaneously, the amount of interference that will occur will depend upon the attentional demands required by each task (Kahneman, 1973). Indeed, the effort required may be even greater than the simple combination of the two loads if the tasks are incompatible or require attention to organize the efforts (Brown, 1964).

If the level of demand when the tasks are combined does not exceed the limited capacity of the individual, then there is no interference and both tasks are accomplished successfully. However, if it does exceed the capacity, one or both of the tasks will suffer. The amount of interference is directly related to level of combined load, with more interference occurring at higher levels of demands (Kahneman, 1973). If the load becomes great enough, the system must choose and one task is continued while the other is abandoned (Brown, 1964).

Implications of Theory

Drawing from the movement development perspective and information processing perspective, it becomes clear why a child lacking in visual motor integration skills would be at a severe disadvantage in today's kindergarten classrooms. Children may be faced with the same task but this task cannot be characterized as having a universal, fixed level of demand. The level of demand and thus, success, is dependent on the resources with which each child is equipped, which is in turn, highly dependent on the contexts from which they come. In evaluating how this likely plays out with children of varying visual motor integration ability on the first day of kindergarten, consider what will be referred to here as the *a* task, a task very similar to what current language arts curriculums demand on the first day of school - to write the capital letter *a*, remember that it is called an *a*, and learn that it sounds like *a* as in apple.

For children with proficient visual motor integration skills that have already been introduced to writing letters, the level of demand that the *a* task requires is relatively small. They already have the motor plan established that is needed to create the *a*, have an appropriate pencil grip, have practiced refining aim, and know the correct amount of pressure required. It would take little effort to draw the letter because they have had ample practice and so, their working memory has room to process the letter-sound correspondence and transfer the information to long-term memory. This group of children will likely experience success immediately.

Children who have refined fine motor skills but lack visual motor integration ability will have mastered the ability to produce the individual lines needed (diagonal lines at different angles and a horizontal line) but would still be learning to assess figures visually and create a movement plan to replicate it. For these children the a task requires more energy. Though capable of the separate movements they would still need to use their limited capacity to plan and organize their movements. This is no small task when one considers that replicating the letter *A* requires the ability to draw the lines at specific orientations in relation to one another (two diagonal lines of equivalent length at the same but opposite angles, spaced properly so as to connect at the top end of each, and a horizontal line beginning and ending very specifically at the inside edge of the diagonal lines mid-way to the top of the inverted *V*). These children would likely be able to make the letter *a*, albeit poorly, but would not have enough space in working memory to focus on the name of the letter or the letter-sound correspondence and so would probably have attained only partial success.

For children that have not yet developed true consistency of movement in regards to drawing lines, the a task would require significant effort. Consistency of movement is defined by Keogh and Sugden (1985) as "a reliable set of movements" (p. 199) and is considered fundamental in accomplishing more complicated movements. If consistency of movement has not been achieved, in regards to drawing lines, the lines will be too long or too short and/or uneven. Children in this category lack the visual motor integration skills and some of the fine motor accuracy skills that are required by the task. Generally speaking, they would be unable to work at the visual motor integration level as their attention would be focused on trying to draw the requisite lines properly. These children would likely have very limited success.

Children with extreme deficiencies in fine motor and visual motor integration skills are likely to not know how to hold a pencil in an appropriate grip and have no knowledge as to the amount of pressure to exert, etc. to use it properly. Consequently, they would be prone to using their full working memory capacity to learn how to hold and handle the pencil and would have little or no energy left to devote to the other requisite skills. They would be likely to experience almost complete failure during this initial activity.

Children that fit into these groups characterized by varying visual motor integration skills, will be faced with tasks similar to the a task upon entering kindergarten but there are significant differences in the amount of demand placed upon each type of child because of differing resources (likely stemming from their diverse prior experiences). Applying the movement development perspective and information processing perspective to these groups of children provides a foundation for understanding the experiences of kindergarten children and for devising interventions for those in need.

To further understand the complex nature of how visual motor integration skills impact children's academic success, it is important to not look at just how it affects their proficiency and ability to learn material in a timely manner, but also at how their success or failure in these ventures affects them emotionally. Potentially, a feedback loop is created with the children's emotional responses and reactions feeding into the situation, impacting their academic success.

Children who experience difficulties meeting the demands of the kindergarten classroom are likely to develop negative feelings about school, themselves, and their potential as students. Once these negative feelings have emerged, they are likely to impact the amount of effort a child is willing to invest in schoolwork and learning activities; thus compounding their difficulties. Poor visual motor integration skills are one of the factors that may contribute to this downward spiral.

The following studies are particularly useful to examine because they provide insight into some of the mechanisms that may underlie the connections seen between visual motor integration skills and school readiness/achievement. Interested in the relationship between motor skills and school adaptation in general, Bart, Hajami, and Bar-Haim (2007) used several motor skills assessments as well as three teacher rated scales to create several composite scores measuring school adjustment. The following variables were used to explore this issue: Scholastic adaptation as defined by task orientation, learning problems, and self-directedness; disruptive behavior as defined by acting out, frustration tolerance, aggression with peers, cooperative participation, and school avoidance; and anxious-withdrawn behavior as defined by asocial behavior with peers, anxious-fearful and shy-anxious behaviors.

A total of 88 kindergarten children from seven different elementary schools were tested to obtain motor skill scores and then followed into first grade, where in the second semester, data was collected from their teachers. They found that higher motor skills scores in kindergarten were correlated with higher scholastic adaptation in first grade. In particular, the Developmental Test of Visual-Motor Integration (VMI) (which requires the replication of increasingly difficult geometric figures onto a blank page) explained 29% of the variance observed in scholastic adaptation scores and low scores were significantly correlated with high levels of disruptive behaviors. VMI scores did not correlate significantly with anxious-withdrawn behaviors though kinesthetic ability did.

These results clearly indicate that the motor abilities, particularly visual motor integration abilities, children are equipped with upon entering kindergarten, are important predictors of their emotional and social adjustment to school. The authors attribute their findings to the emotional toll repeated failure in academic and social activities may have on children, causing them to withdraw from school activities and/or be disruptive in class. They characterize children with poor motor abilities at the start of kindergarten as being vulnerable to adjustment difficulties and promote assessment prior to school entry for the purposes of providing intervention and easing their transition to school.

Dewey, Kaplan, Crawford, and Wilson (2002) conducted a study utilizing the following three groups of children (average age of 11 years old): 45 children with developmental coordination disorder (DCD), 51 children suspect for DCD, and 78 normal children. DCD is a developmental disorder marked by extreme coordination difficulties. Children with DCD or suspect for DCD had significantly higher rates of internalizing (withdrawn, somatic complaints, and anxious/depressed) and externalizing behaviors (aggressive behavior and a trend toward delinquency), as well as higher levels of social problems.

Viewed from within the contextual framework presented here, these results are unsurprising. They indicate that children with motor issues experience difficulties that negatively impact their emotional well-being and steer them toward unproductive behaviors. This is further supported by research conducted by Creasey, Mitts, and Catanzaro (1995) investigating the correlations between young children's stress and school/home behaviors. To evaluate kindergarten children's levels of perceived daily hassles, they used an assessment that surveyed several types of stressors, including items specifically related to school such as, "You didn't know the answer when the teacher called on you", "Another kid could do something better than you could", "Your mother or father was mad at you for getting a bad school report" and "Your teacher was mad at you because of your behavior" (Kanner, Feldman, Weinberger, & Ford, 1987, p. 169).

Kanner and colleagues found that those children who reported higher levels of hassles, had higher levels of externalizing behavior problems as reported by their teachers and mothers (1987). The authors felt that this indicated that children under stress, act out. They also found that the majority of children react by avoiding the situation, which does not seem to lead to externalizing behaviors but does elicit avoidant behaviors such as crying.

This study underscores that children do, of course, react to stressful situations such as being unsuccessful in their schoolwork in a variety of ways. In considering these three studies together, a plausible picture emerges. Children that struggle with things like visual motor integration feel stress due to the difficulty they experience in meeting classroom demands. Some cope with this stress by acting out which leads to them getting in trouble, which deepens their dilemma and increases negative feelings. Others avoid stressful situations causing them to participate less in difficult activities and ultimately, not get needed practice in the skills they are lacking. In either situation, the child's emotional reaction to initial failure sets him/her up for increased failure academically and socially.

Problem behaviors in school and academic struggles may lead some parents to give their struggling children negative feedback, potentially straining the parent-child relationship. For the externalizing child, this combination of factors may lead them to conceive of themselves as the bad kid, helping to shape negative behavior patterns that persist throughout school. For the internalizing child, continued failure may cause them to feel incapable and lead to feelings of helplessness, ultimately leading to giving up and emotional shut down.

More indirect but still potentially influential, is that kindergarten children with poor motor skills (to include visual motor integration) are more reticent to join in their peers in play and overall, show lower frequencies of social play (Bar-Haim and Bart, 2006). These children find social games more difficult to engage in due to their poor motor skills and avoid them. This may lead some children to feel isolated and potentially add to their negative feelings. As well, it deprives them of beneficial learning experiences that could be had by interacting with their peers (such as increased language use).

In summary, it seems likely that children without appropriate experiences and support from adults in their home environment or daycare do not develop sufficient visual motor integration skills. Entering into a school that has set rigorous standards and adopted difficult curriculum due to societal expectations, they experience adjustment difficulties immediately. They are unable to perform the learning activities expected of them in the kindergarten classroom and not only do they get behind academically, but negative feelings begin to emerge. They engage in disruptive behaviors and receive negative attention from teachers and parents or withdraw and lose the motivation to try. They are hesitant to engage socially with their peers and further feel incompetent.

Additionally, without the protective element of peer social support and/or positive parental relationships, the difficulties in the classroom may feel even more stressful. They form negative impressions of school and themselves, setting them up for a multitude of problems down the road. So viewed contextually, what at first appears to be an isolated weakness may set in motion a torrent of negative events for a child and set a difficult path through school. Providing children lacking in visual motor integration skills with an appropriate intervention may help them to develop needed readiness skills, allowing them greater success and thus, preventing many negative experiences and allowing these children to take an easier path, leading to positive experiences such as academic success and self-worth.

Correlations of Visual Motor Integration Skills to Kindergarten Readiness and Academic Proficiency

The theoretical frameworks discussed above allow for a tentative understanding of how visual motor integration skills directly and indirectly impact a child's school readiness, school adaptation, and subsequent success. This understanding points to a visual motor integration intervention as a logical course of action because a lack of such skills can be viewed as an antecedent to subsequent negative outcomes. This is, of course, based on the premise that, indeed, there is a link between visual motor integration skills and academic potential and success. The present study will provide data with which to explore this premise; however, there is already substantial support for the assertion that such a link exists.

The following review of the literature will present relevant research findings that support the link of visual motor integration to school readiness and subsequent academic proficiency. It needs to be noted at this point, that some of the research presented herein, focuses primarily on fine motor skills rather than on visual motor integration skills. This should not be viewed as challenging the contention that visual motor integration skills should be the primary focus of an intervention.

The reasoning that underlies the focus on visual motor integration skills for intervention instead of fine motor skills exclusively is two-fold. One, the ability to do such things as replicate geometric figures comes well after the separate abilities of perceiving and distinguishing them correctly and drawing the independent component lines (Keogh & Sugden, 1985). So, though many tasks in kindergarten require fine motor skills while not requiring extensive visual motor integration, many do. Therefore, it is necessary to ensure that children have proficient visual motor integration skills. Two, by having children practice tasks that require visual motor integration, by default, fine motor and perceptual skills are being practiced as well. In other words, an intervention that develops visual motor integration will be strengthening both perceptual and fine motor abilities as well as the integration of the two (Birch & Lefford, 1967 and Haywood, 1986).

As part of a large battery of perceptual and perceptual-motor tests, Belka and Williams (1979) administered, the Shape-O-ball test (in which the child inserts three-dimensional shapes into matching holes on a sphere), the Bender Gestalt test (which requires the child to graphically replicate visually presented geometric figures), and the eye-motor coordination subtest of the Frostig Developmental Test of Visual Perception (during which the child draws lines between guide lines or from point to point) to 189 4 and 5 year old pre-kindergarten children in order to assess their fine perceptual-motor skills. A year later in kindergarten, these children's cognitive abilities were assessed using the Metropolitan Readiness Test.

Using an optimal regression equation, it was found that together, the pre-kindergarten perceptual and perceptual-motor test scores accounted for 75.1% of the variance observed in kindergarten cognitive readiness. Within this equation, the Bender-Gestalt was one of the most important contributors. This is particularly significant, as the Bender-Gestalt assesses visual motor integration ability specifically and out of the tests administered, can be viewed as the one most closely related to the academic demands of the classroom because it involves the replicating of figures as one must do in learning to write letters.

Another study employing the Metropolitan Readiness Test found similar results. Richey (1980) explored the relationship of academic readiness to fine motor skills in kindergarten and first grade children and found that fine motor and in particular, visual-motor integration were highly predictive of overall academic readiness. Importantly, this correlation remained even after controlling for socioeconomic status (the strongest predictor of overall readiness).

Based on these results, in order to enhance children's learning potential upon entering school, Richey advocates for the inclusion of fine motor activities (particularly those emphasizing visual-motor abilities) such as stringing beads, blocks, and tinker toys in preschool curriculum. Though the results of these two studies are compelling, it should be noted that the Metropolitan Readiness test is composed of six sections, one of which requires copying (requiring fine motor and perceptual abilities).

However, different dependent measures have been utilized in many other studies producing similar results. One such study was conducted by Solan, Mozlin, and Rumpf (1985), who evaluated the learning readiness of 48 kindergarteners from two parochial schools using the SRA

Primary Mental Abilities Test. The total kindergarten population from both schools was used. Although no individual IQ scores were available for the participants, it is likely that the participants' IQs were within normal range as previous scores of primary grade children at these schools ranged from 72 to 145. Perceptual-motor abilities were evaluated using the Tachistoscopic Exposure test, the Six Figure divided foam board test, and the Grooved Peg-board test. Most relevant to the present discussion is the Grooved Peg-board test because it evaluates the ability to integrate visual, kinesthetic, and tactile perception and fine motor actions.

In all, perceptual motor skills explained 54% of the variation seen in learning readiness and the Grooved Peg-board test was significantly correlated with total readiness scores. This provides strong support for the link between perceptual motor abilities and learning readiness. Since the participants in this study were not chosen based on low visual motor scores, the authors note the need for follow-up research testing the effectiveness of interventions with children deficient in these areas, such as this study.

Chissom, Thomas, and Collins (1974) conducted a study exploring the connection between perceptual motor skills and school success. 39 kindergartners' academic abilities were assessed using a teacher rating scale and the Otis-Lennon Mental Ability Test. Scores on the Shape-O Ball Test and the Frostig Developmental Test of Visual Perception provided measures of perceptual motor ability. A significant correlation was found between perceptual motor abilities and academic aptitude.

In another study, the Frostig was found to be predictive of reading proficiency in first graders as well. Mlodnosky (1968) found the Frostig and Bender Gestalt scores of 93 students (the entire first grade class of a predominately lower socioeconomic status school) to be related to reading proficiency, as assessed by the Gates-McGinitie Reading Test, the California Reading Test, and sections of the Stanford Achievement Test. This study is especially relevant because the participants' mean score on the Frostig was below the 30th percentile of the sample of 2,100 nursery and public school children used to standardize the test. Given that the study proposed here is concerned with children of sub optimal abilities, this provides evidence that a link exists for this population of children as well as children with fewer difficulties.

Interestingly, the scores on the Bender Gestalt and the three subtests of the Frostig most highly related to reading achievement were also correlated to IQ scores. This can be interpreted in several ways. It may be that the reading scores are a result of IQ or perceptual motor abilities alone or in combination. Another interpretation is that perceptual motor abilities are relevant in shaping IQ, which is then the cause of reading ability. Given the correlational nature of the research, it is of course impossible to determine causality; however, it seems likely that as with most human factors, there is a dynamic interaction occurring, one in which perceptual motor skills play a pertinent role.

In a recent study, Son and Meisels (2006) utilized data from the Early Childhood Longitudinal Study's Kindergarten class (ECLS-K) of 1998-1999. The ECLS-K participant population used in this study was a nationally representative sample of 17,212 students. The findings in this study are especially useful because the participant pool is so large and nationally representative, allowing for cautious generalizations. Motor skills were tested in the fall of the kindergarten year and reading and math achievement was tested in the fall of the kindergarten year and the spring of the first grade year.

Visual motor skills were assessed primarily by tasks taken from the ESI-R developmental screening instrument. These tasks were as follows: building a gate, drawing a person, and copying a circle, cross, square, triangle, and an open square and circle. Reading and math achievement were assessed using cognitive assessments created by the National Center for Education Statistics specifically for the ECLS-K, which include the testing of such abilities as identifying letters, recognizing words, knowing numbers and shapes, and using addition/subtraction.

Hierarchical regression analyses was performed to determine if motor skills were a significant predictor of later reading and math ability and were responsible for any unique variance beyond kindergarten reading and math scores and demographic variables including socioeconomic status and home language. The analysis indicated significant correlations and though small, unique variance for motor scores (2.8% for reading and 3.4% for math). Receiver-Operating-Characteristic curve analyses was also performed in order to determine if visual motor assessment was useful in predicting if children would be at risk in regards to their reading and math proficiencies in first grade.

The results found that children who scored low on visual motor skills had a much higher likelihood of being low in reading and math than those who scored average or above and suggested that visual motor skills and reading in the fall of kindergarten shared a considerable amount of variance. Ultimately, predictions based on kindergarten visual motor scores generally placed children in the same risk categories as did those based on reading and math achievement in the spring of first grade. Son and Meisels concluded that there is a significant relationship between visual motor and cognitive achievement and that visual motor test scores can be useful in predicting which children will be at risk academically, especially since cognitive achievement is difficult to gauge in this age group.

Interestingly, they also note a longitudinal relationship between motor skills and cognitive abilities, with the relationship between motor skills and cognitive ability becoming stronger through time. This indicates that there may be a cumulative effect of the deficiency, where the difficulties faced in kindergarten become compounded as time progresses and as the authors point out, supports the view that motor, reading, and math skills are interconnected and that it is the child as a whole that must be considered. These interpretations fall very much in line with the theory-based scenarios proposed earlier.

Luo, Jose, Huntsinger, and Pigott (2007) conducted an interesting longitudinal study (kindergarten to first grade) exploring the connection between motor skills and math achievement in East Asian American (EAA) and European American (EUA) children. The study was spurred by other research indicating superior performance of East Asian Americans versus European Americans in math and links between fine motor skills and mathematics achievement in the lower grades.

As Son and Meisels did in the previous study, they used data from the ECLS-K to analyze the math and VMI scores of 9,816 EUA and 244 EAA children. Concordant to other research, they did find ethnic differences, with EAA children having higher math scores (effect size ranging from .31 to .43). They also found them to have higher VMI scores (effect size .69). However, after children were matched for sex, age, and fine motor skills, no difference in math ability was found. Using hierarchical linear models, they found that fine motor skills likely mediated the relationship between ethnicity and math achievement, indicating that it was the influential variable, not ethnicity. This relationship continued through first grade.

This study is especially intriguing because it not only shows fine motor skills to be significantly correlated with math achievement but also a cultural difference implicating prior experience as playing an important role. In general, EAA families are doing something different than are EUA families and that difference is positively influencing their children's fine motor skills. The authors note that previous research by Huntsinger et al. has found Chinese American parents to often encourage preschool aged children to write numerals, in sequence, on graph paper and that this type of practice may allow for more mental space to be available for computation. This interpretation is rooted in the information processing concepts previously discussed. Overall, as well as supporting the connection between academic achievement and fine motor skills, it opens up an interesting avenue for future research.

Investigating the relationship of perceptual-motor skills to learning readiness and reading in kindergarteners, first-, and second-graders, Solan and Mozlin (1986) administered the grooved pegboard, six figure divided form board, tachistoscope, and an auditory-visual integration test (requiring the student to match a auditory tapped pattern to a visual representation) to assess perceptual-motor abilities. To test readiness and reading, the S.R.A. Primary Mental Abilities Test was given to the kindergarteners and the Gates-MacGinitie Reading Test (levels A and B) to the first- and second-graders.

More than 50% of the variation in the learning readiness of kindergarteners and reading vocabulary of first-graders was explained by perceptual skills. For all three grade levels, the sensory-motor tasks (divided foam board and grooved pegboard) were significantly related to readiness and reading while the auditory-visual integration was strong only for grades one and two, pointing to sensory-motor skills (i.e. visual motor integration) as an appropriate focus when providing intervention to young children.

Kulp (1999) also conducted a cross-sectional study. She used 191 children, from the same elementary school, kindergarten through third grade. Employing the VMI, teacher ratings of academic achievement, and standardized tests (Stanford Diagnostic Reading test for first-graders and Otis-Lennon School Ability test for second graders), she evaluated the connection between visual motor integration skills and academic achievement. For the group as whole, a significant relationship was found between VMI scores and the student's abilities in reading, math, writing, and spelling. Even after partial controls for cognitive abilities were used, the correlation was significant for writing and math.

Interestingly, when analysis was conducted by age, classroom teachers' ratings were significant for only 7 through 9 year olds, not for 5 and 6 year olds. Given the strong correlation between visual motor integration skills and kindergarten achievement found in other studies, this finding is surprising. The authors note that no standardized test was given to kindergarteners and that it may have been more difficult for teachers to give precise ratings to younger students, possibly explaining why a significant correlation was not found in their study. It should also be noted that 5 and 6 year olds had the lowest range of scores on the VMI. This may indicate that there were fewer deficient children within this group than in the others and also explain the lack of findings.

Handwriting is one of the skills demanded in today's kindergarten classrooms most obviously linked to visual motor integration ability. This logical connection has been validated by research. A study by Weil and Cunningham (1994) found a positive correlation between VMI scores and scores on the Scale of Children's Readiness in Prin Ting (SCRIPT) (a handwriting assessment) of 60 kindergarten students from six schools. A partial replication study conducted by Daly, Kelley, and Krauss (2003) corroborated their findings. Specifically, the children's ability to copy the first nine forms on the VMI test predicted their ability to copy letters correctly, a crucial kindergarten standard.

Another study employing both the SCRIPT and VMI found less convincing results. 101 children were given the VMI at the beginning of kindergarten and later given the SCRIPT in the middle of their first-grade year. Kindergarteners' ability to complete the first nine forms of the VMI explained only 10% of the variance in first grade SCRIPT scores for females and none for boys. However, during the course of this study, the district implemented a kindergarten program designed to improve students' motor skills. This program consisted of weekly group activities led by an occupational therapist and included consultation for teachers. Though writing and copying of letters were not explicitly taught in this program, given the substantial evidence that visual motor integration skills are related to handwriting, it is highly likely that these weekly sessions improved visual motor integration skills and therefore, handwriting ability.

The authors do little more than mention this confounding factor but since the VMI was not re-administered to the children when in first grade at the same time as the SCRIPT, it is impossible to gauge the influence of the occupational therapy intervention and therefore, the lack of findings in this study should not be allotted much merit. Actually, the results can be interpreted as indicating that motor skills intervention is effective and supporting the link between visual motor integration skills and handwriting ability.

Cornhill and Case-Smith (1996), reported no such interference during their study of first graders' handwriting and visual motor integration skills. 48 students were given the VMI, a tracing test, a rotation and a translation task (both utilizing pegs and pegboards) and an alternative handwriting test, the Minnesota Handwriting Test (MHT). The MHT scores correlated significantly with all of the motor-based assessments. Some activities suggested by the authors to improve handwriting include stringing, cutting, lacing, and putting together manipulatives; all activities included in the intervention to be studied here.

A child's ability to be successful in handwriting is not only relevant in kindergarten but has long-term effects. In later grades, those that still struggle with automaticity, potentially have less mental energy to engage in the complex cognitive functions required to generate content. Jones and Christensen (1999) studied this relationship in 114 first-grade students. Orthographic-motor integration was assessed by asking the students to write as many letters as they could in one minute and then evaluating the quality of their letters. Interrater reliability on this test was .99.

Story writing ability was assessed by the classroom teacher and a trained teacher associated with the study, using a potential total score of 20 based on 5 points each for 4 separate factors (organization, spelling and grammar, syntax, and fluency). Students' independently generated writing samples were read aloud to the teachers (to avoid any influence of the handwriting quality). Interrater reliability was acceptable at .89. Reading ability was evaluated using the Southgate Group Reading Test and scores were categorized as poor, low average, average, good, and very good.

After controlling for reading ability, 53% of the variance observed in story writing was explained by orthographic-motor integration. Controlling for reading ability allows for greater surety that this relationship is not due to general linguistic competencies. Even more compelling than their original findings are those that emerged in a subsequent study where 19 students identified as having handwriting problems by the original study were given an intervention that provided individual aid until students could form letters correctly and then group practice. A group of 19 children matched on gender, age and reading ability from the same class but without handwriting difficulties, was used as a control group. The intervention was effective. Although the control group was originally significantly higher in story writing, post-intervention tests showed no difference between the two groups. The fact that remediation of handwriting difficulties was responsible for such a dramatic increase in writing ability strongly supports the contention that students' handwriting ability (strongly linked to visual motor integration skills) impacts academic achievement even as they progress through school.

Similar conclusions can be formulated when interpreting the results of Berninger and Rutberg's (1992) study of 300 first-, second-, and third-grade children from a diverse range of ethnic and socio-economic backgrounds. The children were given numerous motor related tasks to perform, one of which was the alphabet task (requiring the students to print the lowercase letters of the alphabet in order while the researcher marks 15 second intervals on their papers). They were also given a handwriting test, one of the subtests of the Group Diagnostic Reading Aptitude and Achievement Test (which assesses the speed and legibility of letter formation), a spelling test (subtest from the Wide Range Achievement Test-Revised), and a composition test assessing fluency. The alphabet task was significantly related to handwriting, spelling, and composition and is viewed by the authors as probably the best predictor of early writing ability since it requires orthographic-motor integration, motor planning, and execution. Though cross-sectional, this study as well, points to handwriting ability being a factor in overall writing ability.

Providing substantial support for these studies linking visual motor integration skills to academic achievement are studies that demonstrate a higher incidence of low visual motor integration skills in retained versus unretained children. Mantzicopoulos, Morrison, Hinshaw, and Carte (1989) found that one of the factors associated with kindergarten retention was low visual motor integration ability; retained children having a higher incidence of low VMI scores. Fowler and Cross (1986) assessed 210 children using the VMI six months before the beginning of their kindergarten year and then followed them through their third year of schooling. As well as finding that VMI scores significantly correlated to reading and math achievement, evaluating VMI alone found it to have a positive predictive value of 38% for retention. This supports the claim that a lack of visual motor integration skills is partially responsible for difficulties great enough to end in retention.

Taken together these studies make a strong case for the assertion that visual motor integration skills impact young children's ability to succeed in school. This is true despite the use of different populations, measurement instruments, and assessments of academic proficiency as well as demographic controls. The similarity in findings across methodological variation indicates that the link is significant and consistent and provides ample support for devising and testing an intervention based on visual motor integration skills.

Current Interventions

As demonstrated in reviewing the current literature, research provides strong support for the potential benefits of a visual motor integration intervention; however, in claiming that a new intervention is needed, it is important to review and evaluate existing interventions in terms of their efficacy. Retention and transitional classes are two widespread practices schools have implemented in order to intervene on behalf of struggling children once they have entered the system and been identified as having difficulties.

Schools consider retention to be an intervention wherein the student is required to repeat a grade and is intended to help children by allowing them extra time to improve their skills and therefore be successful in later grades (Wood, Powell, & Knight, 1984). In 1993, approximately 6% of kindergarten students were retained. Using this 6% as the percentage of kindergarten children retained and the 2000 U.S. Census Bureau report of the number of students enrolled in public kindergarten, it can be predicted that approximately 200,000 kindergarten children are retained annually. However, this is most likely a conservative estimate since numbers today are likely even higher as the elevated standards and rigorous accountability resulting from the No Child Left Behind Act have been implemented and have likely increased retention rates (Jimerson, 2001).

If retention were an effective, beneficial intervention without negative consequences then these numbers would pose no problem and the issue of how to intervene for children who are insufficiently ready for school and subsequently fail, would be solved by simply requiring them to spend another year in kindergarten. Research, however, has not shown this to be the case. Many studies examining the effect of kindergarten retention on retainees' future school success compared to children who were recommended for retention but were advanced anyway, have found no evidence that retention provides any advantage. In fact, studies indicate that not only does retention not help, it ultimately results in lower achievement (Dennebaum & Kulberg, 1994, Jimerson, 2001, Niklason, 1987, and Zill, Loomis, West, 1997).

In defense of retention, some have proposed that it may not be useful for all children but for particular subgroups. Research has not substantiated this claim. A study conducted by Niklason (1987) exploring the potential benefit for children who were given supplementary instruction, were of average or above intelligence, and for whom retention occurred in kindergarten or first grade, found that retention was an ineffectual intervention for all of these groups. These conclusions are supported by research conducted by the National Center for Education Statistics, which found that for its 1995 cohort, retention provided no advantage for younger boys or those with developmental problems (1997). And though it is popular to think that retention in the earlier grades is more beneficial than in the upper grades, Niklason's results point to retention in the earlier grades as being even less beneficial than retention later on.

Since retention frequently results in children simply repeating the same curriculum without the benefit of extra help in deficient areas (Zill, Loomis, & West, 1997), transition classes have also been implemented as an intervention. Children that have a poor prospects going into first grade are not passed on but put in transition classes where the focus is on teaching learning skills (based on the premise that this will enhance abilities needed in first grade). Often, the instructional level is low, less content is covered, and there is a reduction in actual instructional time. Ultimately, research has indicated that they convey no advantage (Niklason, 1987).

When assessing the validity of retention and transition classes as appropriate interventions, it must also be considered that these practices involve economic disadvantages by requiring schools to pay for children to repeat a grade (in the case of retention) and in the case of transitional classes, not only paying the cost to provide an extra year of school but also the salary of an extra teacher. A short-term, intensive intervention early on in kindergarten would be more cost effective.

More importantly, the emotional toll on children and families must be considered. What message do children receive when they have essentially been told they failed in their first attempts as students? It is likely many feel a subsequent lack of confidence in their abilities. As well, parents' expectations are important predictors of children's school adjustment and so the impact of lowered parental expectations, after watching their children struggle and not advance with the other children, may very well have a long-term impact on their children's school accomplishments (NAEYC, 1990). An early intervention can be seen as an ounce of prevention versus a pound of cure.

Delayed entry (commonly referred to as "red shirting") is a proposed solution that focuses on the prevention of versus the remediation of kindergarten failure by attempting to guarantee that children begin school ready. Children are held back a year past when they are chronologically eligible for enrollment in the hopes that another year will give them time to catch up (Carlton & Winsler, 1999). There are several problems with this policy. The National Household Education Survey found for its 1993 cohort that those children of parents who were college educated were more likely to have had their entry delayed than those with parents who had only a high school degree or less (Zill, Loomis, & West, 1997). Also to be considered is that children who begin school earlier, compared to those that begin school older (age 6), tended to have more family-risk factors (having a mother that has not completed high school, being in household that receives welfare, living in a single-parent household, and having parents whose primary language is not English; U.S. Department of Education, 2001). Delayed entry may not be an option for economically disadvantaged families who can ill afford to continue to have a parent stay home or to pay for daycare.

Judgments regarding school readiness based solely on chronological age, will cause some young but prepared, capable children from starting when eligible, essentially wasting what could be a productive educational year (Wood, Powell, and Knight, 2001). As well, if schools make the decision based on a lack of developmental readiness, children that most need educational experiences may be precisely the ones that are being held from it, returning to the same environment that did not prepare them for school to begin with (Carlton & Winsler, 1999).

Additionally, if 4 and 6 year olds are in the same class, the older, more capable children will likely set the pace and higher expectations will result: making it appear that children who entered at the eligible age are behind even if this is not actually the case (Zill, Loomis, & West, 1997). In the end, delayed entry compounds the issue of school readiness by widening the gap between students and does nothing to help prepare those children who begin either at the eligible age or a year later and are unprepared.

Since the intended benefit of retention, transitional classes, and delayed entry is not supported by research and there appear only to be negative consequences, these interventions cannot be viewed as appropriate solutions to the problems faced by children who start at a disadvantage and consequently struggle with curricular demands. In fact, they are outcomes that themselves should be prevented. It is potentially much more effective and humane to devise interventions to be implemented at the very beginning of kindergarten, preventing children from having negative experiences (Zill, Loomis, & West, 1997). If children are prepared by their experiences at the beginning of kindergarten in such a way that they develop the needed skills by the sixth week of school, many potential difficulties may be prevented and the chances of kindergarten success are highly increased.

Currently, the most effective early intervention is attendance at a high quality preschool. There is a general consensus that preschool increases school readiness (Zill, Collins, West, & Hausken, 1995). In fact, as kindergarten has taken on the previous role of first grade, preschools have begun to fulfill the need that kindergarten used to fill for incoming students - preparing children developmentally for an academic environment (Vecchiotti, 2001). Children that have attended preschool have better reading and math scores (Magnuson, Meyers, Rhum, & Waldfogel, 2004), are less likely to be retained (Anderson, Shinn, Fullilove, Scrimshaw, Fielding, Normand, et al., 2003, Magnuson, Meyers, Rhum, & Waldfogel, 2004, and Zill, Collins, West, Hausken, 1995), and are less likely to be placed in special education classes (Anderson, Shinn, Fullilove, Scrimshaw, Fielding, Normand, et al., 2003).

Though preschool conveys many advantages, one such advantage is increased fine motor and visual motor integration skills. This is not surprising, given that center-based preschools offer a variety of activities that strengthen visual motor integration, visual perception, and fine motor skills and that the more a child participates in activities that require these skills within an encouraging environment, the more they are likely to improve (Gallahue, 1982, Keogh and Sugden, 1985, Lederman, 1986, and Zaichkowsky, Zaichkowsky, and Martinek, 1980). In a study of 10 Head Start classrooms, Marr, Cermak, Cohn, and Henderson found that children spent an average of 37% of their day involved in fine motor activities, 10% of which was paper and pencil activities (2003).

Curriculum guides for preschool often include such activities as building with blocks, drawing and coloring, cutting and copying simple shapes (World Book, 2008). The California Department of Education (2008) has published Preschool Learning Foundations for language and literacy as well as mathematics, which include examples of what behaviors should be emerging in preschoolers if they are meeting preschool standards. For example, holding a pen or pencil in an appropriate finger grasp, writing strings of symbols which look like letters or are actually letters, arranging blocks according to shape, building towers, using play dough to create shapes, and sorting buttons. In ascertaining whether these curriculum guides and foundation standards are indeed being implemented, a review of daily activities at four prominent child care facilities in San Bernardino, California (Tutor Time, 2008, Child Time, 2008, KinderCare, 2008, and La Petite Academy, 2008) confirm that this is the case.

Research on the connection between motor skills and preschool attendance support the notion that these activities indeed increase motor skill abilities. The U.S. Department of Education (Zill, Loomis, & West, 1997) conducted the National Household Education Survey, collecting data in 1993 and 1995 found that those children who had attended preschool were more likely to be able to write or draw versus than scribble. The lack of this ability was also correlated to those children whose mothers did not complete high school and who were poor, indicating that children in low socio-economic homes are unlikely to attend preschool or receive practice at home.

In conducting a correlation study on early childhood experiences and kindergarten success among 3,969 children from urban, public schools, Fantuzzo, et al., (2005) found that, even after controlling for a multitude of risk factors (to include, family poverty, age and low maternal education), those children who had formal, center-based experiences had significantly higher motor skills scores upon entering kindergarten than those that had care only through their mothers or within informal daycare settings. Data was collected at three points during the kindergarten school year and though all groups of children's motor skills improved over time, the correlation between advanced motor skills and center-based experiences versus other childcare experiences, held at each point. Additionally, those with center-based care not only improved but made more progress than the others.

Unfortunately, not all children have the opportunity to attend preschools and often the children that could most use it, are the ones that do not receive it. Despite programs such as Head Start (specifically targeting disadvantaged children), less than half of 3- to 5- year old children coming from households that make $30,000 or less a year attend preschool (National Center for Education Statistics, 1993). Ironically, it also true that children from low income families are less likely to have stimulating experiences at home that are relevant to school success. In other words, it is often children from economically disadvantaged households that do not get beneficial learning experiences in their homes and also do not attend preschool, leaving them unprepared for school.

The research reviewed above indicates that it is within this population that we will frequently find children lacking in visual motor integration skills and it seems likely that until such time as free, universal, high quality preschool is available, these children will continue to be vulnerable group in need of an alternative intervention. Given the substantial research indicating that retention, transition classes, and delayed entry are not effective as interventions and that a school is unlikely to have access to this population of incoming students until kindergarten registration begins, it is also important that the focus of interventions be one that is amenable to a short-term program, as are visual motor integration skills.

Visual Motor Integration, Fine Motor, and Visual Perception Interventions

Practice in visual motor integration skills will inherently include the practice of visual perception and fine motor skills (Birch and Lefford, 1967). It is also the case that the outcome of integrating visual perception and fine motor output, can only be as good as are these subcomponents. If a child is deficient in visual perception, the outcome of the integration of a poor quality perception with fine motor output (even if high quality) will prove to be lacking. The reverse is also true. If a child is proficient in his/her ability to perceive a figure accurately and even to translate that image, but has poor fine motor control the total outcome will also be poor (Haywood, 1986). Therefore, a review of the research on the effectiveness of interventions in the strengthening visual motor integration skills as well as visual perception and fine motor, is warranted.

Rule and Stewart (2002), created, implemented, and studied the effects of a six-month fine motor skills intervention on 101 kindergarten children. A penny-posting test was used as a pre- and post-test of fine motor ability. In this test the children are given 30 seconds to place as many pennies as they are able into a can with a one-inch slot in the top. Eight classes were used as treatment groups and five as controls. The treatment consisted of teachers instructing their students on the use of activity boxes and then making them available for use during center time. Activity boxes contained activities such as using a spoon to transfer pretend diamonds from a bowl onto small velvet pillows nested in egg cartons and then back again.

Although the authors do not state the specific amount of time each student participated in these activities, using twenty minutes a day, four days a week (with the assumption of four week months) it can be estimated that the total number of hours was 32. Both control and experimental classrooms reported that children engaged in fine motor activities for equal amounts of time. The difference in penny-posting scores between the control and treatment group was significant and showed the effect size of the intervention to be .74. This demonstrates that the intervention was likely responsible for improving motor skills beyond the effects of normal classroom activities or maturation alone. The authors state that these results, " . . . underscore the need for carefully constructed and coached [fine motor] activities" (p. 12).

A 40-hour perceptual-motor training study conducted by Farr and Leibowitz (1976), was found to be effective as well. Using the Rosner-Richman Perceptual Motor Survey, pre- and post-tests were given to the treatment group (N=9) and the control group (N=11). The improvement of scores was significantly different between the control and treatment group. The authors point out that since none of the activities used during the training were those tested on the survey, the results indicate generalization from training to total motor and perceptual abilities. Additionally, because all children were enrolled in nursery school, the intervention brought about improvements that were not achieved by activities engaged in during the regular course of the nursery school day, nor can maturation alone explain the results.

Results have been found with substantially less treatment time as well. Goodway and Amui (2007) explored the effectiveness of a 9-hour, fine motor skills training (spread over 9 weeks) on the object control skills of disadvantaged preschoolers, utilizing a direct instruction format treatment group, a mastery motivational climate format treatment group, and a control group. Both treatment groups improved their scores significantly from the pre- to post-test, while the control group did not.

Visual perception has also been shown to improve after training. Bishop, Gayton, and Bassett (1972) implemented the Frostig Program (which includes visual perception and visual motor integration activities) to a group of 20 first graders with low visual perception scores but with IQs within a normal range. A control group of 59 children with normal IQ and low visual perception scores as well, was used for comparison. The treatment consisted of approximately 70 hours of visual perceptual training over a seven-month period. The improvement on pre- and post-tests for the treatment group was significant and three times that of the control group. Interestingly, 25% of the control groups' scores declined from pre- to post-test while no such decline was observed in the treatment group's scores.

Improvements in visual perception can be achieved through informal programs as well as formal ones (such as the Frostig). Church (1979) conducted a study comparing an informal versus formal visual perception training program administered to 90 five and six year olds. The informal program consisted of activities such as a toy train on a track, puzzle cards with hidden figures, matching games, and copying block designs. The formal program utilized the Frostig workbook, the focus of which is drawing beginning pictures and patterns). No indication as to the amount of time spent on the training was given, other than to say that a time was set for the activities during each school day. Using the Marianne Frostig Developmental Test of Visual Perception (third edition), the children were given pre- and post-tests, approximately six months apart. Both groups improved significantly on their test scores, without a significant difference between them emerging. Taken together, it seems that both formal and informal programs can be equally effective in strengthening visual perception skills (visual motor integration skills included within this).

Other studies have found similar results. Lahav, Apter, and Ratzon (2008) found that, for kindergarten children living in a low socioeconomic area who scored below the 25th percentile on the Beery-Buktenica Developmental Test of Visual Motor Integration, a nondirective supportive visuomotor intervention was effective. The treatment consisted of games such as tic-tac-toe, checkers, snakes and ladders, and board games; memory games; and social games. It was spread over 12 weeks with weekly sessions of 45 minutes each, totaling in approximately 9 hours of treatment time. Although the authors state that these activities do not involve grapho-motor or fine motor activities, this does not actually appear to be the case.

Tic-tac-toe involves the use of writing X's and O's and the board games involve the manipulation of typically small game pieces. Therefore, it can be argued that though this intervention was informal and did not include direct instruction on visual motor integration or fine motor skills, it did engage the children in activities that promoted the practice of these skills. Post-test scores revealed significant visual motor integration improvement for the treatment group as compared to the control group.

This study also tested the effectiveness of a directive visual motor integration intervention among kindergarten and first students. The directive intervention included the use of patterns, pencil and paper work (2/3rds of each session), and playful fine motor activities (1/3rd of each session). Interestingly, whereas only the nondirective intervention proved effective with the kindergarten children, both directive and nondirective were effective with first graders. This indicates that an informal, developmentally appropriate intervention that is not heavily dependent on paper and pencil work can be effective in increasing visual motor integration and that the training will generalize (as was seen in the Farr and Leibowitz study previously discussed).

These studies indicate that interventions are indeed effective in improving fine motor, visual perception, and visual motor integration skills. The intervention tested in this study included activities that require predominantly visual motor integration but also visual perception and fine motor coordination and provided a total of 36 and a half hours of training. These activities include such things as puzzles, blocks, Legos, shape sorters, lacing, stringing, cutting, tracing, copying shapes, Playdough, playing games such as "Don't Spill the Beans", and crafts.

The amount of time devoted to training in the studies reviewed here ranges from 9 to 70 hours. This provides substantial support for the contention that the 36 and a half hours allotted for the visual motor integration intervention tested in this study, is sufficient to elicit improvement. However, all of these studies, tested interventions where treatment was implemented in small chunks of time, spread over an extended period.

Due to the desire to provide services at the very beginning of school to give the children needed skills as quickly as possible to reduce experiences of failure, the intervention studied here provided short-term, intensive training for 3 hours and 25 minutes a day, 5 days a week, for 3 weeks beginning the third week of school. Therefore, this study adds to the literature in terms of exploring the value of a short-term, intensive intervention on visual motor integration skills.

Summary

Current kindergarten classroom and curricular demands require incoming students to have readiness skills in order for them to participate immediately in learning activities. Those children that do not have requisite skills are susceptible to academic difficulties that begin in kindergarten and set the stage for poor academic proficiency throughout school. A substantial number of studies have found a correlation between school readiness/success and visual motor integration skills, indicating that these skills are one important component of school readiness. Movement development and information processing perspectives provide a tentative explanation for this correlation.

The level of individual demand a lack of visual motor integration skills places on children's working memories can make even the first days of kindergarten a struggle.

Children that experience difficulties may develop negative feelings about themselves and school causing them to misbehave or withdraw. These emotional reactions put the child further at risk as they further impede the child.

Research has shown retention, transition classes and delayed entry to be ineffectual interventions and advocates for programs that reach children as soon as possible. Children most at risk for having low visual motor integration skills are those that have not attended a center-based preschool and have not participated in skill building activities at home. Schools are unlikely to have access to this vulnerable population until kindergarten registration which can occur up until the first day of school, leaving no time to intervene before the school year begins.

Research demonstrates that perceptual motor interventions of varying duration are effective in increasing skills making the three-week visual motor integration intervention that began in the third week of school, after identifying children with sub optimal skills in the first week of school, a reasonable intervention to test. Though it cannot be said that the acquisition of these skills will allow children to compete with more prepared students or even to excel in kindergarten, it likely provides them with sufficient resources to participate in the learning activities required of them, giving them a chance at success.

Purpose and Research Questions

The purpose of this study is to evaluate the effectiveness of a short-term, developmental visual-motor integration intervention conducted at the beginning of the school year to improve visual motor integration skills, basic school functioning skills, and school adjustment for kindergarten children with low average or below, visual motor integration skills. Specific research questions that this study will address include: (a) Will a short-term, developmental visual motor integration intervention program improve the visual motor integration and basic school functioning skills of the treatment group? (b) Will the treatment group demonstrate levels of school adjustment in the middle of the second trimester similar to students who met study requirements but did not demonstrate low average or below, visual motor integration skills.

CHAPTER THREE

METHODS AND PROCEDURES

Participants

Participants included 7 children recruited from the population of children who were registered and in attendance on the second day of kindergarten in the 2009/2010 school year at an elementary school in the Colton Joint Unified School district, located in San Bernardino County of Southern California. They were selected based on low average or below, VMI scores and having met study participation requirements.

Prior to recruitment, IRB approval was gained. 67 kindergarten students were assessed using the VMI leading to the identification of 32 children with low average or below, visual motor integration skills. After potential participants were removed from consideration due to eligibility requirements, the parents of 9 children were provided with informed consent, all children gave oral assent, and all participants were treated under the ethical guidelines of the American Psychological Association.

These 9 children attended and completed the intervention program; however, data from two children had to be dropped due to a determination of English Language Learner status by the district for one and excessive absences for the other (5 out of 15 days). Additionally, one student moved immediately after the program, allowing for data collection regarding the first research question only.

Of the 7 children whose data is included, 2 are female and 5 male, ranging in age from 5 to 5.9 years. 5 students had never attended a center-based preschool, 1 attended for half of a year, and 1 for one year. Participant ethnicity is as follows: 4 Caucasian, 1 African American, 1 Japanese American, and 1 Hispanic. Combined household income ranged from $12,000-$84,000 a year with the majority below $24,000.

Design

This study employed a multiple subject single case study design. The independent variable was the attendance of the visual motor integration intervention program. The dependent measures were the participants' Beery-Buktenica Developmental Test of Visual-Motor Integration, 5th edition, short form (VMI) and supplementary visual perception test; non-standardized assessments of cutting and letter copying accuracy; observational assessments of scissor and pencil grip; and the Teacher Rating Scale of School Adjustment (TRSSA) scores.

To address the first portion of the first research question, "Will a short-term, developmental visual motor integration intervention program improve the visual motor integration and basic school functioning skills of the treatment group?", all participants were assessed using the VMI on the second day of school and on the last day of the intervention program. They were also assessed using the VMI supplementary test of visual-perception during the second week of school and on the last day of the intervention program. Scores were analyzed to determine if the VMI and visual perception scores of the treatment group had improved.

The basic school functioning skills of cutting accuracy, letter copying accuracy, scissor grip, and pencil grip were also assessed. All participants were given a non-standardized letter copying assessment administered on the first and last day of the program. The participants also took a non-standardized cutting accuracy test on the ninth day and on the last day of the program. The pre- and post-scores on these assessments were analyzed to determine if improvement had occurred in the basic school functioning skills of cutting and letter copying accuracy.

The program teacher documented scissor and pencil grip by observing the children's performance. The participants' scissor and pencil grips were classified as functional or non-functional and their pre- and post-performances were compared to determine if those participants who began the program with non-functional grip(s) had acquired functional grip(s) by the end of the intervention program and if those that began with functional grip(s), maintained them throughout the intervention program.

To address the second research question, "Will the treatment group demonstrate levels of school adjustment in the middle of the second trimester similar to students who met study requirements but did not demonstrate low average or below, visual motor integration skills?" TRSSA scores were obtained from the children's teachers in the middle of the second trimester. As well, classroom teachers provided TRSSAs for 12 randomly chosen children from their classes who were in attendance on the second day of school and had taken the VMI assessment but not been asked to participate in the program (indicating that they had not been identified as having low average or below, visual motor integration skills) and who met the study's requirements (except for readiness scores which were unavailable for these students). The TRSSA scores of the program participants and non-participants were analyzed and compared to determine if the treatment group displayed similar levels of school adaptation.

Measures

Beery-Buktenica Developmental Test of Visual-Motor Integration and Supplementary Test of Visual Perception

The VMI (Beery, Buktenica, & Beery, 2006) is a standardized test that measures individuals' abilities to integrate visual and motor abilities, taking approximately 10-15 minutes to administer. It has been standardized on a national sample of 2,512 individuals age 2 to 18 and has been proven to have adequate reliability and validity. The test requires the taker (ages 2 - 100) to copy geometric forms of increasing complexity until he/she fails on three drawings consecutively. The forms are presented in a booklet, three on a page and are to be copied in the space provided below each form.

The VMI supplementary test of visual perception is designed to provide further information about the taker's abilities on relatively pure visual tasks in order to decipher the specific area(s) of difficulty. The supplementary visual perception test measures the individual's ability to recognize geometric forms. The test takes approximately 5 minutes to administer.

Letter Copying Assessment

The letter copying assessment is a non-standardized test of letter copying ability. This assessment includes 4 manuscript letters (*K*, *M*, *O*, and *S*) both uppercase and lowercase for a total of 8 letters to be copied. There is one example provided on the left hand edge of a handwriting line (two solid horizontal lines equally spaced with a dotted line running parallel and equidistance better them) measuring 3 ¼ inches in height and 6 ½ inches in length. The taker is given a fine point, felt-tipped pen and asked to copy the letters, completing each line. If the participant stops during the assessment, they are asked to copy each letter at least one time.

The letters are evaluated on three criteria: a) space, b) size, and c) form. Space refers to how well the copied letter is placed within the guidelines of the handwriting lines per the example letter. For example, none of the capital letters on this assessment should extend below or above the bottom and top solid line and lowercase letters should not extend above the middle dotted line (except in the case of the letter *k*) or below the bottom solid line. Size refers to how large the letter is written. Form refers to the accuracy of the type of lines required (straight or curved), their angles, and their relation to one another. For example, the capital *M* should be written using two straight, vertical lines on either side and two straight diagonal lines that extend from the tops of the vertical lines down to meet equidistance from the vertical lines.

Each of these criteria is scored based on the percentage that the copied letter accurately replicates the given example letter. 1 point is given for a replication that is 0-25% accurate, 2 points for 26-50% accuracy, 3 points for 51-75% accuracy and 4 points for 76-100% accuracy. This allows for a total of 12 possible points per letter, totaling in 96 possible points. A transparency with the example letters on it is used to lie over the chosen letter to aid in determining the percentage that the copied letter is accurate regarding size and form. The copied letter that scores the highest of the ones written by the taker for each example letter is used for scoring.

Cutting Accuracy Assessment

The cutting accuracy assessment is a non-standardized test that requires the taker to cut out a circle and a parallelogram shape, each printed on an 8.5 by 11-inch white copy paper. The lines on the shapes are composed of dashes, indicating where the individual is supposed to cut. The participant is given a pair of scissors but not instructions as to their use and asked to cut out the shapes, staying on the dotted line as closely as possible. The circle measures 53 centimeters in circumference and the parallelogram measures 58 centimeters, for a total of 111 centimeters of line to be cut.

The accuracy of the cutting is determined by the total length of cuts that are .25 of a centimeter or more off of the dashed line. This measurement is then divided by the 111 centimeters to determine the percentage of cutting that is accurate and inaccurate.

Pencil Grip Assessment

The pencil grip assessment is an observational assessment conducted while the participant takes the letter copying assessment. Grips are classified as functional or non-functional. Functional grips include the tripod grasp (where the index finger and thumb pinch the writing instrument while it rests on the middle finger), the quadripod grasp (where the index and middle finger and the thumb pinch the writing instrument while it rests on the ring finger), and the adaptive tripod grasp (where the writing utensil is held the same way as in the dynamic tripod grasp but is held between the index and middle finger). All other grips are classified as non-functional.

Scissor Grip

The scissor grip assessment is an observational assessment conducted while the participant takes the cutting accuracy test. Scissor grips are classified as functional or non-functional. A grip is considered functional when the scissors are held with the thumb in one loop facing up and either the index and middle finger in the bottom loop or the index finger held on the outside of . the loop with the middle and ring finger within the loop. In either case, the fingers must not be pushed into the loops past the second knuckle (the joint between the finger joint on the hand and the finger joint toward the tip of the finger). Any other types of grips are classified as non-functional.

Teacher Rating Scale of School Adjustment

The TRSSA (Ladd & Price, 1987) is a scale designed to measure young children's behavioral and relational adjustment to school and the classroom (see Appendix A). It is composed of five subscales: (a) independent participation, (b) cooperative participation, (c) teacher's perception of children's school liking, (d) teacher's perception of children's school avoidance, and (e) teacher's perception of children's interest/comfort with the teacher. There are 52 items that the teacher rates on a likert scale of 0 (doesn't apply), 1 (applies sometimes), and 2 (certainly applies). Sample items include, "Uses classroom materials responsibly", "Participates willingly in classroom activities", "Seeks challenges", and "Enjoys most classroom activities".

Procedures

Teacher Informed Consent

Prior to the beginning of the school year, the researcher explained the intervention program and study to the 4 teachers scheduled to teach morning kindergarten. All teachers agreed to participate and signed an informed consent.

Beery-Buktenica Developmental Test of Visual-Motor Integration Pre-test

On the second day of school, all four morning kindergarten teachers administered the VMI to their classes as a whole group following the directions in the VMI manual. The tests were given to the researcher and scored as above average, average, below average, low, and very low per the standardized instructions in the manual, except that the score of average was split in the middle to determine a low and a high average. 32 children were identified as having low average or below, scores.

First Eligibility Screening and Informed Consent

In order to screen these students for eligibility, the classroom teachers were consulted to remove from the group students who, to their knowledge, were not native English speakers, had an IEP, or had been retained. 16 children remained in the group after these eligibility requirements were considered and formed a group of potential participants.

These 16 children were sent home with an informed consent giving permission for the researcher to administer further testing and have access to school records. These students were also sent home with a caregiver information form (see Appendix B) regarding marital status, occupation, age, gender, education level, ethnicity, home language, and income; and a screening form.

The screening form (see Appendix C), includes the following sections: (a) child's name; (b) parents' names and contact information; (c) a space to sign giving permission to be contacted regarding the research study; (d) a question regarding whether their child has ever attended a center-based preschool and if so, for how long and where; (e) a question regarding what the child's native language is; and (f) boxes to indicate if the child was born prematurely and if so, at what weight; has a handicap of the arm, hand, finger(s) and if so, to explain; has an Individualized Education Plan; has a hearing deficit and if so, whether it has been corrected or not; has a vision deficit and if so, whether it has been corrected or not; has any form of autism, Aspergers, or pervasive developmental disorders; has mental retardation; has a chronic medical condition and if so, to explain; has a traumatic brain injury; has a developmental delay; has cerebral palsy; has Down's Syndrome; and has a behavior or conduct disorder to include Attention Deficit Hyperactive Disorder.

9 children returned the informed consent, caregiver information form, and screening form. A review of the screening forms revealed that all 9 children met study requirements.

Second Screening

The 9 potential participants were removed individually from the classroom on the seventh day of school and given the VMI supplementary test of visual-perception and a non-standardized, pre-academic readiness assessment administered by a trained graduate student to further determine eligibility (see Appendix D).

The pre-academic readiness screening test is an non-standardized test created specifically for this study, consisting of 13 tasks in the areas of reading (alphabet familiarity and book handling), mathematics (rote counting and one-to-one correspondence), language (intelligibility and ability to speak in sentences), and general knowledge and cognitive skills (identification of colors, sorting, ability to distinguish between more and less, imitation, identification of the location of objects on a page, following directions, and ability to distinguish different and same).

The child's performance on each task is scored from 0-3 points based on a rubric specified for each task. A point score of 0 indicates that the child did not or was unable to complete the task with any or very little success. The points allotted to a given performance on a task increase with an increase in ability to perform the task. A total of 39 points are possible. Children scoring 13 points or less were to be excluded because the developmental difficulty of these tasks is low and a score of 13 out of 39 points would indicate that the child was developmentally delayed or dealing with other confounding issues. None of the children scored below 13 points and so were eligible to participate in the study.

Permission for Intervention Program

On the ninth day of school, these children were sent home with an informed consent requesting permission for them to attend the intervention program. All were returned and the children scheduled to participate.

Treatment

The intervention program is a mixture of formal and informal activities and was implemented on the elementary school campus in one of the kindergarten classrooms (see Appendix E for the full curriculum schedule and a description of activities). It ran for three weeks, three hours and 25 minutes a day, in the afternoon. The children's school day ends at 12:10, after which they were given 25 minutes to eat and play outside on the playground. The days were split into two sessions, one session lasting for 1 hour and 15 minutes and the other for 1 hour and 30 minutes in length, separated by one 15 minute recess break.

The core of curriculum is 10 centers (constituting the formal portion of the intervention), each focusing on a particular type of visual motor integration or related skill Children rotated through the centers in three groups of 3 children. The centers are as follows: (a) Build It, utilizing various types of blocks; (b) Connect It, utilizing connecting cubes, Zoob pieces, and Legos; (c) Puzzle It, utilizing shape sorters and puzzles; (d) Move It, utilizing tweezers, tongs, and spoons; (e) Lace It, utilizing beads; (f) Draw It, utilizing a workbook of lines and shapes to trace and copy; (g) Color It, utilizing coloring pages; and (h) Cut It, utilizing scissors and preprinted cutting cards.

A new center was introduced each day and in order of the level of visual motor integration difficulty they present, so the children were building up to the more difficult tasks, culminating in more academically oriented tasks such as cutting and drawing. The groups of children rotated through the centers assigned for the day. During center sessions the teacher went from center to center checking on students, offering assistance, and providing positive reinforcement and encouragement.

Each center was visited 8 times, 15 minutes per session, for a total of two hours and each following the same pattern of visitation. The Build It center will be used to illustrate the general content of these sessions. The first session is an exploratory session where the children were introduced to the materials but given no direction, simply allowed to play with the materials as they wished. For example, at the Build It center the children were presented with various types of blocks and allowed to simply experiment with their use.

The second session is an instructional session with all children present, during which the teacher provided instructions and tips on the use of the materials, modeled their use, and guided the children's practice for 5 of the 15 minutes. The remaining 10 minutes is a practice period for the children with teacher feedback provided. For example, at the Build It center the teacher instructed and modeled how to hold the blocks for best control, how to set them on top of one another for best stability, and types of structures that can be built with the blocks.

The third and fourth sessions are free practice. In the Build It center they were allowed to work with the blocks however they wished. The fifth session marks the point at which the centers become more complex and demand specific performances from the children. Generally, the tasks from this point on require some form of replication so that the children must visually assess an item and then create it themselves. This fifth session is instructional, given to one group at a time, during which the teacher explained the increasing complexity of the center, gave instructional tips, and modeled the upcoming required tasks.

For example, in the Build It center the teacher demonstrated how to evaluate an existing structure and strategically replicate it. The difficulty of the task then increases during the sixth, seventh, and eighth sessions. In the Build It center this was moving from replicating simple patterns of single rows to multilevel rows to structures that extend out in different directions and up, as well as incorporating bridges, etc.

This type of curriculum structure can be referred to as "nested scaffolding" as there are two sets of scaffolding that are operating simultaneously, one nested in the other. Each center increases in complexity and difficulty as the child goes through the exploratory, instructional, practice, instructional on replication/complexity, and practice on replication/complexity sessions. At the same time that the progression through each center visit scaffolds the skill, visual motor integration skills in general are scaffolded by introducing the centers in order of difficult, beginning at low developmental demands to high developmental demands (see Figure 1).

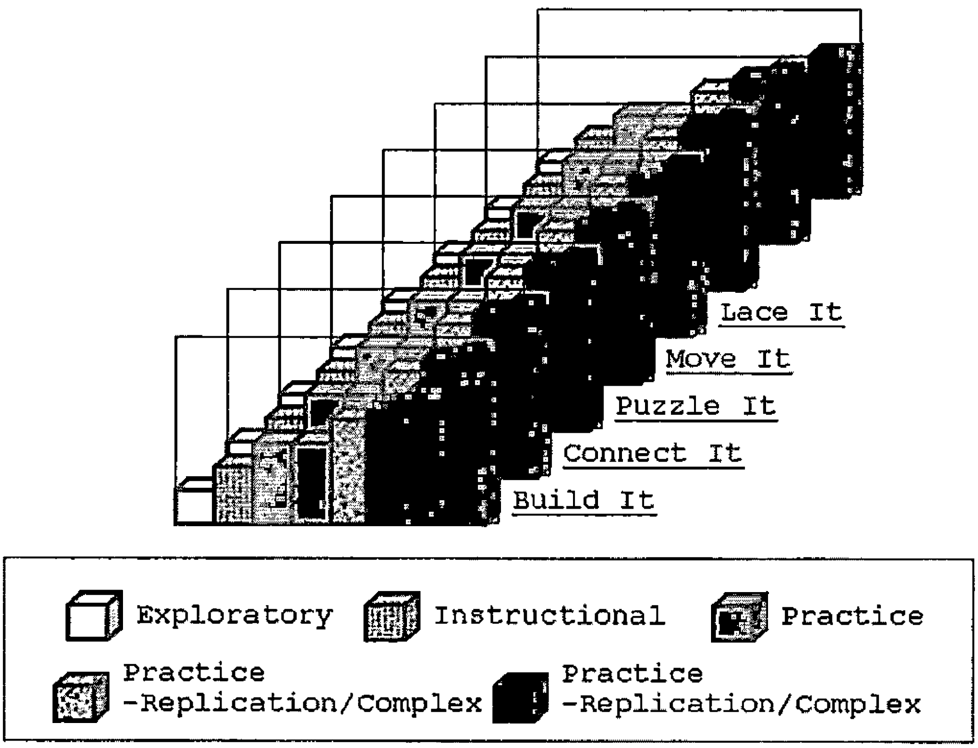

Figure 1. Diagram displaying "nested scaffolding". The bars represent the type of center visit with the length of the bars indicating the level of difficulty. The labels next to each step indicate the centers in order of introduction, from Build It to Cut It.

Time periods that are not allotted to centers are spent in a variety of activities such as playing games, painting, drawing, and crafts. A typical day begins with entering and participating in a free play activity with materials laid out for the children (such as toy cars and Playdough) for 10 minutes. Then, for 5 minutes the children join the teacher on the carpet and participate in finger warm-up exercises. The next 15 minutes are in an instructional center session followed by three 15 minute practice center sessions. Recess is outside on the playground for 15 minutes.

After recess, the children rotate through four more centers for replication practice sessions and two activity sessions (such as playing with a doll house or playing a game). The actual schedule of the day and the number of formal centers the children visit varies depending on which day it is within the three week time period. At the beginning, as centers are just being introduced, there was more activity time and less center time. At the point at which all centers had been introduced and actively in the rotation, centers consumed most of the day. Toward the end of the three weeks, when centers had finished their rotation, there was again less center time and more activity time.

Basic School Functioning Pre-Tests

On the first day of the program, all participants took the letter copying assessment pre-test during which the program teacher performed the observational assessment of pencil grips. One the ninth day of the intervention program, the students were given the cutting accuracy assessment pre-test, during which the program teacher performed the observational assessment of scissor grips. The cutting accuracy and scissor grip assessments were given on the ninth day because they were added as a measure after the program had begun and therefore, were given on the first day of the Cut It center in order to provide information about skill improvement from that point to the end of the program.

Post-tests

All participants were given the VMI, VMI supplementary test of visual perception, letter copying assessment, observational assessment of pencil grip, cutting accuracy assessment, and observational assessment of scissor grip post-tests on the last day of the intervention program. Scores were analyzed to answer the first research question, "Will a short-term, play-based visual motor integration intervention program improve the visual motor integration and basic school functioning skills of the treatment group?"

Teacher Rating Scale of School Adjustment Scores

In the middle of the 2009/2010 school year, the kindergarten teachers filled out a TRSSA for each child in their class that participated in the intervention program. They also analyzed their class lists, removing any students that were not in attendance on the second day of school to take the first VMI assessment or to whom any of the exclusionary criteria listed on the screening form applied. This created a group of four students per class who met the study requirements but did not score low average or below, on the VMI at the beginning of the year. Informed consent was sought for these students' parents.

Each teacher then randomly chose 4 students from this group by writing their names on slips of papers, folding them, shuffling them, and choosing four slips. The teachers filled out a TRSSA for each of these students, placing no identifying information on the forms. The TRSSA scores of the program participants and non-participants were analyzed and compared to answer the second research question, "Will the treatment group demonstrate levels of school adjustment in the middle of the second trimester similar to students who met study requirements but did not demonstrate low average or below, visual motor integration skills?"

CHAPTER FOUR

RESULTS

Program Effects on Visual Motor Integration and Basic School Functioning Skills

Pre- and post-test scores for the VMI; VMI supplementary test of visual perception; letter copying and cutting accuracy assessments; and pencil and scissor observational assessments were analyzed to determine if the short-term, developmental visual motor integration intervention program was effective in increasing the participants' (n=7) visual motor integration skills and basic school functioning skills. As shown in Table 1, these analyses revealed an overall positive effect for all participants.

Table 1

Pre- and Post-test Results of Visual Motor Integration and Basic School Functioning Skills Assessments

	VMI Standard Scores		VMI Visual Standard Scores		Letter Copying Accuracy Percents		Cutting Accuracy Percents		Pencil Grip		Scissor Grip	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Meg	73 Low	94 L.Av	79 Low	119 A.Av	85%	94%	60%	100%	F	F	N	F
Mike	92 L.Av	97 L.Av	82 B.Av	104 H.Av	91%	99%	5%	96%	N	F	N	F
Dave	86 B.Av	101 H.Av	86 B.Av	100 H.Av	80%	94%	100%	100%	F	F	F	F
Kim	92 L.Av	97 L.Av	86 B.Av	126 A.Av	93%	95%	93%	97%	F	F	N	F
Ian	98 L.Av	108 H.Av	95 L.Av	89 B.Av	57%	65%	16%	95%	N	F	N	F
Phil	95 L.Av	98 L.Av	64 V.Lo	78 Low	77%	82%	95%	98%	N	F	N	F
Tom	95 L.Av	100 H.Av	117 A.Av	123 A.Av	78%	90%	50%	96%	N	F	F	F

Note. All participant names have been changed. L.Av = low average; H.Av = high average; A.Av = above average; B.Av = below average; V.Low = very low; N = non-functional; F = functional.

VMI pre-test standard scores averaged 90 while the averaged post-test score was 99, demonstrating an overall increase in visual motor integration skills. Additionally, the data revealed that all children made gains and 100% scored average, with 29% (n=2) scoring in the upper half of average at the end of the program. As would be expected, the amount of increase was related to the participants' proficiency on the pre-test, with those students who scored the lowest on the pre-test making the most gains. Meg moved from a standard score of 73 (low) to 94 (average) while Dave moved from 86 (below average) to 101 (average)(see Figure 2).

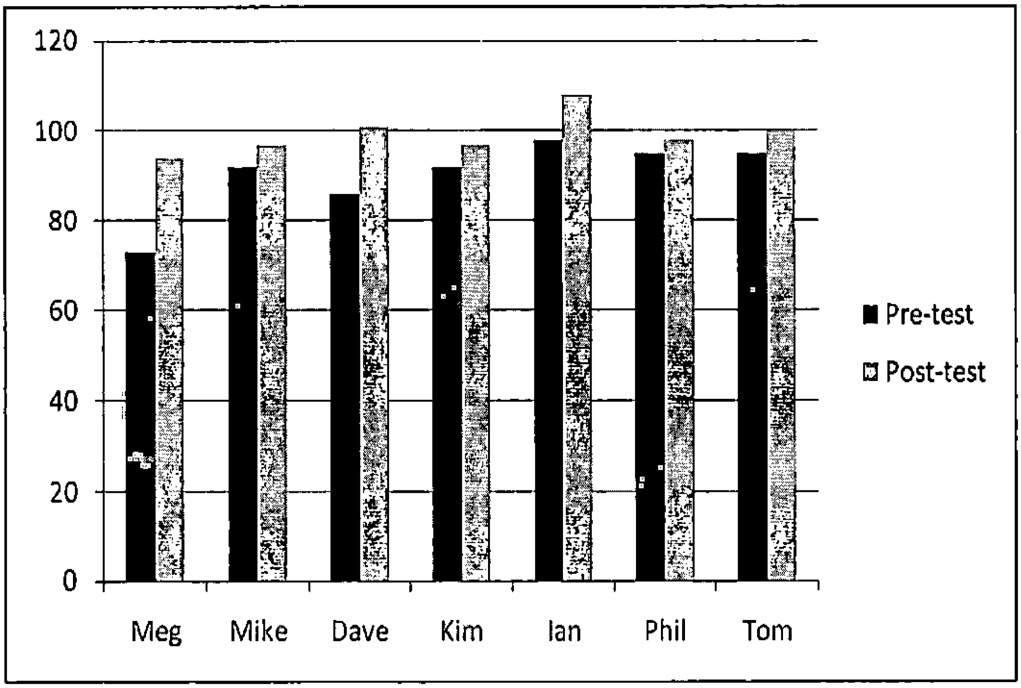

Figure 2. Participants' Beery-Buktenica visual motor integration standard scores.

The analysis of the VMI supplementary test of visual perception revealed an even more substantial improvement with a mean increase of 18 points. The average standard score on the pre-test was 87 and for the post-test, 105. All but one student showed improvement (possible reasons for this are considered in the discussion section). Several students who scored below average or below, on the pre-test made significant gains, ranging from 14 to 40 points. Improvement was even seen in Tom who began at above average (he moved from 117 to 123 points)(see Figure 3).

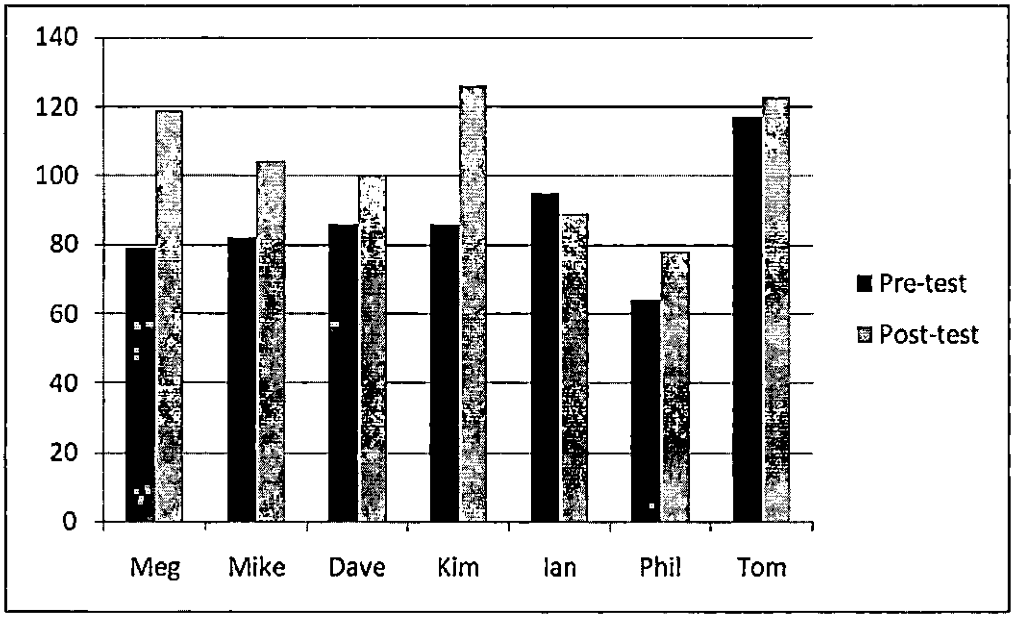

Figure 3. Participants' Beery-Buktenica supplementary test of visual perception standard scores.

Letter copying and cutting accuracy also showed improvement, though the growth in cutting accuracy was greater than in letter copying. Possible reasons for this variation will be discussed in the discussion section. The letter copying pre- and post-tests revealed an average growth of 8%, from 80% on the pre-test to 88% on the post-test. The range of increase across individuals was 2% to

14%. Cutting accuracy scores increased by an average of 37%, with an average of 60% on the pre-test and 97% the post-test. All participants demonstrated gains except for Dave who scored 100% on the pre-test and maintained that score on the post-test. The range of increase was 0% (Dave, who scored 100% on both the pre- and post-tests) to 91% (Mike, who scored 5% on the pre-test and 96% on the post-test). As to be expected, the pattern of scores revealed that those participants that scored the lowest on the pre-test, showed the most improvement (see Figure 4).

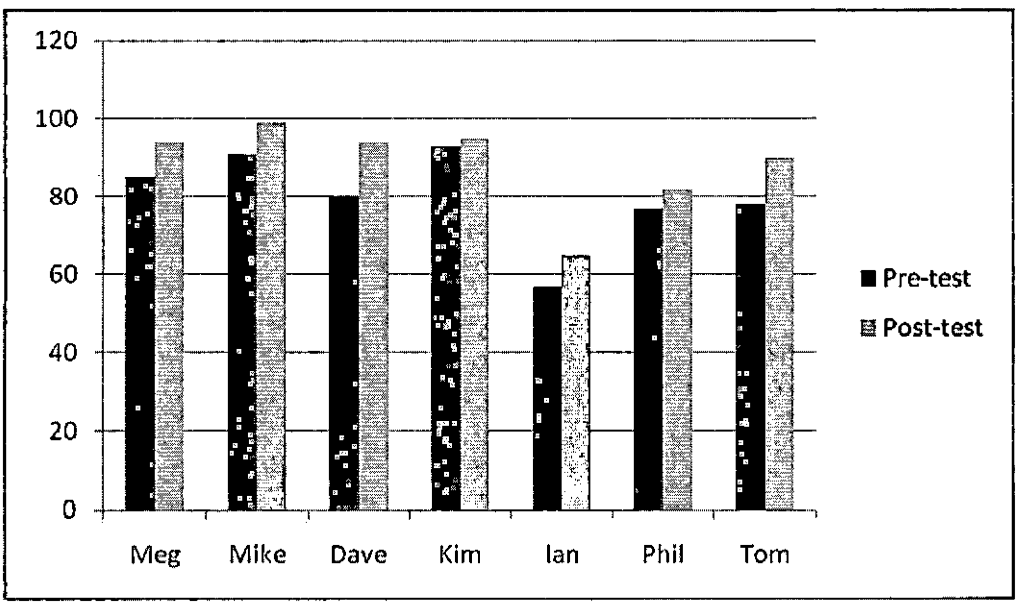

Figure 4. Participants' letter copying accuracy percentile scores.

The change in pencil and scissor grips was also positive. At the beginning of the program only 43% (n=3) held their pencils in a functional grip and only 29% (n=2) had a functional scissor grip. At the end of the program, 100% were using a functional pencil and scissor grip (see Figure 5).

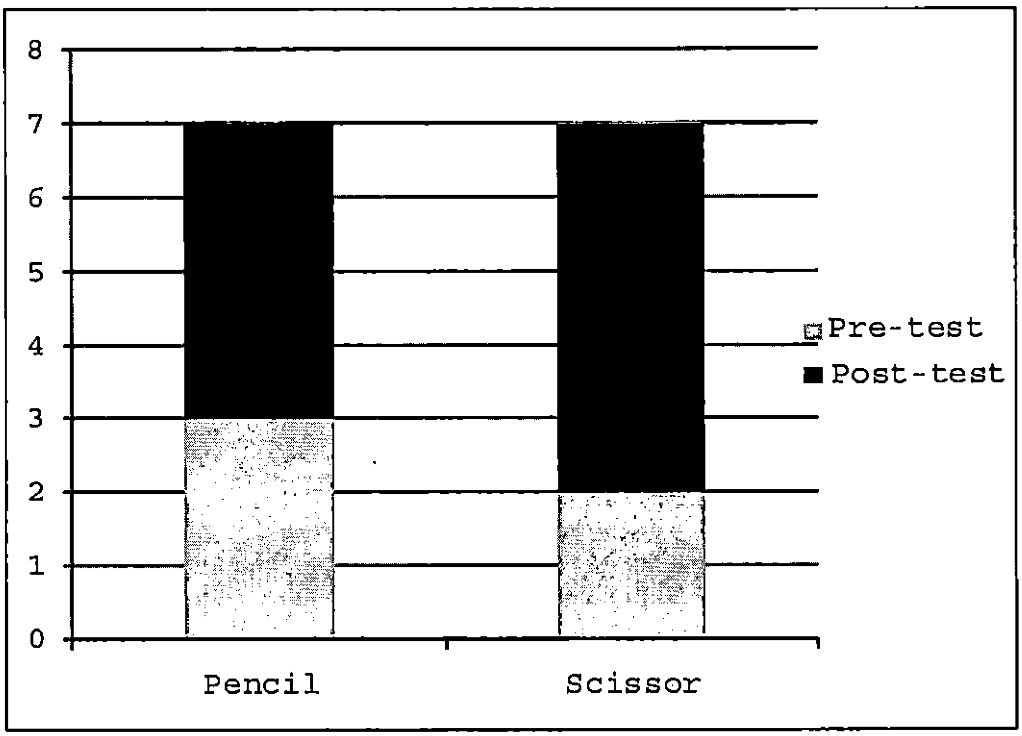

Figure 5. Number of participants with functional pencil and scissor grips on pre- and post-tests.

Effects on School Adjustment

A comparison of TRSSA scores of program participants and non-participant students who met study requirements but did not demonstrate low visual motor integration scores at the beginning of the year, demonstrated that the program participants did indeed have levels of school adaptation similar to those that did not have visual motor integration difficulties at the beginning of the school year. In order to make comparisons between the participant and non-participant groups, an average score (possible range of 0-2) for each of the five categories was calculated for both groups and the percentage of variation between the two groups was found.

The program participants not only had similar levels of adjustment across the 5 categories but even scored higher in one category. The program participants demonstrated a level of cooperative participation that was 4.5% higher than the non-participant group. The non-participant group scored higher on the other 4 categories but the discrepancies were small. The non-participant group scored 7% higher on independent cooperation, 5% higher on school liking, 1% lower on school avoidance, and 9% higher on comfort with teacher.

A review of individuals' scores reveals that one program participant's scores may have skewed the results. Tom scored the lowest of all individuals in two of the categories and was equal to one other child (though three different individuals) in the other three categories. If this individual is considered an outlier and removed from the data, the two groups are almost identical, with the program participants actually scoring better in three categories. The program participants would score 28% higher in cooperative participation, 3% higher in school liking, and 2% lower in school avoidance. The non-participants would score 1% higher on individual participation and on comfort with teacher. Further reasons to view the data with this participant's scores excluded will be discussed in the discussion section.

CHAPTER FIVE

DISCUSSION

The available research literature indicates that today's kindergarten standards require children to begin school already equipped with readiness skills allowing them to be successful in an academic environment (Spodek, 1988). It also indicates that those children who have not attained certain levels of proficiency in readiness skills, such as visual motor integration, at the onset of schooling, are at-risk academically and in terms of school adjustment (Bart, Hajami, & Bar-Haimi, 2007 and West, Denton, & Reaney, 2001). The goal of this study was to improve the visual motor integration skills and basic school functioning skills of kindergarten children with low average or below, visual motor integration skills early on in the school year and in a short period of time in order to allow them to function easily in the classroom and facilitate school adjustment by preventing the frustration and negative emotions that can result from difficulties in meeting classroom demands.

As the results discussed above indicate, the visual motor integration intervention program implemented and evaluated herein achieved this goal, across all participants, improving visual motor integration and basic functioning skills and fostering school adjustment equal to children who did not begin with the same readiness deficits. The positive results of this program reinforce the findings of other studies that poor visual motor integration skills are amenable to remediation. Also important is that, although other intervention programs have proven successful in improving visual motor integration skills (i.e., Far and Leibowitz, 1976, Goodway and Amui, and Rule and Stewart, 2002), they were designed to be spread over a longer period of time than the intervention studied here. The current intervention demonstrates that improvements can be achieved in a shorter period of time, providing an alternative that achieves results quickly at the beginning of kindergarten, so as to strengthen the needed skills before too many negative experiences in the classroom can accumulate and set in motion a feedback loop of negative emotions and poor achievement.

As in all studies such as the one presented herein, it is important to consider the possible effect of regression towards the mean when interpreting gains. However, looking at the VMI scores demonstrates that there are several factors indicating that the increase in participants' scores was not due to regression toward the mean. First of these factors is that only two of the participants scored below low average (one at low [73] and one at below average [86]), yet all participants showed growth.

The second factor is that the scores follow the pattern that would be expected with those that scored lowest, showing the most growth. Those participants that scored within the average range (though on the lower end), were most likely functioning only a little lower than their maturational potential and did not have as much room to grow before hitting the limits of their maturational development. However, those that scored in the low and below average range were performing well below their maturational potential, allowing for more growth before hitting their limits.

Although positive improvement was seen in all areas, the gains on the VMI and the letter copying assessments were not as great as those seen on the VMI supplementary test of visual perception and letter copying assessments. The discrepancy may be attributable to a lack of explicit instruction and practice on letter and shape copying as part of the program curriculum, whereas this was provided for in regards to visual perception and cutting accuracy.

Despite the lack of explicit instruction and practice in these areas, improvement was seen, indicating that the improvement in visual motor integration skills generalized to these specific skills, as is indicated in the research literature (Farr and Leibowitz, 1976). However, given that letter writing is a requirement in kindergarten per the California State Standards, it would be beneficial to include letter and shape copying as one of the centers in order to provided explicit instruction and practice in this skill, in hopes of stimulating even more growth in this area and consequently better classroom performance.

It is also possible that because of the short period of time (three weeks) that the full effects of the program were not observable. The program may have strengthened the fundamental skills required in letter and shape copying but since is a rather complex task requiring full integration of these skills, it is possible that more time is needed for the bolstered skills to further coalesce and produce significant changes in letter and shape copying ability. This practice is inherent in classroom activities. In future studies, it would be advisable to do another series of post-tests later in the year to evaluate the long-term effects of the program.

Although the results of the program were positive overall there are two cases that ran counter to the larger trend and need to be addressed. As well, each case brings up points regarding the study and the program that are worthy of consideration. One student, to be referred to as Ian, performed worse on the VMI visual perception post-test than on the pre-test (dropping from an average to a below average score). This is incongruent with the improvements he demonstrated in all other areas as well as the improvement seen in all other participants. The circumstances of the post-test and characteristics of this particular child may have contributed to his low performance on this test. All post-testing was conducted on the last day of the program (a Friday), during the intervention program hours (after the children's normal school day,) and the VMI visual perception test was the last to be administered on that day. As well, Ian was the last child to be assessed.

This would not have been an optimal situation for any of the children but perhaps, especially detrimental for Ian. The program teacher reports that Ian often showed signs of tiring during the intervention program and on that particular day prior to the test, had asked several times if it was time to play yet, resting his head on his desk and sounding worn out. As well, during the assessment, Ian performed very quickly, with an apparent lack of effort.

Additionally, during follow-up, the classroom teacher reported subsequent conversations with the mother who, in response to the classroom teachers concerns about Ian's low stamina in the classroom despite his ability to do the work, indicated that he sleeps excessively, frequently vomits after eating, and is currently being tested by doctors to determine the cause of these issues. Given the circumstances of the post-testing, the observations of the program teacher, and the implications of the follow-up information, it seems likely that the post-test was not a valid evaluation of Ian's visual perception skills.

This situation with Ian brings up an interesting issue. The improvements in the actual visual motor integration and cutting accuracy skills of the children may be underestimated due to the timing and circumstances of the pre- and post-testing in this study. The VMI visual perception pre-test was given one-on-one in the morning while the post-test was conducted as the last post-test at the end of the last day of the program in the same room as other children.

The cutting accuracy pre-test was not given until the ninth day of the program when the Cut It center began. Given that this was half way through the program, it is likely that the experiences the children had had up until that point, allowed them to perform better on the pre-test than they would have if it was given on the first day of the program; thus, not allowing for a true measure of effects of the program. However, in both cases, despite the possibility that the results were understated, the improvements were substantial. In future studies it would however, be advisable to give all pre-tests on the first day of the program and to negotiate a way to give the post-tests in circumstances similar to the pre-tests.

As well, it was noted in the results that one child, to be referred to as Tom, demonstrated much lower school adjustment than did the other participants, despite average scores on the VMI, above average scores on the VMI visual perception test, 96% accuracy in cutting ability, 90% accuracy in letter copying, and functional scissor and pencil grips by the end of the program. During follow-up, the classroom teacher indicated that Tom's classroom behavior shows characteristics of Attention Deficit Hyperactive Disorder (ADHD) and that he has clear defiant tendencies. The teacher reported that at the time of her filling out the TRSSA, he had just recently begun seeing a counselor and was being evaluated for ADHD. So, it is highly likely that there are extenuating factors that have influenced Tom's poor school adjustment and are beyond the scope of the intervention program to have remedied.

It should be noted that one of the qualifying criteria for the study was that the participant did not have a diagnoses of any behavioral disorder, including ADHD, because it presented a confounding factor. If Tom had been diagnosed with ADHD prior to the school year, he would not have been included in the program. It should however, also be noted that it is possible that Tom's school adjustment would have been worse if he had not attended the camp, improving his visual motor integration and basic school functioning skills.

The situation with Tom highlights an important point. Although this study was designed specifically to evaluate its effectiveness on children that did not have physical, cognitive, or behavioral issues as well as confounding factors such as being English Language Learners, being retained, or having an IEP, the next step in research would be to include such children, as they may be in even greater need of the program.

This need was apparent during the screening process, when it was found that of the 16 out of the 32 potential participants who scored below average or below, on the VMI, 4 were English Language Learners, 4 had speech IEPs, and 4 were both English Language Learners and had been retained and in general, scored lower than most of the participants did. Because of these issues, these children were not eligible to participate; however, now that the program has been found effective with children without such added difficulties, it would be worthwhile to conduct further studies testing its effectiveness for children such as these.

As well, it would be beneficial in future studies to have a larger group of participants and control groups to ensure that the improvements in visual motor integration and basic school functioning skills were uniquely attributable to attendance of the intervention program and not a result of normal classroom attendance. It would also be valuable to include a control group that attends an intervention not based on visual motor integration skills but lasting for an equal amount of time in order to determine if school adjustment levels are specifically a result of attendance at a visual motor integration intervention and not simply due to added exposure to the classroom environment.

This would also address the question of whether the degree of improvement in visual motor integration and basic school functioning skills were attributable to the intervention or are typical of the improvement brought about by normal classroom experiences. Though there is no definitive answer to this question for this study because of a lack of control groups, follow-up did reveal that an after-school tutoring program was created and designed specifically to help children who mid-way through the year, still demonstrated difficulties with visual motor integration and basic school functioning skills. No child that attended the intervention program was referred to this tutoring group, indicating that some children who did not attend the intervention program were still displaying difficulties mid-way through the year despite classroom experiences, while those who did attend, were not seen by their teachers as struggling with these skills. Though obviously, this follow-up information does not take the place of data gained when utilizing control groups, it does allude to what research with control groups might find.

Although it is not addressed in this study, evaluations of academic proficiency utilizing control groups, would also be worthwhile to determine if the intervention studied herein, facilitates academic success as the research literature suggests it would (i.e., Luo, Jose, Huntsinger, & Pigott, 2007 and Sons & Meisels, 2006). The absence of academic assessments and of a control group, make it impossible to determine whether the program facilitated academic proficiency; however, also revealed by follow-up was that, with the exception of Tom, all participants were considered academically proficient based on district mandated trimester and mid-trimester assessments. Though this is by no means conclusive evidence that the intervention program facilitated academic proficiency, children with low visual motor integration skills (such as those who participated in the intervention) are, according to the research literature, at-risk for poor academic progress at best and retention at worst. Given the proficiency of all participants, expect for Tom (whose academics are likely impacted by other issues as previously discussed), suggest that the intervention program was beneficial scholastically as well as in terms of school adjustment.

As is often the case, future research is needed to fully and precisely determine the impact that the visual motor integration intervention program herein has on its participants. However, given the gains the participants made in visual motor integration and basic school functioning skills, as well the fact that they displayed what appears to be average school adjustment, this study provides strong support for the use of this program. Schools are indeed faced with a difficult task in accommodating all children and finding ways to ensure their success regardless of their readiness level when entering kindergarten. The intervention program studied here, is one way that schools can fulfill their responsibilities to these students, providing them with the skills they need to be successful, and not be forced to rely on such negative interventions as retention and transition classes. It does seem that in the end, an ounce of prevention is indeed worth a pound of cure.

APPENDIX A

TEACHER RATING SCALE OF SCHOOL ADJUSTMENT

The Teacher Rating Scale of School Adjustment (TRSSA)

COOPERATIVE PARTICIPATION

1. Follows a teacher's direction.
3. Uses classroom materials responsibly
5. Listens carefully to teacher's instructions and directions
7. Is easy for teacher to manage
9. Responds promptly to teacher's requests
23. Accepts teacher's authority
32. Accepts responsibility for a given task

INDEPENDENT PARTICIPATION

24. Seeks challenges.
34. Self-directed child
40. Works independently
44. Needs a lot of help and guidance (reversed)

SCHOOL LIKING: Items: 4, 6, 12, 26, 41
SCHOOL AVOIDANCE: Items: 2,10,17,31,43
COMFORT WITH TEACHER: Items: 19, 35, 42, 45, 48

Child's name or ID______________________________ Date______________

Rated by (teacher) ______________________________ School______________

Teacher Rating Scale of School Adjustment

Please consider the descriptions contained in each of the following items below and rate the extent to which each of these descriptions applies to the child. For example, Circle 2-"Certainly applies" if the child often displays the behavior described in the statement, circle 1—"Applies sometimes" if the child occasionally displays the behavior, and circle 0—"Doesn't apply" if the child seldom displays the behavior. Please circle only one response per item.

0 = Doesn't apply   1 = Applies sometimes   2 = Certainly applies

0 1 2 1. Follows teacher's directions.	0 1 2 16. Complains about school.
0 1 2 2. Makes up reasons to go home from school.	0 1 2 17. Feigns illness at school.
0 1 2 3. Uses classroom materials responsibly.	0 1 2 18. Approaches new activities with enthusiasm.
0 1 2 4. Likes to come to school.	0 1 2 19. Is slow to warm up to teacher.
0 1 2 5. Listens carefully to teacher's instructions and directions.	0 1 2 20. Easily makes transition from one activity to another.
0 1 2 6. Dislikes school.	0 1 2 21. Clings to teacher.
0 1 2 7. Is easy for teacher to manage.	0 1 2 22. Notices when other kids are absent.
0 1 2 8. Is interested in classroom activities.	0 1 2 23. Accepts teacher's authority.
0 1 2 9. Responds promptly to teacher's requests.	0 1 2 24. Seeks challenges.
0 1 2 10. Asks to see school nurse.	0 1 2 25.Aware of classroom rules.
0 1 2 11. Has discipline problems.	0 1 2 26. Likes being in school.
0 1 2 12. Has fun at school.	0 1 2 27. Helps others without needing teacher recognition
0 1 2 13. Tends to play in the same activity center.	0 1 2 28. If child's activity is interrupted, he/she goes back to the activity.
0 1 2 14. Participates willingly in classroom activities.	0 1 2 29. Needs lots of structure.
0 1 2 15. Is cheerful at school.	0 1 2 30. Seems unhappy at school.

0 = Doesn't apply 1 = Applies sometimes 2 = Certainly applies

0 1 2 31. Asks to leave the classroom.	0 1 2 42. Enjoys "playing school;" imitates teacher.
0 1 2 32. Accepts responsibility for a given task.	0 1 2 43. Asks how long it is until it is time to go home.
0 1 2 33. Laughs or smiles easily.	0 1 2 44. Needs lots of help and guidance.
0 1 2 34. Is a self-directed child.	0 1 2 45. Interested in teacher as a person.
0 1 2 35. Is comfortable approaching teacher.	0 1 2 46. Is a confident child.
0 1 2 36. Seems bored in school.	0 1 2 47. Can't find things to do during free choice time.
0 1 2 37. Seeks constant reassurance.	0 1 2 48. Initiates conversations with teacher.
0 1 2 38. Is a mature child.	0 1 2 49. "Tuned in" to what's going on in the classroom.
0 1 2 39. After an absence of many days or a holiday, it takes time for this child to readjust to school routines.	0 1 2 50. Groans or complains about suggested activities.
0 1 2 40. Works independently.	0 1 2 51. Needs constant supervision.
0 1 2 41. Enjoys most classroom activities.	0 1 2 52. Flexible; adjusts easily to change in routine.

APPENDIX B

CAREGIVER INFORMATION FORM

Caregiver Information

Please Print

Child's name: ______________________________

Your name: ______________________________

Relation to child: ______________________________

Marital status: Married Single Divorced

Occupation: ______________________________

Age: ______________ Gender: Male Female

Level of Education: Less than a high school degree ☐
High School Degree ☐
Some college, no degree ☐
2 year degree (AA, AS) ☐
4 year degree (BA, BS) ☐
Graduate level degree (MA, MS, PhD) ☐

Ethnicity: ______________________________

Child Ethnicity: ______________________________

Language spoken at home: ______________________________

Household Income (total combined income):
Less than 12,000 ☐
12,000-24,000 ☐
24,000-36,000 ☐
36,000-48,000 ☐
48,000-60,000 ☐
60,000-72,000 ☐
72,000-84,000 ☐
More than 84,000 ☐

APPENDIX C

SCREENING FORM

Please Print

Child's Name: ______________________________

Mother's Name: ______________________________

Father's Name: ______________________________

Has your child ever attended a center-based preschool (for example, Kindercare) - Yes No

If so, for how long? ________ At what ages? ________

Contact phone numbers: 1.______________________________

2.______________________________

Please mark all that apply to your child

☐ Born Premature - Weight at birth: ______________

☐ Has a handicap of the arm, hand, or finger(s)-please explain

____

☐ Has an Individualized Education Plan (IEP)

Has been diagnosed with:

☐ Hearing deficit -

Corrected: Yes No

☐ Vision deficit -

Corrected: Yes No

☐ Any form of autism, Aspergers, or pervasive developmental disorder

☐ Mental Retardation

☐ Chronic medical condition -

Please specify ______________

☐ Traumatic Brain Injury

☐ Developmentally Delayed

☐ Cerebral Palsy

☐ Down's Syndrome

☐ Behavior or conduct disorder/Attention Deficit Hyperactive Disorder (ADHD)

APPENDIX D

PRE-ACADEMIC READINESS SCREENING

Pre-Academic Readiness Screening

The researcher will say to the child, "I have some fun activities for us to do together. Are you ready?" The researcher will wait for the child to indicate that they are ready. If he/she does not, the researcher will ask again, "Are you ready to start?" If the child still does not respond, the researcher will say, "Okay, we are going to get started. This is going to be fun!"

After each task the researcher will give positive feedback by saying phrases such as, "Good job!" or "That was a really good try. Keep it up!"

Reading Skills

1. Alphabet Familiarity:
   The child will be asked, "Can you say or sing your ABC's for me?" Wait time will be 10 seconds. If the child does not respond, the question will be asked one more time.
   - 0- Cannot sing or recite, sings or recites out of order, or can recite only 30% in order
   - 1- Can sing or recite 40-70% in order or can sing or recite 70-100% but with four or more errors
   - 2- Can sing or recite 70-100% with no more than 3 errors
   - 3- Can sing or recite 100% in order with no errors
2. Book Familiarity:
   A picture book will be laid on a table so that it is positioned upside down with the spine to the left in relation to the child. The child will be asked, "Can you show me how someone reads a book?" Wait time will be 10 seconds. If the child does not respond, the question will be asked one more time.
   - 0- Does not open or opens the wrong way (right to left)
   - 1- Opens correctly (left to right) but does not turn to make it right side up
   - 2- Opens correctly (left to right) and turns the book over to make it right side up but does not turn pages or starts to turn them from the back of the book
   - 3- Opens correctly (left to right), turns the book over to make it right side up, and turns the pages beginning from the front

Mathematics Skills

1. Counting:
   The child will be asked, "Can you count for me? Go as high as you can." Wait time will be 10 seconds. If the child does not respond the question will be asked one more time.
   - 0- Does not count at all or says numbers without any correct order
   - 1- Says one, counts to two, or counts to three in the correct order or counts over three with no more than one error in order (one error will be one number said out of place, 1,2,2,3 or 1,2,3,5,4,4,6 or if numbers are switched one time, 1,2,4,3 for example)
   - 2- Counts to 4, 5, 6, or 7 in the correct order or counts to 8, 9, or 10 with no more than one error in order
   - 3- Counts to 8, 9, or 10 in the correct order with no errors
2. One-to-one Correspondence:
   Seven blocks will be placed on a table approximately one foot in front of the child and the child will be asked, "Will you count these blocks out-loud for me please?" Wait time will be 10 seconds. If the child does not respond, the question will be asked one more time.
   - 0- Does not count at all, counts but does not touch or point to blocks, or points to or touches and counts to any number with more than one error (one error will be one number said out of place, 1,2,2,3 or 1,2,3,5,4,4,6 or if numbers are switched one time, 1,2,4,3 for example)
   - 1- Points to or touches and counts correctly 1 or 2 blocks with no errors in counting or points to or touches and counts correctly 3 or 4 blocks with no more than one error in counting (one error will be one number said out of place, 1,2,2,3 or 1,2,3,5,4,4,6 or if numbers are switched one time, 1,2,4,3 for example)
   - 2- Points to or touches and counts correctly 3 or 4 blocks with no errors in counting
   - 3- Points to or touches and counts correctly 5 or more blocks with no errors

Language Development

1. Speaking in Sentences:
   The child will be shown a large, color picture of a family eating watermelon on a beach and asked, "What is happening in this picture?" If the child does not respond within 20 seconds or his/her responses do not allow a score of 3, he/she will be asked, "What happens on your birthday?" If the child does not respond within 20 seconds or his/her responses do not allow a score of 3, he/she will be asked, "What do you think will happen on the first day of school?" Each child's score will be the highest level they achieved on the rubric.
   - 0- Does not speak or speaks in phrases that are not complete sentences and is off topic
   - 1- Speaks in phrases that are not complete sentences but on topic, speaks in complete sentences with 3 or more words without correct word order but on topic, or speaks in complete sentences of any length with correct word order but is not on topic
   - 2- Speaks in 3 to 4 word complete sentences with correct word order and is on topic
   - 3- Speaks in sentences of 5 or more words with correct word order and on topic
2. Speaks Understandably:
   Each child's score will be derived from the responses given to the questions detailed in the "Speaking in sentences" section above.
   - 0- Not understandable at any point
   - 1- Majority of what is said is not understandable even when repeated or understandable only with great effort (requiring the interviewer to ask the child to repeat)
   - 2- Majority of what is said is understandable without great effort
   - 3- All is understandable without great effort

General Knowledge and Pre-academic Cognitive Skills

1. Color Knowledge:
   A laminated paper containing 5 separate 4 inch by 4 inch blocks of color (blue, red, yellow, pink, and black) will be presented to the child. The child will be instructed to name the color as the researcher points to each one and told to say, "I don't know" if they do not know the name of a color. The researcher will point to each block and wait for a response from the child (10 seconds). If the child does not respond initially, the researcher will state the name of the color in order to clarify the task. The researcher will then continue to point to colors but will no longer provide names if the child does not respond. Once the first sheet is completed the researcher will place a second sheet with 5 new colors (green, purple, white, orange, and brown) and continue the assessment.
   - 0- Does not know any of the colors
   - 1- Knows 1, 2, or 3 out of ten colors
   - 2- Knows 4, 5, 6, or 7 out of ten colors
   - 3- Knows 8, 9, or 10 out of ten colors
2. Sorting:
   18 red and yellow attribute shapes of various shapes will be laid on the table. The child will be asked to sort the shapes by color. The researcher will demonstrate by placing 2 different shapes in each category correctly based on color.
   - 0- Does not do or is successful only with 7 or less objects
   - 1- Successfully places 8, 9, or 10 objects
   - 2- Successfully places 11, 12, or 13 objects
   - 3- Successfully places all 14 objects
3. More or Less:
   The child will be told, "I am going to show you some papers. One each paper there will be two pictures of different animals. I would like for you to point to the picture that shows the most animals. Let me show you what I mean." The researcher will place a paper containing a line drawing of 1 seal and 2 penguins separated by a vertical line. The researcher will point to the 2 penguins and say, "There are more penguins than there are seals so I am pointing to the penguins." The child will be asked, "Do you understand?" If the child indicates that he/she does

understand, the researcher will begin to show him/her the test pictures. If he/she responds that he/she does not understand, it will be demonstrated and explained one more time. Wait time will be 10 seconds for each picture. For all pictures shown, one group of animals will take up approximately as much space as the other group shown on the paper, regardless of number of animals and a vertical line will separate each group of animals. The first paper will contain 3 fish and 4 starfish. The second paper will contain 2 fish and 3 crab. The third paper will contain 1 shark and 2 squid.

0- Incorrectly answers all three times
1- Incorrectly answers two times
2- Incorrectly answers one time
3- Correctly answers all three

4. Imitation:

The child will be told, "I am going to do a couple of things and I would like for you to do exactly what I have done. For example, if I put both hands over my mouth, you would put both hands over your mouth." The researcher will demonstrate and ask the child to do it as well. When the child has done so, the researcher will say, "Okay, are you ready? Here we go." The researcher will then demonstrate the following actions: (a) clapping two times, (b) putting hands on opposite shoulders, and (c)putting both hands closed in fists out in front with elbows bent, opening one hand and while it is still open, opening the other. For each action wait time will be 15 seconds. If the child does not respond, the researcher will say, "Okay, let me show you again" and then will demonstrate the action one more time. If the child does not respond after 15 seconds, the researcher will proceed to the next action.

0- Unable to imitate any of the three movements correctly
1- Able to imitate only one of the movements correctly
2- Able to imitate only two of the movements correctly
3- Able to imitate all three movements correctly

5. Location:
The child will be shown a line drawing containing three fish in front of a large piece of coral, one positioned at the top, one in the middle, and one at the bottom of the coral. The child will be told, "I am going to point to one of the fish and I want you to tell me where it is on the page by saying top, middle, or bottom." The researcher will then point to bottom, then top, and then middle fish allowing a wait time of 10 seconds for each. If the child does not respond to the first pointing (to the fish at the bottom) within 10 seconds, the researcher will say, "bottom" and then point to the top fish and wait again for a response but will provide no other answers after that one.
   0- Does not point to the correct object in response to any of the three question or does not respond to the questions in any form
   1- Points to the correct object in response to only one question
   2- Points to the correct object in response to two questions
   3- Points to the correct object in response to all three questions
6. Following Directions:
The child will be told, "I am going to give you some directions and I would like for you to do what I say. For example, if I said, 'Clap your hands twice' you would clap your hands twice, like this." The researcher will demonstrate and then say, "Okay, are you ready? Here we go." The researcher will give the following directions: (a) put one hand on your head, (b) put the pencil in the box, and (c) put the picture under the paper. A wait time of 15 seconds will be given for each task and if the child does not respond the direction will be repeated. If the direction is repeated, a wait time will be given of 15 seconds and if the child does not respond, the researcher will continue on to the next direction.
   0- Does not follow any directions completely or correctly or does not respond to the directions at all
   1- Follows one directions completely and correctly
   2- Follows two directions completely and correctly
   3- Follows all three directions completely and correctly

7. Different and Same:

The child will be told, "I am going to show you some papers. One each paper there will be three pictures that look a lot alike but one will be different from the others. I would like for you to point to the picture that is different. Let me show you what I mean." The researcher will place a paper containing a line drawing of 3 identical fish in a row but with one wearing a hat. The researcher will point to the fish wearing the hat and say, "This fish is different from the others because he is wearing a hat and the others aren't, so I am pointing to it." The child will be asked, "Do you understand?" If the child indicates that he/she does understand, the researcher will begin to show him/her the test pictures. If he/she responds that he/she does not understand, it will be demonstrated and explained one more time before the test pictures are shown. Wait time will be 10 seconds for each picture. The first paper will contain 3 seahorses, one with three spots on its body. The second paper will contain 3 fish, two with a matching set of three stripes on its body and the same body shape and one with a slightly different body shape and only one stripe and a spot on its body. The third paper will contain three scalloped shells, one with several prominent spots on it.

- 0- Does not point to the correct object in response to any of the three questions or does not respond to the questions in any form
- 1- Points to the correct object in response to only one question
- 2- Points to the correct object in response to two questions
- 3- Points to the correct object in response to all three questions

APPENDIX E

CURRICULUM SCHEDULE AND DESCRIPTION OF ACTIVITIES

Day #		1	2	3	4	5
12:35-12:45 (10 min.)	Entry and Free Activity	Greeting	Dollhouse	Dollhouse	Stamps	Animal Figures
12:45-12:50 (5 min.)	Finger "warm-up"	Assessments	Five Fat Peas	Five Fat Peas Three Balls	Five Fat Peas Three Balls	Three Balls Open, Shut Them
12:50-1:05 (15 min.)	Model & Guided Practice	Group Assignments & Practice	1 A B C (T)	2 A B C (T)	3 A B C (T)	4 A B C (T)
1:05-1:20 (15 min.)	Exploratory	1A (E)-Game [1,2] B(T)-Playdough C	1A(P)-2B(E)-Game [3,4] C(T)	1A(P)-2B(P)-3C(E)	2A(P)-3B(P)-4C(E)	3A(P)-4B(P)-5C(E)
1:20-1:35 (15 min.)	& Practice Sessions	1C(E)-Game [1,2] A(T)-Playdough B	1C(P)-2A(E)-Game [3,4] B(T)	1C(P)-2A(P)-3B(E)	2C(P)-3A(P)-4B(E)	3C(P)-4A(P)-5B(E)
1:35-1:50 (15 min.)	Activities	1B(E)-Game [1,2] C(T)-Playdough A	1B(P)-2C(E)-Game [3,4] A(T)	1B(P)-2C(P)-3A(E)	2B(P)-3C(P)-4A(E)	3B(P)-4C(P)-5A(E)
Break 15 minutes		Playground Free Play	Playground Free Play	Playground Free Play	Playground Free Play	Playground Free Play
2:05-2:20 (15 min.)	Modeling of replication & Replication practice	Paint a birdhouse	Free Choice Games	Ping-pong balls/tongs relay races and marble races	1A(C)(T) – Stackers B – Game [1] C	1A(C)-2B(C)(T)-Stamps C
2:20-2:35 (15 min.)	Activities				1C(C)(T) – Stackers A – Game [1] B	1C(C)-2A(C)(T) – Stamps B
2:35-2:50 (15 min.)			Playdough		1B(C)(T) – Stackers C– Game [1] A	1B(C)-2C(C)(T) – Stamps A
2:50-3:05 (15 min.)	Replication practice	Make a Placemat	Sandbox play	Free Choice Games	Marble relay race	Stone races with clothespins
3:05-3:20 (15 min.)	Activities	Sandbox play			Bubbles	Sidewalk chalk
3:20-3:35 (15 min.)		Clean-up	Clean-up	Clean up	Clean-up	

Day #		6	7	8	9	10
12:35-12:45 (10 min.)	Entry and Free Activity	Cars and blocks	Kitchen	Stickers	Flome	Legos
12:45-12:50 (5 min.)	Finger "warm-up"	Open, Shut Them Fingers and Pillows	Open, Shut Them Fingers and Pillows	Fingers and Pillows Itsy Bitsy Spider	Fingers and Pillows Itsy Bitsy Spider	Itsy Bitsy Spider Follow the teacher
12:50-1:05 (15 min.)	Model & Guided Practice	5 A B C (T)	6 A B C (T)	7 A B C (T)	8 A B C (T)	Teach Tic-Tac-Toe
1:05-1:20 (15 min.)	Exploratory & Practice Sessions Activities	4A(P)-5B(P)-6C(E)	5A(P)-6B(P)-7C(E)	6A(P)-7B(P)-8C(E)	7A(P)-8B(P)-Game [3] C	8A(P)- Tic-Tac-Toe B – Free play games C
1:20-1:35 (15 min.)		4C(P)-5A(P)-6B(E)	5C(P)-6A(P)-7B(E)	6C(P)-7A(P)-8B(E)	7C(P)-8A(P)-Game [3] B	8C(P) – Tic-Tac-Toe A –Free play games B
1:35-1:50 (15 min.)		4B(P)-5C(P)-6A(E)	5B(P)-6C(P)-7A(E)	6B(P)-7C(P)-8A(E)	7B(P)-8C(P)-Game [3] A	8B(P) – Tic-Tac-Toe C –Free play games A
Break - 15 minutes		Playground Free Play	Playground Free Play	Playground Free Play	Playground Free Play	Playground Free Play
2:05-2:20 (15 min.)	Modeling of replication & Replication practice Activities	1A(C)-2B(C)-3C(C)(T)	2A(C)-3B(C)-4C(C)(T)	3A(C)-4B(C)-5C(C)(T)	4A(C)-5B(C)-6C(C)(T)	5A(C)-6B(C)-7C(C)(T)
2:20-2:35 (15 min.)		1C(C)-2A(C)-3B(C)(T)	2C(C)-3A(C)-4B(C)(T)	3C(C)-4A(C)-5B(C)(T)	4C(C)-5A(C)-6B(C)(T)	5C(C)-6A(C)-7B(C)(T)
2:35-2:50 (15 min.)		1B(C)-2C(C)-3A(C)(T)	2B(C)-3C(C)-4A(C)(T)	3B(C)-4C(C)-5A(C)(T)	4B(C)-5C(C)-6A(C)(T)	5B(C)-6C(C)-7A(C)(T)
2:50-3:05 (15 min.)	Replication practice Activities	Painting Clean-up	1A –Zoob B - C	2A – Lace Boards B – Whiteboard drawing C	3A - Magnets B – Free play games C	4A – Watercolors B – Stamps C
3:05-3:20 (15 min.)			1C –Zoob A - B	2C – Lace Boards A – Whiteboard drawing B	3C – Magnets A – Free play games B	4C – Watercolors A – Stamps B
3:20-3:35 (15 min.)			1B –Zoob C – A	2B – Lace Boards C – Whiteboard drawing A	3B – Magnets C – Free play games A	4B – Watercolors C – Stamps A

Day #		11	12	13	14	15
12:35-12:45 (10 min.)	Entry and Free Activity	Kitchen	Stickers	Glitter and Glue	Dollhouse	Free choice
12:45-12:50 (5 min.)	Finger "warm-up"	Five Fat Peas Follow the teacher	Three Balls Follow the teacher	Open, Shut Them Follow the teacher	Fingers and Pillow Itsy Bitsy Spider	Assessments
12:50-1:05 (15 min.)	Model & Guide- 5 Practice- 10	3-D stars	Peacock craft	Bumble bee craft	Mazes	
1:05-1:20 (15 min.)	Exploratory & Practice Sessions Activities	3-D stars Continued	Peacock craft Continued		Mardi-Gras mask	
1:20-1:35 (15 min.)						
1:35-1:50 (15 min.)		Free choice games	Free Choice Games	Introduce Mazes		Free choice games
Break 15 minutes		Playground Free Play	Playground Free Play	Playground Free Play	Playground Free Play	Playground Free Play
2:05-2:20 (15 min.)	Modeling of replication & Replication practice Activities	6A(C)-7B(C)-8C(C)(T)	7A(C)-8B(C)-Penny posting C	8A(C)- Game [4] B – Mazes C	Mardi-Gras mask	Assessments
2:20-2:35 (15 min.)		6C(C)-7A(C)-8B(C)(T)	7C(C)-8A(C)-Penny posting B	8C(C)- Game [4] A – Mazes B	Free Choice Games	
2:35-2:50 (15 min.)		6B(C)-7C(C)-8A(C)(T)	7B(C)-8C(C)-Penny posting A	8B(C)- Game [4] C- Mazes A		
2:50-3:05 (15 min.)	Replication practice Activities	5A – Stamp Strings B – Multi-media C	6A - Card B – Store C	7A – Game [5] B – Stackers C	8A – Snap Jewelry B – Kitchen C	
3:05-3:20 (15 min.)		5C – Stamp Strings A – Multi-media B	6C – Card A – Store B	7C – Game [5] A – Stackers B	8C – Snap Jewelry A – Kitchen B	
3:20-3:35 (15 min.)		5B – Stamp Strings C – Multi-media A	6B – Card C – Store A	7B – Game [5] C – Stackers A	8B – Snap Jewelry C – Kitchen A	Gather items

Note. Numbers not enclosed in brackets, represent specific centers. Numbers enclosed in brackets represent specific games. Capital letters not enclosed in parenthesis, indicate groups of children. Capital letters enclosed in parenthesis indicate type of center session. 1 = Build It. 2 = Connect It. 3 = Puzzle It. 4 = Move It. 5 = Lace It. 6 = Draw It. 7 = Color It. 8 = Cut It. A = First group of three children. B = Second group of three children. C = Third group of three children. (E) = Exploratory center session. (P) = Practice center session. (C) = Complex practice center session. (T) = Teacher instructional session. [1] = Don't Spill the Beans. [2] = Hi-Ho Cherry-O. [3] = Don't Break the Ice. [4] = Squiggly Worms. [5] = Go Diego Go, 123 Game.

Activity	Description	Materials
Playdough	Students will be presented with an array of different colored playdough. They will also have available to them, two playdough "machines", cookie cutters, mini rolling pins, straws cut to different lengths, toothpicks, blunt scissors, and blunt plastic knives	*Variety of Playdough *Playdough "machines" *Cookie cutters *Mini rolling pins *Straws cut to different lengths *Toothpicks *Blunt scissors *Blunt plastic knives
Paint a Birdhouse	Students use paintbrushes and paints to paint a birdhouse.	* Small wooden birdhouses * Painted brushes *Paints
Sandbox Play	Students will play in the sandbox with a variety of sand toys. Teacher will demonstrate how to pour sand, how the sand wheels work, and how to make shapes with molds with wet sand.	*Buckets *Sand molds *Variety of different sized cups *Variety of different sized spoons *Sand wheels *Trowels *Sand Sifter
Build a Placemat	Students will be presented with an array of colored paper to cut, stickers, glue, glitter, markers, and crayons. They will decorate a piece of index paper (color of their choosing). The teacher will laminate.	*Variety of colored paper *Variety of index paper *Variety of stickers *Crayons and markers *Glitter *Glue *Scissors
Free choice games	Students will choose games to play out of a selection of those that have been explained to them. Games include the following: (a) Don't Spill the Beans, where the players pick up and place plastic beans on a scale, trying not to tip it, (b) Hi Ho Cherry-O, where the players use a spinner to determine whether and how many cherries, apples, blueberries, or oranges they get to pick and put into their basket, (c) Don't Break the Ice, where the players use a small mallet tap out ice cubes trying to not let the ice skater fall, (d) Squiggly Worms, where the players match plastic colored worms to cards, and (e) Go Diego Go, 123 Game, a matching game.	*Don't Spill the Beans (Cooties Games) *Hi Ho Cherry-O (Hasbro, MB Games) *Don't Break the Ice (Cooties Games) *Squiggly Worms (Pressman) *Go Diego Go, 123 Game (Milton Bradley)
Dollhouse	Students play with a dollhouse furnished with dolls, furniture, etc. and Little Critters playground and figurines	*Dollhouse and accessories *Little Critters playground and figurines
Stamps	Students are provided with a variety of stamps, ink pads, and paper to experiment with.	*Variety of stamps, ink pads, and paper
Stackers	Students play with a stacking peg building set.	*Lauri Tall-Stacker Pegs Building Sets

Ping-Pong Ball/Tong Relay Race	Students are split into groups, three students in each group. Three large bowls of water are lined up next to each other in rows . A 4th empty bowl is placed at the end of each row. Students sit down behind a bowl each equipped with a pair of tongs. The first bowl of each row contains 15 ping-pong balls. On "GO" the first student uses the tongs to pick up a ping-pong ball and transfer it to his/her teammate next to him/her, who then does the same, etc. The student on the end of each row transfers the ping-pong balls to the empty bowl. The first team to transfer all 15 balls into the empty bowl wins.	*Water * Ping-pong balls * Large plastic bowls * Pairs of long, metal tongs
Marble relay race	Students are split into groups (four in each group). Students line up in their groups and the first child in each group is given a marble that they must hold between their thumb and pointer finger in a pincer grasp. This child then transfers the marble to the next child, etc. until the child on the end places the marble in a large plastic bowl. If a marble is dropped a new one is given to the first child and the relay starts over. Once a marble is successfully placed in the bowl, the first child is given a new marble. The first team to get 12 marbles into the bowl wins.	*Large plastic bowls *Marbles
Bubbles	Students will each have an individual small bottle of bubbles. Also available will be an assortment of bubble containers and wands.	*Individual small bottles of bubbles *An array of bubble containers and wands
Animal figure	Students will play with a variety of animal figurines	*Variety of animal figurines
Sidewalk Chalk	Students will draw on concrete with sidewalk chalk	*Sidewalk chalk
Cars and Blocks	Students will play with toy cars using blocks and a rug depicting a road scene.	*Toy cars *Blocks *Rug depicting a road scene
Clothespin stone races	Students will be given a small, shallow bowl containing 15 small, pebble sized stones, an empty bowl, and a wooden clothespin. On "GO" the students will race with a partner to transfer all stones to the empty bowl. No fingers may be used.	*Small, pebble-sized stones *Small shallow bowls *Wooden clothespins
Painting	Students will be given a piece of finger painting paper affixed to a piece of cardboard, several paintbrushes of varying size, sponges, a plate with blue, yellow, and red paint on it, several paper towels, and a cup of water. Students will paint.	*Paintbrushes of various sizes *Pieces of cardboard *Pieces of finger painting paper *Sponges cut into different shapes *Plastic plates *Blue, yellow, and red washable, tempura paint *Paper towels *Cups *Water
Kitchen	Students will play with a play kitchen and accessories.	*Play kitchen *Accessories such as silverware, plates, food, pots, etc.
Zoob	Students will play with Zoob pieces	*ZOOB building sets.

Stickers	Students will take off and apply stickers to paper.	*Variety of stickers and paper
Lace Boards	An assortment of lacing boards and laces will be available to the students who will choose how they would like to lace them.	*Lacing boards with laces
Whiteboard drawing	Students will use a black whiteboard marker and whiteboard to draw freely	*Whiteboards *Black whiteboard markers *Pieces of tissue to serve as erasers
Magnets	Students will use the side of filing cabinets and metal backing sheets to play with an assortment of magnets.	*Metal filing cabinets *Metal baking sheets *An assortment of magnets
Flome	Students will play with Flome.	*Flome
Watercolors	Students will be given watercolors, brush, and paper and allowed to paint as they wish	*Water *Sets of watercolors *Cups *Brushes *Pieces of paper *Easels or appropriate workspace
Legos	Students will build with Legos.	*Legos
Tic-Tac-Toe	Students will pair up and play games of Tic-Tac-Toe on whiteboards	*Whiteboards with the Tic-Tac-Toe pattern drawn on in permanent ink *Whiteboard markers *Tissues to serve as erasers
3-D stars	Students will color four striped stars and cut each out. The teacher will help them to tape them together and add a piece of yarn for hanging.	*3-D star templates *Markers and crayons *Tape *Hole punch *Yarn
Stamp Strings	Students will choose from an array of stamps and on a 3 inch by 6 inch strip of white construction paper with create a 'string' of stamps going straight across the strip. They will then exchange with a partner who will attempt to copy their stamp string.	*Stamps *Ink pads *Strips of 3 inch by 6 inch white construction paper
Multi-media	Students will create a picture on a large piece of construction paper from a variety of materials.	*Large construction paper *Variety of materials. For example, glitter, crayons, stickers, pom poms, corn kernels, cotton, etc. *Glue

Card	Students will fold white construction paper to create a card. They will decorate as they choose with markers, crayons, gluing cut paper, stickers, glitter and glue. The teacher will write any message the children wish in the card.	*White construction paper *Crayons and markers *Glitter *Glue *Stickers *Scrap pieces of construction paper *Scissors *Stickers *Permanent marker
Penny Posting	Students will practice putting pennies into one inch slits on the tops of plastic lids on instant coffe cans. Students will then practice picking up three pennies and holding them in their palm, rotating out one penny at a time into a pinch with their thumb and index finger and putting it through the slot. At the end, the students will have one minute to place as many pennies as they can using the "three penny in the palm" method. Students will be able to keep all the pennies they were able to get in the can during this period.	*Instant coffee cans with one inch slots cut into the plastic lids *Pennies
Peacock craft	Students will color a peacock template and white paper plate according to instructions. They will use paint thumb prints to further complete the "feathers" on the paper plate and glue on the template pieces	*Glue *Peacock template available at *Peacock craft instructions available at *White paper plates *Blue and green crayons and markers *Blue and green washable tempura paint
Mazes	Students will use a pencil to find their way through various mazes given to them as a packet	*Packets of maze worksheets copied from "My First Mazes"
Glitter and Glue	Students will create a picture using glitter and glue.	*Paper *Glitter of varying colors *Glue
Bumble Bee	Students will make a bumble bee craft out of a paper plate, paint, googly eyes, and wax paper. The paper plate is painted yellow with black strips, the eyes are glued on, and wax paper cut out in the shape of wings are glued to the back.	*Thick paper plates *Yellow and black tempura paint *Thick paint brushes *Googly eyes *Wax paper *Scissors
Store	Students will play store with cash registers, play money, pretend food and grocery carts	*Two grocery carts *Variety of pretend foods *Two cash registers *Play money

Mardi Gras Masks	Students will color and cut out a Mardi Gras Mask template. After cutting out, they will glue on rhinestones, beads, and feathers and attach a wooden dowel with tape to the backside, edge of the mask.	*Mardi Gras Mask template copied onto white index paper *Glue *Rhinestones *Very light beads that will easily stick to paper *Feathers *Wooden dowels *Scotch tape
Snap Jewelry	Students will assemble and disassemble jewelry using snap beads and jewelry pieces	*Snap Jewelry set
Kitchen	Students will play kitchen with a free standing plastic "kitchen" and a tabletop wooden stove. They will have access to utensils, pots, pans, aprons, oven mitts, pretend food, bowls, cups and plates	*Free standing kitchen *Tabletop wooden stove *Utensils *Bowls, cups, and plates *Variety of pretend foods *Pots and pans *Aprons and oven mitts

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