

St. Cloud State University
theRepository at St. Cloud State

Culminating Projects in Special Education

Department of Special Education

5-2016

Participation In A Movement Program and Its Impact on Pre-Academics: Pre-Literacy

Julie Hoppe

St. Cloud State University, mrjahoppe@gmail.com

Follow this and additional works at: https://repository.stcloudstate.edu/sped_etds

Recommended Citation

Hoppe, Julie, "Participation In A Movement Program and Its Impact on Pre-Academics: Pre-Literacy" (2016). *Culminating Projects in Special Education*. 24.

https://repository.stcloudstate.edu/sped_etds/24

This Thesis is brought to you for free and open access by the Department of Special Education at theRepository at St. Cloud State. It has been accepted for inclusion in Culminating Projects in Special Education by an authorized administrator of theRepository at St. Cloud State. For more information, please contact rswexelbaum@stcloudstate.edu.

**PARTICIPATION IN A MOVEMENT PROGRAM AND ITS IMPACT ON PRE-ACADEMIC SKILLS:
PRE-LITERACY**

by

Julie A. Hoppe

A Thesis

Submitted to the Graduate Faculty of

St. Cloud State University

In Fulfillment of the Requirements

for the Degree

Master of Science in

Child and Family Studies:

Early Childhood Special Education

May 2016

Thesis Committee:

JoAnn Johnson, Chairperson

Ming-Chi Own

Carol Conkell

Abstract

The purpose of this study was to identify the impact participation in a movement program has on prekindergarten-aged (4-5-year-old) children's pre-literacy skills.

Twelve children, prekindergarten age, 1 year before kindergarten eligibility, enrolled in a school readiness program, participated in the study for six weeks. The 12 children were divided into two groups, a treatment group that participated in the daily movement program and a control group that did not participate in the movement program but engaged in free choice activities in the classroom. The treatment group participated in the movement activities in a room separate from the classroom. This room designated as the S.M.A.R.T. room is where all the children enrolled in the early childhood program participated in the S.M.A.R.T. activities. Pre-literacy skills for all children in the preschool program were measured in the fall and in the spring in line with the program's progress reporting schedule using Individual Growth and Development Indicators-Early Literacy® (IGDI's-EL) Literacy (picture naming, rhyming, and alliteration). The movement program used was Stimulating Maturation Through Accelerated Readiness Training (S.M.A.R.T.) Early Childhood. The program, developed by A Chance to Grow, includes activities for training children in eye/hand coordination, mental focus, gross and fine motor skills, sequencing, left/right awareness, and spatial relations. Pre-literacy skill scores were compared between the two groups to determine if children who regularly participated in a structured movement program obtained higher scores than children who did not.

Results for this sample indicate there was not a positive correlation of an increase in literacy scores for either group that participated in this study.

Acknowledgment

Writing a thesis has been a process for me. Working full-time, synchronizing university deadlines with the availability of study subjects, along with academic school calendar made this a mission of project management. To complicate matters, in the middle of writing my family and I moved away from the area, making this process arduous and at times frustrating. I have learned the value of patience and the understanding that “all things happen in due time” (Ecclesiastes 3:1).

With that said, I appreciate the assistance of the Sartell Early Childhood Program for granting me permission to use the children enrolled in the school readiness program for the study. I thank Brittney Soldner for following through with requirements needed to conduct the study with the children in her classroom with fidelity.

I want to extend gratitude to my committee chair, JoAnn Johnson, for her consistent and steady support throughout the past few years guiding me through this process. Writing a thesis was very intimidating for me and she was always positive and gave me the feeling that I could do it, and was available when needed.

To my family for putting up with, “don’t touch my study stuff,” allowing me to work through this process without complaint or negativity.

Table of Contents

	Page
List of Tables	6
Chapter	
1. Introduction	7
Purpose.....	7
Background.....	7
2. Review of Literature	17
Overview of Brain Development.....	17
Motor Impact on Development	20
Perceptual Motor and Its Impact and Development	23
Motor and Cognitive Development.....	26
Attitudes toward Organized Motor Activities	33
Other Factors Impacting Development.....	36
Motor and Literacy	40
3. Method	46
Participants.....	46
Measures: Individual Growth and Development Indicators-Early Literacy® (IGDI's-EL)®	47
Movement Program: S.M.A.R.T.-E.C. Curriculum (Stimulating Maturity Through Accelerated Readiness Training-Early Childhood)	49
Curriculum	51
Limitations of the Study	52

Chapter	Page
4. Results	54
Analysis of Data	54
Summary	59
5. Discussion	60
Introduction.....	60
Conclusion	65
References	67
Appendices	
A. Learning Triangle	75
B. Parent Consent and Motor Program Information Sheet	76
C. Administration Program Permission	80
D. Institutional Review board Permission—St. Cloud State University	81
E. Mountain of Motor Development.....	83
F. Sample of S.M.A.R.T. Activities.....	84
G. Sample of IGDI’s Stimulation Flash Cards.....	85

List of Tables

Table	Page
1. Paired Samples Test Treatment Group.....	54
2. Paired Samples Test Control Group.....	55
3. Group Statistics.....	56

Chapter 1: Introduction

Purpose

The purpose of this study was to demonstrate the impact participation in a motor movement program may have on academic achievement, particularly, pre-literacy skills. Most studies conducted around the topic of the correlation between the motor and cognitive skills has been conducted around children at risk for developmental delays, either living in low socio-economic status with very few opportunities, or children already identified with learning delays. What I wanted to determine is will participation in a motor program have the same positive results for a class of children considered to be within the average range of development living in a middle-class community. The intent of the study was to find evidence a motor movement program would have a positive impact on academic gains, specifically pre-literacy skills. Pre-literacy skills can be defined as the development of oral language, alphabet knowledge, print awareness, phonological awareness and emergent writing skills (Canto, 2014). If these gains are demonstrated, recommendation for continued use of the motor program as part of the early childhood curriculum would be logical.

Background

Education policy-makers continually look for ways to ensure children receive adequate education to help them be successful into adulthood. Initiatives created by education policy-makers require schools to be accountable for student success by setting standards meant to guide the education process. Educational policy and lawmakers have implemented programs such as the No Child Left Behind Act (Nodding, 2005), and added the Race to the Top Act (US

Department of Health and Human Services Programs and Initiatives, 2009) promoting the development of high school graduation standards to assist schools in preparing children for college and careers beyond high school. These federal initiatives place responsibility on local education agencies and school districts to develop and implement procedures and policies to meet federal standards for educating children and to demonstrate students are meeting the standards required for graduation. Pressure is placed upon school districts to satisfy federal education requirements that show students are progressing using standardized test scores or risk losing federal and state education funding dollars. As part of graduation standards, schools are not only examining whether children are making adequate yearly progress but whether children are entering kindergarten ready to learn.

Children's readiness skills at school entry are highly correlated with later academic skills, suggesting children need to prepare for school in the early years. Literature spotlighting children's learning and development demonstrates exposure to quality, developmentally appropriate, preschool and K-12 programs, prepare children for school success. A movement toward creating early learning guidelines and education standards grew from the No Child Left Behind (NCLB) initiative to make schools accountable for what children learn and how they learn it. Head Start has developed the Head Start outcomes framework focusing on math and literacy to address compliance to early learning standards and ensure continued federal funding (National Association for the Education of Young Children (NAEYC) and the National Association of Early Childhood Specialists in State Departments of Education, 2002). The White House (2002) required all state and local education associations to develop voluntary Early Learning

Guidelines for preschoolers in order to demonstrate compliance and alignment with the learning standards. Head Start reauthorized “The School Readiness Act” to continue efforts to create learning standards using the School Readiness Indicators Initiative (Snow, 2006). The Early Learning Standards are required to be vertically aligned throughout early childhood into K-12 standards, included assessments and curriculum (Gebhard, 2010, p. 2).

Many school districts have adopted an E-12 (early childhood [birth]--12th grade) scope to define whom they educate including early childhood programs as part of their graduation standards framework. This is a change from past practice when schools only considered K-12 curriculum, excluding early childhood as a part of their educational system. This allows early childhood programs to be considered part of a school district’s educational programming. The first few years are critical years for laying the foundation of later outcomes and to have the K-12 system recognize this is a win for children and the communities in which they live. Data collected by the Federal Government used to create the report, “Starting Out Right: Pre-K and Kindergarten” (Hull, 2012), challenges school districts to invest education dollars in preschool programming. The study reported that children who attended preschool and half-day kindergarten fared better on reading tests in third grade than children attending all-day kindergarten alone (Gewertz, 2011). Developing early learning standards within the E-12 format, including high quality early childhood education, can help promote school readiness and build a foundation for later academic and social competence. As a result, educational governing bodies are asking E-12 teachers and administrators to focus on curriculum development and student testing that will demonstrate alignment to the standards at all levels

of education, Early Childhood through grade 12. This push for academic accountability can be observed at all levels of education, including early childhood, making academic topics such as math and reading a primary focus of school readiness and early childhood programming. School districts are examining how to prepare children for kindergarten entrance. While public policy is mandating E-12 learning standards be aligned between grade levels, it is difficult to align early learning indicators of progress to kindergarten entrance expectations.

The Minnesota Department of Education (2005) outlined school readiness as skills that fall within the five developmental domains (cognitive, communication, motor, social-emotional, and adaptive) and the subcategories within these domains: social-emotional development, approach to learning, language and literacy development, creativity, the arts, cognition and general knowledge, physical well-being and motor development. The Work Sampling System-4th Ed. (WSS®) (Meisels, Marsden, Jablon, Dorfman, & Dichtelmiller, 2014) is an example of an assessment system developed for monitoring and reporting student progress (Minnesota Department of Education, 2007) and addresses the domains considered to be the foundations of the early childhood curriculum. Academic benchmarks are embedded within the developmental domains of the assessment tool which does not maintain a narrow focus on academic proficiency as indicators of learning readiness.

Early childhood pedagogy is grounded in the theory children learn skills through the exploration of the environment, learning broad concepts and skills that are embedded within developmental categories or domains (Bredecamp & Copple, 1997). These skills are interconnected; skills in each domain influence the development of the other skills. Often, K-12

standards focus on the academic subject matter rather than keeping the whole child in mind and putting children in jeopardy by giving developmental skills less attention (NAEYC, 2002). In regard to NCLB, cognitive development is limited to language, pre-literacy, and pre-math skills ignoring other developmental skills such as motor, self-help and social-emotional development, and their impact on cognitive development. Snow (2012) reviewed a study published in Pediatrics reporting early childhood programs feel pressured to focus on academic content areas reducing attention to developmental skills. The school readiness study conducted in Minnesota found children are arriving at kindergarten with more academic skills and not enough positive behavior skills (Minnesota Department of Education, 2005). With federal policies emphasizing this narrow focus on learning standards and recent attention in regard to kindergarten readiness, it is easy for school districts to focus on these benchmarks rather than the development of the whole child, especially when funding is attached to high academic achievement scores (Zigler & Bishop-Josef, 2006).

As a result of evolving education policy, early childhood programs are examining current practice and are encouraged to work closely with kindergarten and elementary staff to ensure seamless programming between grade levels. Alignment between early childhood and kindergarten standards is important, but they also need to retain programming that is already proven to be effective for student growth and success. School readiness programs need to continue to focus on children's development and not be side-tracked by academic testing in order to prove adequate yearly progress to receive education dollars. When content areas, for example, literacy and math, are used as the primary indicators of kindergarten readiness, other

developmental skills such as motor, self-help and social emotional development are overlooked, making alignment between kindergarten expectations and early childhood indicators of progress uneven. Development of the whole child, having adequate skills across all developmental domains, is important for school success (Bredecamp & Copple, 1997). High quality early childhood education programs promote intellectual, language, physical, social, and emotional development, contributing to building a foundation for future academic and social competence (NAEYC, 2002). The early years are critical years for laying a strong foundation for development. Studies in early brain development indicate best practice uses a balanced approach addressing emotional, social, cognitive, and language development when preparing children for success in school and life (National Symposium on Early Childhood Science and Policy, n.d.). Quality preschool experiences impact academic performance of children. The Head Start Fade Out study (Barnett; 2002; Guernsey, 2009) demonstrated children living in low economic environments were able to make academic gains and continued to demonstrate strong academic skills through third grade when exposed to quality care and education. Getting things right, the first time is more effective than trying to remediate skills later.

Children attending early childhood education programs benefit from studying broader concepts within academic content areas, using play-based strategies to address concepts, instead of teacher directed format of rehearsing academic concepts (Hirsh-Pasek, Berk, Golinkoff Michnick, & Singer, 2010). Currently, standards for early learning are simplified versions of the K-12 standards, with a narrow focus on the acquisition of academic skills, neglecting the developmental skills that address the whole child. This narrow focus does not

meet the developmental needs of young children as they begin their academic journey. Early learning standards should be built forward instead of pushing K-12 expectations down upon our youngest learners (NAEYC, 2002). Early learning standards need to be connected to ages and developmental stages. Preschool-aged children have a wide range of skill ability; development unfolds at different rates for each child over the years. Yearly age or grade level expectations can lead schools toward ignoring the variability of young children's development, imposing unfair demands on many children (NAEYC, 2002).

Educational stakeholders need to understand that play is the way children learn and that learning takes place within the context of play (Snow, 2011a). Increased focus on academics and achievement on standardized testing is pushing free play out of the early childhood classroom in favor of using direct instruction of academic concepts as a way to meet federal and state expectations (Snow, 2011b). As far back as the 1980s, schools began cutting back on recess and other allied arts (physical education, art, and music) to allow for more instructional time (Jarrett & Waite-Stupiansky, 2009, p. 66). The growing emphasis on learning standards, assessment, and accountability has led to a reduction of active physical play in many schools and centers. Preschool and kindergarten classrooms have become adult-directed with children engaged in passive learning as teachers have increased literacy and numeracy instruction while providing less unstructured free play as a learning platform. Playful learning, not drill and practice, engages children in the learning process in ways that influence their development in positive ways, and promotes a hunger for life-long learning (Hirsh-Pasek et al., 2010). These findings suggest schools are not teaching to the whole child but are reinforcing a

limited set of academic skills to prepare children for achieving high test scores, not life-long practical skills.

School districts are asked to demonstrate student progress and accountability, keeping a narrow focus on high scores on standardized tests. This focus is pushing schools to develop curricula focused on preparation for assessment of academic skills over using the evidence-based pedagogy of teaching broad concepts within the context of children's play. Time and resources need to be allocated to keep physical play as part of early learning curricula in order to address child development and support student success (Nodding, 2005).

Definition of Terms

Academic Skills. Skills needed to be successful in school specifically reading, writing, and math skills.

Assessment. Ongoing procedures to identify a child's unique strengths and needs.

Autonomic Behaviors. Human behavior that is controlled by instinct, fight, or flight response.

Basal Ganglia. Region of the human brain that controls instructions from the motor cortex in directing voluntary muscle movement.

Cerebellum. Region of the human brain that coordinates voluntary muscle movement.

Corpus Callosum. Band of fibers in the human brain that join the two brain hemispheres.

Cortisol. The chemical released in the human brain when humans are exposed to stressful events.

Developmental Skills. Skills related to the developmental domains: cognitive, motor, communication, social-emotional, and adaptive.

Early Childhood Education. Educational program developed for children ages birth–5 years old, before kindergarten entrance.

Executive Function. Humans' ability to use higher order cognitive skills.

Haptic Senses. Ability to sense tactile stimulation: touch, temperature, mass.

Kinematic. The brain's understanding and awareness of the body in space and the body's movement.

Language Arts. Academic subjects (such as reading, spelling, and writing) that relate to using language.

Literacy. The ability to understanding and use language.

Locomotor. Use of the large muscles to move the body in and around environments.

Neural Growth. The growth of brain cells through stimulation.

Numeracy. The understanding of numbers and number concepts.

Pedagogy. The science and practice of teaching children.

Perceptual motor. Perception, using the senses, to interpret what is happening in the environment to make movement choices.

Prehension. Hand and eye coordination to see and obtain objects.

Preschool. An educational program designed for children ages 3-5 years of age before kindergarten eligibility.

Reflexive Development. Inborn, involuntary patterns of movement that appear in infancy and disappear as mature motor skills emerge.

School Readiness. A program designed to prepare children for elementary school education, when a child is deemed to have skills to be successful in kindergarten, they are ready for school.

Self-regulated. The ability to calm self and stay calm when presented with a difficult situation.

Sensorimotor. A combination of the functions of the sensory system (sight, hearing, touch, balance) and motor activities.

Standardized Test. A test designed with standard materials, administration procedures, scoring procedures and score interpretation that have been compared across a large test sample of same-aged peers.

Synapse. The place where a signal passes from one nerve cell to another nerve cell in the brain.

Chapter 2: Review of Literature

Overview of Brain Development

Brain development begins before birth and continues through adulthood. Human brains begin with blueprints for learning, physical growth, and development. Early experiences impact brain development, either with positive or negative results, depending on the type of exposure the developing system receives. It is the interaction between the environment and the genes that influences cognitive and physical development. Early experiences lay the foundation for a lifetime of learning, along with behavioral, physical, and mental health. Acquiring building blocks for learning and development is the most important and challenging task during the early years. Research in brain development has been able to clarify the interaction between genetics and physical factors (Shonkoff & Phillips, 2000; Brofenbrenner, 1979). This development is impacted by early experiences and genetics and how a baby reacts to these factors. Babies engage in their environment through relationships and play. It is the interaction of all these elements that shape the architecture of the brain. Renowned psychologist Stuart Brown (Trawick-Smith, 2010, p. 4) noted that the human brain is “wired for play at birth.” Active play is required for brain health; play is essential for developing the area of the brain that controls regulation of behavior and emotions. Brown noted that rats deprived of play were more aggressive and anti-social than rats who were given play and socialization opportunities (Trawick-Smith, 2010). Physical activity is more than just play (Snow, 2011b). Leitschuh (2013), of the University of Minnesota, stated “Movement is developmentally essential for laying a

strong foundation for brain development and this movement stimulates learning of motor skills, cognitive skills, and social-emotional skills”, (“Critical Learning through Movement”).

A strong foundation in the early years increases the probability of positive developmental outcomes and a weak foundation increases the odds of later difficulties. Genes determine when brain circuits are formed and individual experiences shape how the development unfolds. Appropriate sensory input and exposure to motor movement assists in building healthy brain structure. Foundational skills are needed to create the basic wiring of the brain; without this, the brain will develop adaptively and have difficulty assisting the system in developing higher level skills. Circuitry not used is trimmed away in a pruning process the brain uses to conserve energy. Trying to rehabilitate the brain when it has been wired improperly can be difficult requiring time and energy to compensate for faulty circuitry. Lamont (n.d.), Developmental Movement Consultants, also known as the “Brain Nanny,” takes children through missed motor developmental stages to correct flaws in their perceptual processes enhancing intellectual, academic, and physical functioning.

Evidence indicates there are sensitive periods when the brain is more plastic and responsive to stimulation. Appropriate learning activities presented during sensitive periods supports optimum brain growth. The young brain is highly receptive to the presence or absence of essential experiences and the result may be a positive trajectory for development or permanent risk of dysfunction (Shonkoff & Phillips, 2000, p. 195). Developmentally appropriate activities are necessary to build foundational skills for future learning and brain development. Such is the theory behind Brain Gym® (2011), a motor program grounded in the theory that

movement activates the brain and promotes neurological repatterning, facilitating the development of whole brain learning. The program is based on research theories of neurological repatterning and perceptual-motor training (Brain Gym®2011) that demonstrates learning problems manifest when the brain and body are not working in coordination, blocking an individual's ability to learn. Fortunately, the brain is elastic and can learn when appropriate stimulation is available. Neuroimaging has demonstrated there are periods of great neural growth that are associated with windows of opportunity (Gabbard & Rodrigues, 2007). This theory is supported by the blind kitten study (as referenced in Waters, Klintsova, & Foster, 1997). Kittens were deprived the use of their eyes during the time the brain develops synapsis for sight. Because these neurons were not stimulated by visual stimuli, the brain was not able to make synaptic connections to develop the sense of sight. Other studies support the importance of early stimulation such as the phenomenon of orphans living in deprived environments. Lack of play opportunities, limited verbal interactions, and non-nurturing relationships negatively impacted the children's development (Clarke-Stewart, Vandell, Burchinal, O'Brien, & McCartney, 2002; Gunnar, 2001; Nelson, 2014). A study using rats demonstrated that stimulating environments and positive relationships proved to substantially impact development in a positive trajectory (Provence & Lipton, 1962). When rats were given a stimulating environment and other rats to socialize with, the rats had higher cognitive abilities than rats that were placed in non-stimulating environments and left alone. Animals placed in enriched settings with stimulating activities, including motor movement, have larger brains than animals not exposed to such environments (Gabbard & Rodrigues, 2007).

Motor Impact on Development

Children learn by doing and in the early years movement is developmentally essential for brain development. There is an order to human growth and a pattern of learning we can observe. There are concrete developmental milestones and developmental checklists addressing motor development, but no motor skills curricula designed for typically developing children that can be used to teach children how to roll over, sit, crawl, or stand. There is value in recognizing that developmental steps and current brain research can help us understand these steps. “Research indicates children will not develop active, healthy habits without our help. So as we teach children how to use their minds, we must teach them how to use their bodies” (Staley & Portman, 2000, p. 70). Movement is a vital activity which impacts the brain’s ability to develop cognitive function. Movement that includes a wide variety of developmentally appropriate activities has the greatest impact on children in the early stages of development. Since children should achieve most of the mature patterns of fundamental motor skills by the age of 7 (Oden, 2006), it is practical to suggest that children should participate in organized motor activities to hone these skills. Quality instruction in learning basic motor movements can contribute to the achievement of mature motor patterns. Moreover, when children learn and master fundamental movement skills, they are able to enjoy movement, develop perceptual, cognitive, social, and psychological skills. As movement skills become refined, they can be beneficial in helping children grow in school and social success.

The hierarchy of development starts in the motor domain. Early childhood has been identified as a critical time for the development and mastery of motor skills, also known as the fundamental movement skills. Two critical motor skills are locomotor and object control. When a child's development is assessed at an early age, much about the child's overall development can be learned through assessing reflexive and perceptual skills. These skills are the foundation for future motor development and impact a child's ability to interact with the environment. Once reflexive and perceptual skills are gained a child begins object exploration and manipulation, requiring motor planning and haptic sensory skills. Soon, the child is gaining motor strength and coordination in order to explore the environment, gaining more control over what is experienced. A child's ability to interpret the environment is foundational to academic success (Oden, 2006). Environments that are safe and stimulating can assist the child in this process of learning through motor and sensory exploration which becomes automatic when repeated. Once these skills are mastered the child is ready to move on to more complex play experiences involving complex three-dimensional play. Through exploration of the environment, children begin to learn concepts about texture, weight, size, hot, cold, dark, light, fast, slow... all precursors to academic learning.

Early pioneers of child development theory stated motor activity impacts cognitive development. Isaacs (Ziglar, Singer & Bishop-Josef, 2004, p. 66) stated long that early childhood educators cherished the belief that play nourishes children's intellectual and social development. Piaget (Ziglar, Singer & Bishop-Josef, 2004, p. 7) argued that all knowledge comes from activity and children acquire knowledge by interacting with their environment

through exploration and play. Vygotsky (Ziglar, Bishop-Josef, 2006, p. 8) claimed play served as the primary context for cognitive development and adults serve as the facilitator as a scaffold for moving from mastered skills to the acquisition of new skills. The Gesell Institute called the floor the “the athletic field of the child,” where 50% of all a baby will need to know is learned. It is well-documented brain nerves and cells develop when the whole body is used and all the senses, motor and perceptual, are working together in an organized system called neurological organization (Oden, 2006). Most of this organization happens between birth and 8 years of age. Scientists now believe stimulation in the form of movement during the early years is necessary to achieve a mature brain, particularly between the ages of prenatal to age 5. This period of development is critical for laying the foundation of brain circuits that controls body movement which is the mechanism behind early learning. (Gabbard & Rodrigues, 2007).

Bushnell and Boudreau (1993) did a comprehensive overview of the role motor development has on developmental sequences and other developmental skills within the five developmental domains; cognitive, communication, social-emotional, and adaptive. They noted two primary subdomains of motor development, locomotor (gross motor) and visually guided reaching (fine and perceptual motor) skills. They referred to research published by Gesell in 1933 and Gesell and Thompson in 1934 describing a timetable of motor development in infants. Later, in 1935 and 1945, McGraw (Bushnell & Boudreau, 1993, p. 105) determined how the pattern of motor development impacts future development, highlighting a hierarchy of the development of motor skills. There was little said about motor development after those first investigations as research was focused on cognitive development with little regard to the

other developmental domains. It was noted by Bushnell and Bourdreau (1993, p. 1005) in the *Handbook of Infant Development* published in 1979 and revised in 1987, and the *Handbook of Child Psychology* published by Mussen in 1983, motor development was omitted from the text altogether. In the early 1990s, a resurgence of interest in motor development was noted at the International Conference on Infant Studies where submissions addressing aspects of motor development were presented (Bushnell & Bourdreau, 1993). What changed the focus of infant development research is unclear. Limited research had been made by Thelen (Bushnell & Bourdreau, 1993, p. 1012) throughout the 1980s and early 1990s focusing on the hierarchy of motor development; specifically, the emergence and extinction of the stepping motion in infants (kinematic analysis). Her work resulted in finding that newborns have an innate desire to become mobile. She observed infants making a stepping pattern replicating the bilateral movement needed for walking. She also noted that other species learn to move at earlier stages than humans. This development is different for humans as compared to animals; animals need to move to survive, humans move to interact with the environment and people in the environment (Bushnell & Bourdreau, 1993, p.1007).

Perceptual Motor and Its Impact and Development

Physical actions help to develop the brain's ability to accurately interpret information received through several different senses simultaneously (Oden, 2006). Stimulation through play opportunities enables the brain to develop the ability to coordinate different regions of the brain responsible for sensory-based learning. Sensory-based learning is important for future

school success. Children learn to distinguish auditory, visual, and tactile stimuli and know how to react to them. They learn to complete tasks such as following directions using auditory and visual input. Engaging children in multi-sensory motor play helps to develop these skills and is particularly important for children experiencing sensory processing disorders (Lamont, n.d.).

Motor development begins with reflexive functions during infancy and gradually develops toward skillful movements as children age (Connell & McCarthy, 2013). Understanding the basic reflexive patterns of infants and when these reflexes should disappear is important. Toddlers not able to grow out of reflexive patterns have difficulty gaining new movement skills. Asymmetrical tonic neck reflex, also known as the fencer position, is the foundation for learning to roll over. When a baby looks towards his outstretched arm while on his tummy, the pushing of the arm and the turning of the head, will allow gravity to pull the baby over on his back. It is the foundation for hand eye coordination, to look at and reach out at the same time or prehension. Once this reflex is fully integrated into the infant's repertoire of movement, he can lie on his tummy, and look toward objects and sound without rolling over; both arms are strong enough to support his head while looking in a variety of directions. If this reflex is not fully integrated before entering school, it will be difficult for the child to coordinate his hand and eye to complete simple tasks. Symmetrical tonic neck reflex, prone extension, and supine flexion are also infant reflexes that if not fully integrated into the child's system can impact future school performance. Children continue to grow and learn, but if they are building their learning on faulty developmental patterns this can cause future learning difficulties (Lamont, n.d.).

Ziglar, Singer, and Bishop-Josef's (2004) review of literature in, Children's Play: The Roots of

Reading summarized several studies that support the benefits of play on children's cognitive, social, and physical development making a case for the importance of keeping structured motor activities as part of the daily curriculum and the positive impact play has on overall development of children. In 2006, Deli, Bakle, and Zachopoulou conducted a study aimed to identify the effects of two 10-week intervention programs focused on fundamental locomotor skills for children in kindergarten. Seventy-five children participated; one group followed an adult led movement program, one group followed a music and movement program, led by an adult, and the last group engaged in free play. Results indicated the two groups participating in movement activities had significant improvement in motor skills as compared to the free play group. A position paper presented by Blaydes (2001) stated that physical activity helps to enhance mental focus and concentration in young children. When children are engaged in physical activity, the brain is able to receive more oxygen improving brain function. Exercise improves the function of the basal ganglia, cerebellum, and corpus callosum and promotes brain regeneration and growth. Aerobic fitness aids cognition; it slows the decline of age-induced cognitive function, releases brain chemicals that assist in neuron synapsis, and assists in integration and communication of the of the brain hemispheres (Van Praag, 1999) as cited in Blaydes, (2001). When the areas of the brain (basal ganglia, cerebellum, and corpus callosum) are stimulated through movement, neurotrophins are activated triggering an increase in synaptic connections promoting brain regeneration and growth (Greenough, 1991) as cited by Blayes, (2001). Exercise enhances visual tracking and peripheral vision, improving balance and

core stability which help children to maintain body control when engaged in seat work at school (Blaydes, 2001, p. 4).

Research suggests that motor coordination and play does not simply emerge in all children as part of maturation; healthy physical development is not guaranteed (A Chance to Grow, 2011). Children grow and develop over time and so does the brain. In the past, educators believed motor skills developed automatically, not considering what happens when development does not unfold as expected. Environment plays a major role in determining whether children will acquire important motor skills. Infants engaging in motor play, moving and exploring objects are using cognitive skills. Much of the first year of an infant's life is spent in the development of learning cause and effect during exploration. Babies use toys as tools to solve problems. Over time, the play becomes more sophisticated, interaction with objects become reflections of the child's experiences being replayed through their play.

Motor and Cognitive Development

Development is a complex process between what a child brings to the learning opportunity and what the environment offers in the way of family, home, community, culture, society, beliefs, and values. Early experiences help to build a child's brain architecture. The child and her interactions with the environment or persons in the environment act as an agent in a "serve and return" function in regard to her the relationship with others and the environment. No two children bring the same biological factors or have the same environmental experiences. Gesell and Watson, as cited in Bushnell & Bourdreau (1993) discovered variations on the interplay between a child's biology, physical, and intellectual skills

and his or her child's environment. What they found is that the intersection of a child's environment and a child's developmental skills shape a child's overall development. This intersection is defined as the transactional-ecological process where development is a product of putting together nurture (environment) and nature (biology) (Bronfenbrenner 1979; Sameroff, 2009). Learning theory suggests infants are motivated by a desire to interact with people and their environment, a dynamic systems approach to development (Oden, 2006). All sensory systems and developmental skills have a dynamic interplay with each other. The dynamic systems approach theory states if an infant is unable to interact motorically with his environment this inactivity will negatively impact the development of perceptual and cognitive skills.

The hierarchy of perceptual skills can be impacted when perceptual motor experiences are omitted from an infant's activity routine. There is evidence that when children are moving, they learn at the same time and are activating more regions of the brain than when sitting still in passive activity (Trawick-Smith, 2010, p. 11). When a motor skill emerges, it serves as a foundation for the development of perceptual and cognitive skills. The lower level skill acts as a control over emerging skills impacting the rate a child develops new skills. The learning triangle (Appendix A) adapted by Oden (2006, p. 6) shows learning starts with inborn patterns of motor development that are controlled by DNA. Learning continues as the brain and sensory systems gather and process information from the environment using all of the senses. Disruption in this web of development causes growth to be incomplete or immature. When the sensory system is being used over and over again, synaptic pathways become myelinated, building a stronger

pathway in the brain, movement or learning becomes automatic and becomes the foundation for later academic performance (Gopnik, Meltzoff, Kuhl, 2001). Children displaying atypical movement and behaviors have an immature sensory system (Oden, 2006). Skills that have been missed at an early age can be recaptured through intense therapy or practice. The brain has a masterful ability to adapt and adjust to the demands life presents. All children, regardless of disability, can acquire motor skills and use their body in play.

A study conducted by Klintsova, Dickson, Yoshida, and Greenough (2004) found when rats with motor dysfunction were exposed to a forced motor skill training, the motor dysfunction was decreased and synapses in the cerebral cortex were increased. Research on early brain development demonstrates children growing up in environments lacking adequate growth fostering experiences are at risk for having difficulties later in life. Children with undetected sensorimotor difficulties warrant concern. Lack of sensory stimulation causes early slights to development. Participation in well-designed corrective interventions creates significant gains for children who experienced environmental or biological insults or deficits in their early developmental experiences. Tremarche, Robinson and Graham (2007) designed a study to determine the impact an increase in physical education time would have on tests scores of fourth graders in two different schools. The treatment group received increased physical education time and the control group had no change in the amount of physical education they received. Tests scores in English, Language Arts, and Math were compared between the two groups, using the Massachusetts Comprehensive Assessment System (MCAS). The study demonstrated students who received more hours of quality physical education

scored higher on the MCAS than the control group receiving no increase in physical education time. In 2008, Piek, Dawson, Smith, and Gasson, conducted a study to determine if the quality of motor skills in children birth–4 years old was a predictor of future motor and cognitive performance in the same children once they reached school age. Results indicated there is a predictive relationship between the quality of motor performance at the younger age and future working memory and processing ability in the children as they age. In a “Play, Policy and Practice Interest Form” paper from the National Association for the Education of Young Children (2009), the authors’ review of literature found when children participate in recess daily, they are less fidgety, have improved attention and memory, and have increased test scores overall, assisting in the development of brain connections.

Studies demonstrate the impact motor development has on cognitive development. Piek et al. (2008) reported motor skill performance can predict cognitive development in school-aged children. Sanders (2002) stated locomotor activity is the primary platform for the healthy development of a child’s brain. Draper, Achmat, Forbes, and Lambert (2012) conducted a study to measure the impact exposure to a motor program would have on motor skills and cognitive development. It was found children who participated regularly in a gross motor program developed better gross motor skills and improved cognitive function. A study designed by Deli, Bakle, Zachopoulou (2006), discovered when children participated in an organized movement program their overall motor skills improved. Studies conducted by Klintsova et al. (2004) and Greenough and Black (1992) demonstrated when children learn motor skills through exercise, the children had increased synaptic activity and growth of blood

vessels in their brain's. Mazzeo, Arens, Gereroth, and Hein (2012, p. 15) examined preschool programs in regard to childhood obesity and found when children engaged in more physical activity during in the preschool day, not only were they healthier, but motor and social skills improved. In 2004 Piek, Dyck, Nieman, Anderson, Hay, Smith, McCoy, & Hallmayer revealed children with developmental coordination disorders also had executive functioning difficulties and slower ability to process speech. A more recent study found one-third to one-fourth of children with developmental delays have motor dysfunctions. A follow-up study by Peiters, DeBlock, Scheiris, Eyssen, Desoete, Deboutt, and Roeyers (2011) found the majority of children in their study with motor problems had other disabilities. They also discovered that 33% of children with speech and language difficulties also had motor delays.

Children's motor development and physical well-being can be enhanced through play opportunities. Bredecamp and Copple (1997) and Fjortoft (2001) found when children are provided a variety of indoor and outdoor play experiences with quality play equipment and materials, they are better prepared to meet the demands of handwriting and other academic tasks. Well-developed sensorimotor skills and reflexes that are integrated, assists in the development of eye-hand coordination, necessary for writing and drawing. Research conducted by Ratey (2011) supported the theory that children make cognitive gains when they have access to regular physical activity. Meine and Schnanabel found that motor skill development is learned through organized movement programs (as cited in Deli et al., 2006). Gallahue (2005) stated good developmental physical education programs focuses on the process of learning quality movement rather than the quantity of movement, quality comes

from practice. Children participating in motor activities appropriate for their age, stimulate their nervous system. As the process unfolds as designed, children learn to discriminate, plan, remember, and create, share their experiences, and to care. Without these early experiences, children lack the basic building blocks for future learning. Brain development relies on stimulation from the environment and learning gained from interacting with the environment (MDE, 2003). Unfortunately, there are few programs that implement quality movement programs to foster the development of fundamental locomotor skills (A Chance to Grow, 2011).

In 2005, the organization A Chance to Grow (Miller, Franzen, & Lieberman, 2010) designed a study to look at the long-term impact research designed motor activities had on young children attending Head Start programs throughout Minnesota. They used a motor program they had designed for the use with children in elementary settings: S.M.A.R.T (Stimulating Maturity through Accelerated Readiness Training) sensorimotor curriculum and redesigned it for the early childhood setting. The children participating in the motor program attended Head Start and were followed up through the third grade. They determined participation in the motor program had a positive effect on early cognitive development and the children performed better on early literacy and school readiness tests as compared to children that did not receive the motor program. They also found through time the children maintained a higher level of academic performance into third grade as compared to peers that did not participate in the motor program (Miller et al., 2010).

An article published in the StarTribune on April 23, 2012, reported on a school in Farmington, Minnesota, where children participated in 15 minutes of physical activity each day

before school. The children who participated in the movement activities improved their standardized tests score by double the school average (Estrada, 2012). Bushnell and Boudreau (1993) also noted the impact motor development has on cognition. They noted two key motor milestones in infant motor development, locomotion and visually guided reaching. Locomotion is the foundation of the building blocks for the development of spatial relationships. Using the environment, the infant learns about the environment, the beginning of social referencing. Learning begins when infants use visually guided reaching, hand-eye coordination, to see and obtain an object, moving their body toward and to play with an object. Piaget noted when children play or manipulate objects they are working on object permanence, cause and effect relationships and spatial concepts.

When early movement skills are not given attention in the early years, many children can pass through stages, looking rather typical. But as educational tasks, requiring mastery of early motor skills, become more demanding, they may begin to have difficulty. It often is discovered later, there were gaps in the developmental sequence, impacting the child's ability to gain new skills. Ensuring the development of the whole child is examined during the early years, assessing all skills within the domains of development, developmental gaps may be eliminated (Odom, 2006). Attention to early motor development is an important step in the prevention of school failure. A review of a child's developmental and medical history can provide answers about basic sensory and motor development. When children are required to do tasks above their developmental level, they may learn faulty or adaptive patterns that can be hard to remediate later and may have difficulty performing at age expected skill level in the

future. With proper stimulation, the brain keeps growing and changing. Taking children back through missed or disorganized stages can correct flaws in perceptual processes and can enhance other areas of learning. Making sure children develop foundational motor skills can impact future learning success.

Sanders (2002, p. 9), stated in his book Active for Life, children's primary mode of learning is through locomotive activity. He stated the National Association for Sport and Physical Education (NASPE), the Center for Disease Control (CDC) and the Surgeon General's guidelines for physical activity for preschoolers. The recommendation is for preschoolers to participate in one hour a day of accumulated physical activity, unstructured and structured, and opportunities to develop competence in movement skills. This physical activity should be a combination of moderate to vigorous movement (Sanders 2002, p. 11). The ability to use all of the body's senses, to move, see, hear, feel, touch, and control ourselves in relationship to the environment is the foundation that academic learning is built on.

Attitudes toward Organized Motor Activities

"Many parents and teachers think the needs of the mind should take precedence over those of the body-as if the two can be separated! Thus, adults may allocate little time to physical activity at school (and even at home)" (Pica, 1997, p. 8). A study conducted by Copeland, Sherman, Kendeigh, Kalkwarf, and Saelens (2012) discovered academics were valued over physical activity, and educators needed to demonstrate a purpose for physical activity and not have children as being seen as "just running around" during physical activity. This opinion was shared by both lower and upper-income parents. A position paper published by the

National Association for the Education of Young Children (NAEYC) stated schools who cut back on recess, physical education and other movement opportunities in favor of spending more time on content-based learning activities did not see a rise in student academic performance, but often saw more disruptive behaviors and lower test scores overall (Jarrett & Waite-Stupiansky, 2009).

Other concerns expressed in the same study, (Jarrett & Waite-Stupiansky, 2009, p. 66), was the safety of children on play structures, the cost of obtaining high-quality play structures, and liability issues in regard to injuries children may endure when engaged in play on playgrounds and in gross motor activities. There are misunderstandings about the amount of movement children should be participating in daily. Some believe preschoolers are moving all the time, but recent research suggests children are more sedentary now than ever. This inactivity can partly be attributed to the practice of schools and centers limiting or eliminating recess and physical education (Trawick-Smith, 2010). Some professionals may argue children learn and practice motor patterns through free play, recess and incidental motor activities, such as music and movement activities embedded in large group lesson times (e.g., circle activities). In a study conducted by Deli et al. (2006, pp. 15-17), the investigators found when children participated in free play motor activities alone, without any other type of organized motor activities the children did not make gains in the quality of fundamental movement patterns, but actually demonstrated regression. This study suggests fundamental locomotor skills can be improved through participating in organized activities, such as a motor activity program.

Changes in our culture and environment have impacted how children engage in their environment. Children are exposed to increased passive entertainment more so than in the past. Children are spending more time in front of screens and electronic toys reducing the amount of time they are engaged in large movement activities (Trawick-Smith, 2010, p. 5). Over the past 20 years, the campaign to end sudden infant death syndrome has resulted in infants spending more time on their back instead of their tummy. Developmental practitioners began the campaign of “tummy time” encouraging parents and caregivers to provide opportunities for baby to spend time on her tummy (Trawick-Smith, 2010, p. 5). When a baby engages in tummy time, she needs to hold her head up, push herself up onto her elbows, and eventually onto her hands which helps to develop upper body strength (hands, arms, shoulders, neck, upper back). Lack of tummy time impacts the development of body awareness, upper body strength, and hand development. When the hands are active during weight-bearing activities, receptors of the hands receive information about touch and joint sense (Oden, 2006). Propping on arms and hands also increases the baby’s visual field, causing the eye muscles to work helping to build visual motor capabilities (Lamont.n.d). All these activities act to help develop the foundations for children to be good readers and writers when they enter school. The emergence of mobile baby carriers has also impacted the developing baby’s motor development. When the baby is carried in a carrier for most of her day, she is not developing trunk strength and visual motor skills. When a baby is carried in the caregiver’s arms, she needs to work on keeping herself upright, using neck strength to keep her head up, and is able to look around at her environment and develop visual motor skills.

Other Factors Impacting Development

Studies mentioned earlier in this literature review indicated children with developmental delays have a high probability of having delays in motor development. Several studies address the connection between motor development and cognitive function. A study published by Apache (2005) found when children with an identified developmental delay, participated in a motor program for 30 minutes, three times a week, over a 15 week period, improved locomotor skills and object control, increasing their ability to participate in play activities. In 2004, Piek et al. revealed that children with developmental coordination disorders had executive functioning difficulties and slower ability to process speech. In 2008, Piek et al. found when children had poor motor skills at an early age, it was a predictor of future low cognitive performance. In a more recent study conducted by Draper, Achmat & Forbes, 2011, p. 148) it was found that one-third to one-fourth of children with motor dysfunctions have developmental delays. In a follow-up study by Pieter's et al. (2011) it was found that the majority of children they studied with motor problems had other disabilities. They also discovered that 33% of children with motor delays had speech and language difficulties. Piek et al. (2004) also connected low motor ability to slower speech processing. The Young Athletes Intervention study conducted by Favazza, Zeisel, Odom, Parker, and LeBoeuf (2011) using the Special Olympics Young Athletes™ program, found when children participated in the program there was improvement in their motor skills, even children with identified educational disabilities such as Developmental Delay, Autism Spectrum Disorders, and Intellectual Disabilities. The study demonstrates when children with developmental delays participate in

high-quality motor interventions, improvement in their motor skills can be expected. The Young Athletes™ program (Favazza et al., 2011) is a structured 8-week program that conducts sessions 3 days a week for 30 minutes each session. During the sessions the children work on foundational skills such as visual tracking, motor imitation, walking, running, balance, jumping, and ball skills (Favazza et al., 2011). The program is based on Clark and Metcalfe's Mountain of Motor Development (Appendix E). The Mountain of Motor Development (Clark & Metcalfe, 2002) illustrates the progression of motor development from what they define as the "reflex period" to the "skillful period" revealing the importance of how the integration of motor skills and sensory development is critical for overall growth and development. A paper written by Graff (2013) for LRP Publications reported how music and movement activity enhanced brain function and increases motor skills when used as a platform to teach academic skills. He specifically reported children with developmental delays were more engaged in learning activities when participating in music and movement at the same time. Graff's paper reports movement requires global brain processes, using many areas of the brain, which in turn increases brain function and improves developmental skills overall.

Other studies focused on children from low Social Economic Status (SES) families or communities that are considered at risk for developmental delays. Goodway and Branta (2003) conducted a study with a group of disadvantaged children with low SES background, and fewer environmental play opportunities. These children increased their cognitive function by participating in a motor program for 45 minutes, 2 days a week for 12 weeks. Thompson (2008), discussed the impact impoverished environments have on children's development. His

study supported his theory that exposure to well-planned motor activities would increase cognitive function and academic performance for young children at school. In 2011, Draper et al. (2012) conducted a study in South Africa with economically disadvantaged children using the “Little Champs” motor program. The “Little Champs” program consisted of structured activities the children participated in for 45-60 minutes a day, 3-4 days a week, and exposed children to structured play giving them the opportunity to develop and master motor skills. Activities included hopping in hula- hoops, balance walking with a bean bag on the head, and developing foot skills using a soccer ball. The study found the children who participated in the program regularly, demonstrated better gross motor skills and also improved cognitive function. Cognitive function was measured using the Herbst test, developed by Herbst and Huysamen in 2000 (Draper, Achmat, Forbes, Lambert, 2011, p. 144) for the assessment of cognitive and motor tasks believed to underlie school readiness skills in children ages 3-6 years old.

The A Chance to Grow (ACTG, 2005) study conducted by the Minnesota Learning Resource Center set out to demonstrate the impact a motor curriculum has on cognitive development. For over 20 years the Minnesota Learning Resource Center had worked with elementary school teachers to implement the S.M.A.R.T (Stimulating Maturity through Accelerated Readiness Training) sensorimotor curriculum daily into elementary classroom routines. The researchers recognized brain stimulation can improve academic outcomes for children when exposed to the structured motor and sensory activities. Motor movement was not the only area of development the program addresses. ACTG also recognizes the importance of how the sensory system visual/vision, tactile/touch, auditory/hearing,

vestibular/balance, proprioceptive/muscle, joints and inner ear, and brain function cannot be separated; the brain and sensory system are dependent on each other for growth and optimum development. The S.M.A.R.T. curriculum was developed based on research focused on brain development and school readiness. Miller, Franzen & Lieberman (2010) applied what research has demonstrated about brain development and the impact movement has on brain stimulation and developed the program to be used in the early childhood setting. In 2005, the ACTG created a curriculum using purposeful and effective sensorimotor activities that could be used in the early childhood setting for this study. The ACTG partnered with two Head Start programs in Minnesota involving over 20 Head Start classrooms with a 6-year demonstration project to test the effectiveness of the S.M.A.R.T.-E.C. with younger children in preschool settings. The children involved in the project participated in the sensory motor activities 20 minutes each day while enrolled in the Head Start program.

The activities focused on the development of eye-hand coordination, visual acuity, fine motor skills (pre-writing), spatial relationships, and primitive reflexes (Miller, Franzen, Lieberman, 2010). The project directors assumed the program would have greater effects on pre-school age children based on what they learned about its impact on school-aged children and research indicating children have greater brain plasticity in the early years of development. Program trainers reported positive results regarding the effectiveness of the curriculum not only on motor and sensory integration development, but also on academic achievement. Teachers reported the children in the S.M.A.R.T. classroom learned skills faster, had improved focus and attention to learning tasks, and improved scores on academic measures using the

Individual Growth and Development Indicators in Pre-Literacy and Math, which are considered to be primary skills for indicating school readiness (Canto, 2014). They also found through participation in the S.M.A.R.T.-E.C. program, children performed better on a majority of learning readiness and early literacy tests than children that did not participate in the study. Skills were measured using the AimsWeb and MAP standardized tests, literacy and math, comparing pre- and post-test abilities (Miller, Franzen, Leiberman, 2010). The children who participated in the S.M.A.R.T.-E.C. program had better test scores and long-term higher test scores up into third grade.

Motor and Literacy

The early years, from birth through age 8, are the most important period for literacy development (Neuman, Copple, & Bredecamp, 1999). Motor development impacts cognitive and brain development. It is practical to conclude motor activity also has a positive impact on literacy development. When children interact with the environment they are learning concepts about objects which build the foundations of understanding language. Cause and effect, problem-solving, and motor planning as objects are manipulated through pretend play, set the foundations of literacy learning. Pretend play is a platform for developing symbolic thought, linking words to objects, the word being a symbol for the object. Literacy develops as part of the social and cultural process of a child's environment (Owacki, 2001). It is the interaction with the environment that gives meaning to words, understanding of language resulting in literacy skills. Bodrova and Leong (2001) developed a program for preschool and kindergarten children called, "Tools of the Mind" focusing on dramatic play in the classroom. They found

when children spent 50-60 minutes during a 2-1/2 hour program engaged in dramatic play, the children scored higher on literacy skills than children in a control classroom receiving less dramatic play opportunities.

In 2010, the A Chance to Grow (ACTG) study looked at the long-term impact that research-designed motor activity had on young children attending Head Start programs throughout Minnesota (Miller, Franzen, Lieberman, 2010). Children attending Head Start that participated in the motor program were followed through third grade. They found that children, who participated in the motor program had higher early cognitive developmental skills and they performed better on early literacy and school readiness tests, as compared to children that did not participate in the motor program. Through time, the children also maintained a higher level of academic performance into third grade as compared to peers that did not participate in the motor program (Miller et al., 2010). As mentioned earlier in this paper, the StarTribune printed an article on April 23, 2012, about a school in Farmington, Minnesota, where children participated in 15 minutes of physical activity each day before school. The children that participated in the movement activities improved their standardized tests score by double the school average (Estrada, 2012). Some studies and literature link other factors such as low social economic status, environmental and cultural differences to delays in cognitive development. Guernsey (2009) found a higher correlation to the low economic status of a school as a greater influence on long-term school success for children, over the child's family's economic status. Underfunded schools tend to have lower quality environments, limited access to high-quality teaching materials and equipment, and less experienced teachers. Barnett

(2002) found when children attended high-quality preschool programs they have better long term positive outcomes later in school. This finding is supported by the study mentioned earlier in this paper, conducted by Goodway and Branta (2003). They found when disadvantaged children from low SES families participated in a motor program, the children increased their cognitive function. Thompson (2008) discussed the impact an impoverished environment can have on development but also demonstrated exposure to well-planned motor activities increased cognitive function and increased academic performance for young children. Burger (2010) also reviewed effects participation in motor intervention programs had for children from a variety of social backgrounds. He found when children participated in the structured motor activities, the children demonstrated improved cognitive skills.

Developmental checklists such as the Hawaii Early Learning Profile (HELP) (Warshaw, 2011), the Assessment, Evaluation and Programming for Infants and Children (AEPS) (Bricker, Capt, Johnson, Pretti-Frontczak, Straka, & Waddel, 2002), and the Insite Developmental Checklist (Morgan, 1989) include motor skills and sensory (vision, auditory, oral, and prehension) ability within the cognitive domain to assess children's development. The Receptive-Expressive Emergent Language Test 3rd Ed (The REEL-3) (Bzoch, League, & Brown, 2003) a language development evaluation tool, examines a child's use of sensorimotor and reflexive responses as a way to evaluate the development of pre-linguistic communication. Studies reviewed by Bushnell and Boudreau (1993) regarding motor development indicate that motor skills and cognitive development can be linked to the development of language and communication skills.

From early on, children begin to learn about words and word meaning through play experiences. Although children are hardwired to learn language they also require environments that promote language experiences and use of language in meaningful contexts. Play is valued as a language-rich context in which children learn to communicate with others (Connell & McCarthy, 2013). The connection between motor development and motor coordination needed to produce fluent speech, are related to greater language fluency in later childhood. Movement and play in concert provide the setting for learning word meaning, syntax, and the social use of language. Through manipulation of objects and interactions with people, children begin to understand nouns (labels), verbs (actions) and adjectives (emotions). Renowned child development practitioner Bev Bos (2003) stated, "If it hasn't been in the hand and the body, it can't be in the brain." Children learn about their world by interacting with it. Adults talking, singing, and interacting with children throughout daily routines, assist in this development. Social play with others assists children in understanding the "give and take" structure of social conversation.

The National Research Council (1999) determined that children need to know 10,000 words before they enter kindergarten in order to be successful readers by third grade. Children pick up about 2,000 words a year just by living, given they have normal hearing and cognitive potential. Parents playing and talking to their children one hour a day will assist their child in gaining about 10, 000 words by age five. If they play and talk with their children one point one hour a day they will learn about 12,000 words by age five. Language and literacy are gained by interacting with the environment and socializing with people in the environment using play and

social interactions. Even infants learn concepts that are literacy-based when they interact with the environment. The development of haptic perception, the ability to acquire information about an object by handling an object as opposed to just looking at it, develops the foundation of literacy. Literacy concepts that can be haptically perceived are temperature, size, texture, hardness, weight, and shape. Through the handling of objects in exploration, children are using hand-eye coordination and haptic perception to learn terms to describe the objects that leads to communicating with others about the objects. Developmental practitioners, Isaacs, Piaget, Vygotsky (Connel & McCarthy, 2013, p. 177), understand that development evolves from proximal to distal, core to extremities, so to imply hand-eye coordination and haptic perception are more important, would be wrong (Oden, 2006). It is important to remember the critical role locomotor skills play leading to prehension skills allowing children and infants to access their environment. In this example of the development of object manipulation, we can see how motor development can act as a control over other domains of development, such as communication. When a child cannot move his body to obtain objects for exploration, it is difficult to form a cognitive understanding of the object. When a child does not understand the properties of an object it is hard to assign or remember a label for it.

We may not be able to alter what children bring to learning environments, but we can manipulate environments to support children's development and impact developmental trajectories toward positive outcomes. Well-designed environments allow appropriate play and movement. Exploration in developmentally appropriate environments has shown promotion of short-term cognitive gains for children (Castro & Mastriopieri, 1986; Guralnik, 1998; Shonkoff &

Hauser-Cram, 1987). Stimulating environments, positive social opportunities, and motor and sensory activities are the essential ingredients for brain development and growth. Play and movement are the primary vehicles in which children learn. The literature demonstrates children can increase cognitive and academic skills by being exposed to regular, well-designed motor and play opportunities.

Chapter 3: Method

Participants

The sample was taken from a classroom of 18 preschool-age children of the same ethnicity attending school readiness, ages 4-5 years old, 1 year before kindergarten eligibility. This particular class attended school readiness two times a week for 2-1/2 hours each day. School district census information for the school year 2013-2014 indicated the families of children attending school in the district were 5% minorities, 18% of families received free and reduced lunches, less than 1% received English as a second language services and 15% of the enrolled population received special education services (Sartell-St. Stephen ISD School District #748, 2013). From the 18 children, 12 participated per informed consent from a parent or legal guardian (see Appendix B for parent/guardian permission and information sheet). Each child enrolled in this class came from intact, two-parent homes. Six children in the class participated in the motor activities (the experimental group) and six children engaged in free play (the control group). In this particular class, one child received special education services in the special education category of Speech and Language Impaired: Articulation Disorder. No other children were identified as having learning delays. The 12 participants were numbered in order of returned permission forms and sorted randomly to create two study groups, one being the control the other being the treatment group. Within this sample, seven children were male and five were female. The treatment group was comprised of four males and two females and the control group was comprised of three males and three females.

Measures: Individual Growth and Development Indicators-Early Literacy® (IGDI's-EL)®

To obtain a baseline of literacy skills, all the children in the study, including the children not participating in the study, were administered the Individual Growth and Development Indicators-Early Literacy® (IGDI's- EL®) literacy probes as part of the district's program-wide progress reporting for the early childhood program. The IGDI's® are designed to capture information about preschool-age children's language and literacy development and specifically to inform questions about how a child's skills in oral language and phonological awareness grow over time (Bradfield, 2008). For the purpose of reporting children's school readiness progress to parents, the IGDI's® were administered two times a year, fall and spring and results are reported on semi-annual progress report cards.

The IGDI's® (McConnell, Wackerle-Hollmann, & Bradfield, 2004) are a tool for monitoring individual children's pre-literacy development and can be used to predict future reading proficiency as children age. Empirical evaluation has been conducted on the IGDI's® to determine the reliability and validity of the tool when used with preschool children (Missall & McConnell, 2004). Empirical studies conducted by Missall and McConnell suggested strong evidence for the reliability of all three measures and validity across examiners within a variety of preschool settings. The IGDI's® provides a national and state-level normative data based on test scores collected from over a decade of research and over 150,000 students across the country (McConnell et al., 2004). Currently, the IGDI's are the only Response to Intervention

(RtI)-oriented early childhood measures (McConnell, Wackerle-Holman, Rolloff, Rodriguez, 2015).

At the core of the Individual Growth and Development Indicators-Early Literacy® (IGDIs-EL®) are a set of language and literacy measures designed specifically for children, ages 3-5. The IGDIs-EL® are comprised of Picture Naming (expressive language and vocabulary), Rhyming and Alliteration (phonological awareness), and Letter Sound Identification (Missall & McConnell, 2004) (Sample of stimulation flash cards Appendix G). The assessment is administered one on one with child and adult using pictures to stimulate responses and standardized procedures are used to administer each test. There is a sample activity at the beginning of each test to assure understanding of the tasks. Scores are determined by how many pictures the child correctly identifies per test task within a specified time limit. The IGDIs® developers identified four score targets: above target, on target, close to target, far from target. For the purpose of progress reporting the early childhood program used the target, close to target, and far from target ranges renaming the measures as secure (target), developing (close to target), and beginning (far from target). Children obtaining scores above target were placed in the secure category. Indicators of reading potential have been identified by the National Research Council (1999) as the child's ability to show an understanding of words (picture naming), rapid letter naming (letter identification), and phonological awareness (alliteration). Other indicators include the ability to produce a sentence using four words, following 2-3 step directions, verbal memory and story recall. The IGDIs demonstrates the

basic skills needed to become a good reader and can be considered a robust measure of pre-literacy skills.

Scores were collected using the programs' data collection format both in the fall and the spring per district progress reporting schedule, two times a year. Scores collected were defined as beginning skills, developing skills and secure skills. The classroom teacher was trained in the administration of the test and administered the test to the whole class, both pre and post treatment. The classroom teacher administered the probes to the children in her class within the same time period the entire early childhood program was assessing pre-literacy skills of all the children for the purpose of reporting student progress to parents. The program did not provide the classroom teacher with a testing room in which to assess the children. Assessment took place where space permitted, using the hallway or a corner of the classroom. A substitute teacher was provided by the district so the teacher could conduct the testing without being interrupted by the needs of the children in the classroom. This procedure was standard for all the teachers in the program, there are no inconsistencies as to the environment for testing the early childhood program.

**Movement Program: S.M.A.R.T.–E.C.
Curriculum (Stimulating Maturity
Through Accelerated Readiness
Training-Early Childhood)**

The S.M.A.R.T-E.C program provides gross motor movement activities supporting brain stimulation improving learning readiness and early literacy. The S.M.A.R.T.-E.C. program is designed by its creators to be in line with current national early learning standards (Miller et al., 2010). The program activities are designed to promote the development of visual, auditory,

balance, fine and gross motor skills, physical fitness, strength, coordination, and increase a child's ability to pay attention to learning tasks for children who participate in the program activities. The program activities involve a number of purposeful exercises such as crawling, creeping, spinning, balancing, and rolling (Example of motor activities in Appendix F). These activities provide brain stimulation that help to develop sensory and motor pathways in the brain. For the 6-week trial the children participated in activities designed similar to an obstacle course that included an alligator crawl (crawl on belly using arms and legs to propel body forward for 15 feet), balance walks (walking on stepping stone and a balance beam), free creeping (crawling on hands on knees), slap track (crawling on hands and knees with hands slapping pictures placed on a mat nine inches apart in a left/right-hand pattern for 15 feet), jumping (trampoline), yoga poses for balance, pencil roll (rolling perpendicular to a line down a mat 15 feet). The S.M.A.R.T.-E.C. curriculum was selected because this motor program was already implemented by the early child program to enhance motor skills and improve participation in learning activities for the children attending the early childhood program. Based on study results of the A Chance to Grow study, using the S.M.A.R.T.-E.C., the early childhood staff believed the program would address behaviors and assist in improving academic and literacy skills for the children attending the early childhood program. The staff was most impressed by the reported long-term impact regular participation in the S.M.A.R.T.-E.C. had on the study subjects in the A Chance to Grow study.

Curriculum

The early childhood program in which this study was conducted used the Creative Curriculum (Dodge, Colker, & Heroman, 2002) as a guide to developing the program curriculum. The curriculum is based on five building blocks in which to guide program planning: positive interaction and relationships with adults, developing social emotional competence in children, constructive, purposeful play activities, and the physical design and set up of the classroom and teacher-family partnerships. The Creative Curriculum uses these building blocks as the foundation for its philosophy, the objectives for children's learning, and guidelines for teaching and working with families. The Creative Curriculum provides guidance for teachers in how to interact with children in ways that promote development and learning, foster children's social competence, support children's learning through play, create rich environments for learning, and forge strong home-school connections. By meaningfully translating research into practice, the Creative Curriculum gives educators the tools they need to help all the children in their classrooms succeed in school and in life. There is no specific scoring method or scope and sequence included in the curriculum, and early childhood programs are given the flexibility to make the curriculum fit the routines of the population they serve. The program, in which this study was conducted, chose to use monthly themes as a platform to develop learning activities for the program. Because there was no scope and sequence to the curriculum the program staff developed a list of activities that addressed the developmental domains and specifically addressed the assessment rational criteria aligned with the Work Sampling System-4th Edition (WSS®) for developing the program curriculum (unpublished). Each month there was a list of

suggested activities teachers could choose from; doing as many as they wanted or could provide based on how often class met. I was able to observe the teachers and how often literacy was addressed in the classroom. There was a discrepancy between teachers as to how often they presented academic concepts; some teachers presented concepts daily, others one time a week or one time a month.

Procedures

The treatment group participated in 6 weeks of the S.M.A.R.T.-E.C. Curriculum for 10 minutes a day, 2 days a week during center or free choice time, depending on the structure of classroom schedule. The S.M.A.R.T.-E.C. course was set up in a room for large motor activities where all the children attending the school readiness program were able to participate in the activities with their class. All faculty of the early childhood program had been trained and refreshed in the use of the S.M.A.R.T.-E.C. curriculum before the start of the school year. Before the study began, the classroom teacher taught the children and classroom paraprofessional the activities in order to have consistency in how the activities were to be done within the group of children participating in the study. There was provision for either the classroom teacher or paraprofessional to escort and guide the children through the activities. While the treatment group engaged in the S.M.A.R.T.-E.C. activities, the control group was given free choice or center time in the classroom.

Limitations of the Study

The primary limitation of the study was the type of sample used for the study. The sample was small; including only 12 children (control and experimental) from one classroom

and one site. The sample was homogeneous; children of similar demographic and ethnic backgrounds. In defense, one classroom was chosen to keep the reliability of exposure to the school readiness curriculum consistent; one teacher and one classroom assured exposure to the same academic activities. Also, the use of one teacher provided for inter-rater reliability with participation in the movement program and administration of the literacy probes. The group of children involved in the study was non-disruptive and cooperative so no adjustment for unwillingness to engage in the movement activities or perform literacy probes needed to be considered.

Extraneous variables that were not addressed in this study included the intensity of exposure to academic activities, the amount of exposure to other movement opportunities, and the level of parent involvement in the children's educational experience, either at home or in the community. Other threats to the validity of the study were would the children gain literacy skills regardless of participation in the movement activities or gain skills simply through the maturation process.

Permission to conduct the study was secured with the school readiness administrator and through Saint Cloud State University Institutional Review Board to conduct a human subject study (see Appendix C and D for a letter of permission from program administrator and Institutional Review Board approval).

Chapter 4: Results

Analysis of Data

In order to test the differences of the two groups, a t-test was used to analyze the information in order to determine if a true difference existed between the two groups. The first set of t-tests includes the data collected from the treatment group, Table 1. A paired test was used to compare the six participants, pre- versus post-treatment on each of the three dependent variables: rhyming, picture naming, and letter sounds. The t-values (sig=.363) in all three cases indicate there was no significant difference on the three dependent variables when comparing pre- and post-treatment scores.

Hypothesis: The treatment group will demonstrate significant gains from pre- to post-treatment between pre-literacy probe scores.

Table 1: Paired Samples Test Treatment Group

Paired Samples Test Treatment Group	Paired Differences	t	df	Sig. (2-tailed)
	95% Confidence Interval of the Difference			
	Upper			
Pair 1 Prerhyme – Postrhyme	.595	1.000	5	.363
Pair 2 Prepickname – Postpicname	.262	-1.000	5	.363
Pair 3 Prelettersound – Postlettersound	.524	-1.000	5	.363

The second set of t-tests, Table 2, includes data collected from the control group. The t-value (sig=.025) for rhyming indicates there is a significant difference between pre and posttests. The t-value (sig=.175) for letter sounds indicate there is no significant difference between pre and posttest. The t-value for picture naming could not be computed because the means were identical between pre- and post-test, therefore, no difference.

Hypothesis: Control group will not demonstrate significant gains between pre- and post- treatment pre-literacy probe scores.

Table 2: Paired Samples Test Control Group

		Paired Differences	t	df	Sig. (2-tailed)
		95% Confidence Interval of the Difference			
		Upper			
Pair 1	Prerhyme – Postrhyme	-.125	-3.162	5	.025
Pair 3	Prelettersound – Postlettersound	.875	1.581	5	.175

Hypothesis: The treatment group will demonstrate significant gains between post- and pre-treatment probes of pre-literacy skills as compared to the control group. The third set of t-tests compared the two groups, Table 3, treatment versus control, for pre- and post-test skills. In all six comparisons, no significant difference was found between the scores of the two

groups, demonstrating there was no positive impact on pre-literacy skills for the children who participated in the motor program.

Table 3: Group Statistics
1 Treatment
2 Control

Group	N	Mean	Std. Deviation	Std. Error Mean
Prerhyme	1	2.50	.837	.342
	2	1.83	.983	.401
Prepicname	1	2.17	.753	.307
	2	2.50	.548	.224
Prelettersound	1	1.67	1.033	.422
	2	2.17	.983	.401
Postrhyme	1	2.33	1.033	.422
	2	2.50	.548	.224
Postpicname	1	2.33	.816	.333
	2	2.50	.548	.224
Postlettersound	1	2.00	1.095	.447
	2	1.83	.983	.401

Results of this study indicate participation in a movement program did not impact pre-literacy skills for the children participating in the program or not. Even the control group, receiving the same amount of school readiness experiences as the treatment group, did not show a significant gain or loss of overall pre-literacy skills. Four children in the control group

did have a change in the score but only in the rhyming set of indicators, there is no pattern as to which children obtained improved scores and which children obtained lower scores. Some children demonstrated an increase in skills in one literacy probe but demonstrated loss of skill in another. The purpose of the study was to determine whether participation in a structured motor program would improve the pre-literacy scores of the children studied. It was hoped, information gained would have a positive impact on children's pre-literacy skills, could be used for curriculum consideration and planning. The hope was when motor interventions are used in a program-wide application, all children's scores would increase. Per review of the literature, exposure to the motor activities paired with developmentally appropriate academic curriculum would benefit all children attending an early childhood program. The intention was that implementation of motor program activities would impact cognitive skills, including pre-literacy skills due to the brain stimulating effects of motor movement.

A factor that may have impacted the results of the study could be the unpredictability of children's development at such an early age. Because skills can fluctuate between the developmental domains and each domain impacts each other, a child's skills can look different when tested at different stages of development. Development typically does not stabilize until near and around when children reach 8 years of age. Probes may need to be taken more than two times a year to track progress. Another factor may be that this particular group of children was not exposed to the early childhood curriculum enough in order to gain and demonstrate mastery of the literacy skills taught and assessed. Consideration should be made in regard to the length of the study. Six weeks, two sessions per week, may not have been enough time for

children to be exposed to or excluded from the motor activities in order for the brain to have an appropriate amount of stimulation or non-stimulation to impact literacy skills. Consideration for other motor activities the children participated in throughout the school day should be considered as part of daily moderate to vigorous physical activity as suggested by the CDC and Surgeon General. A future topic of study could be making a comparison of activity level and types of physical activity children participate in across a program, comparing classrooms. Measuring teacher perception of the amount of movement opportunities children are exposed to throughout the day would be an interesting topic. What do teachers consider moderate to vigorous physical activity and do they feel they embed such activity throughout the day within routines such as circle time, transitions in the classroom and within the school building and outdoors? I am interested in learning why the children participating in the study did not demonstrate gains in literacy skills based on exposure to the early childhood curriculum. A topic for future exploration may be whether the early childhood curriculum address' pre-literacy skills enough for children to gain skills and demonstrate mastery between probes. In a technical report conducted by Missall and McConnell (2004), it is noted scores in each pre-literacy measure remain relatively stable over time and significant growth can be correlated to children's chronological age and language development. These measurements were taken during a span of 2 years, not accounting for exposure to specific intervention strategies and general growth and maturation. More recently (McConnell, Wackerle-Holman, Roloff, & Rodriguez, 2015) conducted a study to examine whether the IGDI's could be used as a reliable measure to support Response to Intervention (RtI) in the areas of language and literacy in early

childhood programs. In their study, they found it difficult to provide conclusive data due to the inconsistencies of the population of children attending early childhood education programs. Although universal access to preschool programs is increasing, most programs serve only high-risk children; children more likely to demonstrate lower levels of development in language and early literacy skills. They concluded more data were needed to be collected and analyzed to make a determination as to the effectiveness of the IGDI's in regard to making decisions in the response to intervention model.

Summary

For this study, the data collected did not support the hypotheses: participation in a motor program will enhance pre-literacy skills. Scores were compared within the treatment group, control group, and between both groups and no significant change was determined to support the hypothesis. Even though research states otherwise, this study did not support those findings. The length of the study impacted the results as this researcher feels that longer exposure to the movement program, such as, more days a week, for a longer period of time, possibly the length of the school year, would have garnered better results. The IGDI's® literacy measurement tool may not have been a sensitive enough tool to measure smaller increments of growth or regression even when measured over an academic school year, such as the two times a year progress monitoring schedule.

Chapter 5: Discussion

Introduction

Those who educate young children are concerned about how to assist them in gaining skills needed to be successful students. Educators want children to be ready to learn when entering the elementary years. They want to keep children on a positive trajectory, so they can continue to be successful into adulthood. The purpose of this study was to investigate the effects participation in a motor program would have on young children's acquisition of pre-literacy skills and whether exposure would help to increase pre-literacy skills. For this study, no significant differences could be found between the treatment and the control group of children included in the study. What was found was the skill level of all the children involved in the study had no significant increase or regression of skills. Review of literature demonstrates participation in a motor program had the greatest impact on children with identified developmental delays and children from low social economic families or communities. Studies conducted with the general education population (children with and without developmental delays and a mix of economic status) benefited from physical activity. Schools providing daily physical activity found test scores were higher for children participating in additional physical activity than for children who did not. Why this particular study did not garnish significant outcomes is for discussion. This researcher is not discouraged by the results and believes different results may have been obtained had the study been conducted with other parameters such as increasing the length of study, using a larger variety of study subjects such as children from low social economic status backgrounds, children with identified developmental delays,

or children from different early childhood programs. The A Chance to Grow (Miller, Franzen, Lieberman & McLaughlin, 2010) study looked at literacy growth and sustainability over a 5-year time period. The studies conducted over shorter periods of time such as those carried out over a 12-16-week duration, demonstrating positive outcomes, were conducted with a population of children identified with a variety of developmental delays. Studies demonstrating this are the Young Athletes Program (Favazza et al., 2011), the study conducted by Apache (2005), and the studies conducted by Piek et al. (2004), Piek et al. (2008), and Pieters et al. (2011). Other studies focused on children from low social economic status, such as the A Chance to Grow study and the Little Champs program, the Goodway and Branta (2003) study, and the Thompson (2008) study. These studies demonstrate the positive impact intervention can have on children to lessen the degree of delay of developmental skills. There is adequate research supporting my hypothesis stating participation in a motor activity program has a positive impact on children's overall development, specifically pre-literacy skills.

Another aspect of the study is to consider whether the Individual Growth and Development Indicators are an adequate measure of literacy skills. The tool was developed to measure just that; literacy skills needed to be ready to learn elementary level literacy and language concepts. It is a tool used to inform practice, to let teachers know where children's skill levels are and what concepts need to be taught. McConnell et al. (2015) conducted a study on the effectiveness of using the IGDIs as a tool in a response to intervention model for identifying needs and interventions for children in preschool. What they found was children in the early years of development have unstable development and the tool was not effective for measuring growth or

regression after interventions were implemented. The intent of exposure to structured movement activities is to stimulate the brain, preparing it for learning, and when in tandem, having exposure to a literacy curriculum, would reap gains in literacy skills for the children involved. Is this a practice that shows positive results can be expected when intervention is delivered over time such as was demonstrated in the A Chance to Grow study? Should an intelligence test been used to measure cognitive growth as was used in the Little Champs study? Will gains in intelligence or academic skills be the result of exposure to an academic curriculum or just a process of maturation? These are questions that may need to be answered in a different study. What was exciting for the early childhood staff involved in this study was that the measurement tool, IGDI's, was a tool the early childhood program already was using for progress reporting. The IGDI's also directly aligned with the school district's assessments of progress for the elementary students, the AimsWeb: literacy and the MAP: Reading and Math and Language use. These progress measuring tools are nationally normed and standardized tests (Miller et al., 2010). The school readiness staff was also pleased with the multimodal approach of the program and how it addressed multiple developmental skills, within all the domains of development for the whole child.

As for the type of motor program that best meets children's needs, I cannot say any one program is superior to another. What is clear from the literature is that a variety of movement activity is best for children. Children should have an opportunity for structured and unstructured dramatic play that allows for movement in their environment. Children should have exposure to physical education with developmentally appropriate movement activities,

led by a trained adult, which allows them to participate freely with their peers in movement. Children also need to have unstructured outdoor play on developmentally appropriately designed playground equipment allowing for children to explore sensory motor activities such as weight-bearing activities, activities that stimulate the inner ear, joints, and allow for building muscles and balance, control in climbing, jumping, and aerobic exercise. Music and movement support the development of body awareness, appreciation for the art of dance and music and should be explored daily. Developmentally appropriate movement activities support brain development, assists children in recapturing missed skills, allows children to engage with peers in emotionally satisfying activities building social community and build appreciation for each other's physical gifts and talents.

We may not be able to alter what children bring to learning environments, but we can manipulate environments to support children's development and change developmental trajectories toward positive outcomes for children. Well-designed environments allowing for play and movement and exploration of the environment has shown to promote short-term cognitive gains in children (Castro & Mastrioperi, 1986; Guralnik, 1998; Shonkoff & Hauser-Cram, 1987). Providing stimulating environments with positive social opportunities through supportive human relationships and providing motor and sensory activities impacts brain development. Play and movement are the primary vehicles in which children learn. Motor ability, specifically in infants and toddlers, is often used as an indicator of neurological development (Shonkoff & Phillips, 2000). When children are unable to use motor or sensory skills to explore their environment, other domains of development are negatively impacted.

Developmental checklists for infants and toddlers focus on rating a child's ability to use motor skills to interact with their environment as a way to determine a child's developmental skills. It has been demonstrated that delays in motor skills directly impact executive function (Piek et al., 2004). In Connell and McCarthy's (2013, p. 177) book, A Moving Child is a Learning Child, they illustrate the relationship sensory, motor, and reflexive development have on learning using the Kinetic Scale. The Kinetic Scale maps how six physicalities within three sensory tools help to wire the brain for learning. This illustration shows how language acts as a bridge between the concrete experiences of movement and the conceptual knowledge of language.

Sanders (2002) stated in his book Active for Life, children's primary mode of learning is through interaction with their environments. He promotes the National Association for Sport and Physical Education (NASPE), Center for Disease Control (CDC) and Surgeon General's guidelines for physical activity for preschoolers: one hour a day of accumulated moderate to vigorous physical activity, unstructured and structured, and the opportunity to practice and develop competence in movement skills. Components of quality physical education are small class sizes providing maximum opportunity to practice a variety of activities, integrating movement into play, and using well-designed activities to support the development of the whole child (Rampmeyer, 2000). Often teachers support group playground time or gym time. When gross motor activities are offered only in these settings, opportunity to give direct instruction is lost, some children do not get enough practice while waiting their turn, or some are intimidated in large groups.

The SMART program was used as a movement supplement in the school readiness curriculum in the program this study was conducted. The purpose was to find evidence that increased exposure to motor skill and brain stimulation activities would improve test scores, specifically on the IGDl's literacy measurement, demonstrating kindergarten readiness and align to kindergarten standards.

Conclusion

There has been much discussion and action taken in regard to physical education and its place in education. The discussion has been around how schools work to assist children's acquisition of academic skills and demonstrate student progress using standardized tests. For years, physical education and recess have been a daily activity in the elementary school routine. As discussed in the introduction, for a time schools were eliminating recess and physical education within children's school day to make more time for teaching academic subjects. It appears that over time children were not making academic gains. The elimination of physical activity had negative results that schools were not expecting. Although this study did not demonstrate my hypothesis that a positive correlation between participation in a structured motor program would have a positive impact on the participant's pre-literacy skills, there is evidence indicating otherwise. Research indicates children having exposure to physical activity ranging from structured physical education classes to simple motor activities that are done within the classroom throughout the school day enhances brain function and generates cognitive and physiological benefits. The literature is clear about the impact mature motor skills have on the development of children. It also stresses the impact it has on brain

development. Motor activity is important for facilitating the brain and body working together to promote development and prepare children for learning and school success.

References

- A Chance to Grow (2011). *SMART pre-k program guide*. Minnesota Learning Resource Center. Minneapolis, MN
- Apache, R. (2005). Activity-based intervention in motor skill development. *Perceptual and Motor Skill, 100*(3), 1011-1020.
- Barnett, W. S. (2002, September). *The battle over Head Start: What the research shows*. Science and Public Policy. Briefing on the Impact of Head Start. Sponsored by the Federation of Behavioral, Psychological, and Cognitive Sciences, and the Foundation for Child Development.
- Blaydes, J. (2001). Advocacy: A case for daily quality physical education. *Teaching Elementary Physical Education, 12*(3), 9-12.
- Bodrova, E., & Leong, D. J. (2001). Tools of the mind: A case study of implementing the Vygotskian approach in American early childhood and primary classrooms. *Innodata Monographs, 7*.
- Bos, Bev (2003). Lecture Handouts: Creative Music and Language Presentation. Bev Bos and Michael Leeman.
- Brain Gym® (2011). Brain Gym® International/Educational Kinesiology Foundation. Ventura, CA.
- Bradfield, T. (2008, June). *Why do we assess young children. Early childhood assessment: Why, what, how*. Washington, DC: The National Academies Press.
- Bredenkamp, S., & Copple, C. (Eds.). (1997). *Developmentally appropriate practice in early childhood programs* (revised ed.). Washington, DC: National Association for the Education of Young Children.
- Bricker, D., Capt, B, Johnson, J., Pretti-Frontzak, K., Straka, E., & Waddell, M. (2002). *Assessment, evaluation, and programming system for infants and children (AEPS) Birth-3* (2nd Ed.). Baltimore, MD: Brooks Publishing.
- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard Press.
- Building the brain's "air traffic control" system: How early experiences shape the development of executive function*. (2011). Center on the Developing Child at Harvard University. Retrieved from <http://www.developingchild.harvard.edu>.

- Burger, K. (2010). How does early childhood care and education affect cognitive development? An international review of the effects of early interventions for children from different social backgrounds. *Early Childhood Research Quarterly* 25, 140-165.
- Bushnell, E. W. & Boudreau, J. P. (1993). Motor development and the mind: The potential role of motor abilities as a determinant of aspects of perceptual development. *Child Development* 64, 1005-1021.
- Bzoch, K. R., League, R., & Brown, V. (2003). *The REEL-3: The receptive-expressive emergent language test* (3rd Ed.). Austin, TX: Linguisystems: ProEd.
- Canto. (2014). www.power-of-speech.com/learn-to-read.html
- Castro, G., & Mastriopieri, M. A. (1986). The efficacy of early intervention programs: A meta-analysis. *Exceptional Children*, 52(5), 417-424.
- Clark, J.E. & Metcalfe, J.S. (2002). The mountain of motor development: A metaphor. In Clark & Humphrey (Eds), *Motor development: Research and reviews* (vol. 2, pp 163-190). Reston, VA: National Association of Sport and Physical Education.
- Clarke-Stewart, K. A., Vandell, D. L., Burchinal, M., O'Brien, M., & McCartney, K. (2002). Do regulable features of child-care homes affect children's development? *Early Childhood Research Quarterly*, 17(2002), 52-86.
- Connell, G., & McCarthy, C. (2013). *A moving child is a learning child*. Minneapolis, MN: Free Spirit Publishing.
- Copeland, K. A., Sherman, S. N., Kendeigh, C. A., Kalkwarf, H. J., & Saelens, B. E. (2012). Societal values and policies may curtail preschool children's physical activity on child care center. *Pediatrics*, pp. 1-10.
- Deli, E., Bakle, I., & Zachopoulou, E. (2006). Implementing intervention movement programs for kindergarten children. *Journal of Early Childhood Research*, 4(5), 5-18.
- Dodge, D. T., Colker, L. J., & Heroman, C. (2002). *The creative curriculum for preschool* (4th Ed.). Bethesda, MD: Cengage Learning.
- Draper, C. E., Achmat, M., Forbes, J., & Lambert, E. V. (2012). Impact of community-based programme for motor development on gross motor skills and cognitive function in preschool children from disadvantaged settings. *Early Child Development and Care*, 182(1), 137-152.

- Estrada, H. M. (2012). School finds active kids makes smarter students. *StarTribune*. Retrieved from <http://www.startribune.com/printarticle/?id=148459015>.
- Favazza, P. C., Zeisel, S., Odom, D., Parker, R., & LeBeouf, L. (2011). *Young athletes study fact sheet*. University of Massachusetts: Center for Social Development and Education.
- Fjortoft, I. (2001). The natural environment as a playground for children: The impact of outdoor play activities in pre-primary school children. *Early Childhood Education Journal*, 29(2) 111-117.
- Gabbard, C., & Rodrigues, L. (2007). Optimizing early brain and motor development through movement. *Early Childhood News*. Retrieved from http://www.earlychildhoodnews.com/earlychildhood/article_view.aspx?article id=360.
- Gallahue, D. L. (2005). *Developmental physical education*. Human Kinetics publication.
- Gebhard, B. (2010, November). What are early learning guidelines and why are they important. *Zero to Three*, pp. 1-8.
- General growth outcomes for children between birth and age eight*. (2010). National Survey to Validate General Growth Outcomes for Children between Birth and Age Eight.
- Gewertz, C. (2011, November 4). Aligning early childhood learning with elementary education. *Education Week*.
- Goodway, J. D., & Branta, C. F. (2003). Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Exercise Sport*, 4(1) 36-46.
- Gopnik, A., Meltzoff, A.N. & Kuhl, P. (2001) *The scientist in the crib: what early learning tells us about the mind*. New York, NY. Perennial Publishing
- Graff, L. (2013). Use music to enhance students motor and cognition development. *LRP Publications*.
- Greenough, W. T., & Black, J. E. (1992). Introduction to brain structure by experience: Substrates for cognitive development. In M. Gunner and C. Nelsons (Eds.) Minnesota Symposium on Child Psychology. *Developmental Behavioral Neuroscience* 24, 155-200.

- Guernsey, L. (2009, May 13). New findings link the "fade-out" phenomenon to high-poverty schools. *New America Foundation: The Early Ed Watch Blog*. Retrieved from <http://www.newamerica.net/blog/.../new-findings-link-fade-out-phenomenon.-11749> [web log comment].
- Gunnar, M. R. (2001). The effects of early deprivation: Findings from orphanage-reared infants and children. *Handbook of Developmental Cognitive Neuroscience*.
- Guralnik, M. J. (1998). Effectiveness of early intervention for vulnerable children: A developmental perspective. *American Journal on Retardation, 102*(4,) 319-345.
- Hirsh-Pasek, K., Berk, L. E., Golinkoff Michnick, R., & Singer, D. G. (2010). *A mandate for playful learning in preschool: Presenting the evidence*. Oxford University Press. doi: 10.1073/acprof:oso/9780195382716.003.002.
- Hull, J. (2012). *Starting out right: Pre-k and kindergarten*. Center for Public Education. Retrieved from <http://www.centerforpubliced.org>.
- Jarrett, O., & Waite-Stupiansky, S. (2009). Recess-it's indispensable! *Young Children*, pp. 66-69.
- Klintsova, A. Y., Dickson, E., Yoshida, R., & Greenough, W. T. (2004). Altered expression of BDNF and its high-affinity receptor to complex motor learning and moderate exercise. *Brain Research, 1028*(1), 92-104.
- Lamont, B. (n.d.). *Learning and movement*. Development Movement Consultants. Retrieved from www.developmentalmovement.org.
- Leitschuh, C. (2013). *Critical learning through movement*. Minneapolis, MN: The University of Minnesota: unpublished raw data.
- Mazzeo, D., Arens, S. A., Germeroth, C., & Hein, H. (2012). Stopping childhood obesity before it begins. *Phi Delta Kappan, 93*(7), 10-15.
- McConnell, S. R., Wackerle-Hollman, A., & Bradfield, T. (2004). *Individual growth and developmental indicators (IGDIs)*. Minneapolis, MN: University of Minnesota, Early Learning Labs.
- McConnell, S. R., Wackerle-Hollman, A. K., Roloff, T. A., & Rodriguez, M. (2015). Designing a measurement framework for response to intervention in early childhood programs. *Journal of Early Intervention, 36*(4), 263-280.

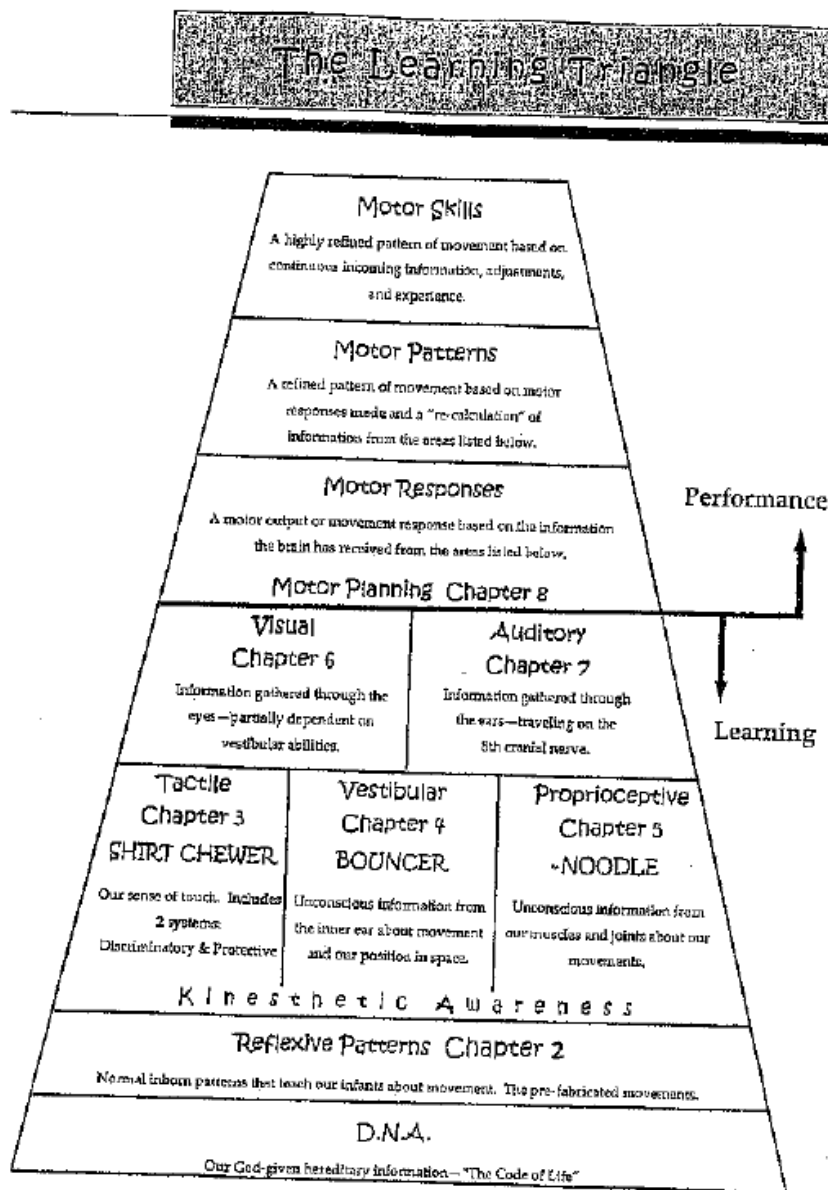
- Meisels, S. J., Marsden, D. B., Jablon, J. R., Dorfman, A. B., & Dichtelmiller, M. (2014). *Work sampling system* (4th ed.). San Antonio, TX: Pearson Education Incorporated.
- Miller, G., Franzen, C., & Lieberman, J. (2010) *A chance to grow: Head Start and S.M.A.R.T.-early childhood follow-up study: Elementary school results in Detroit Lakes, Minnesota. A Chance to Grow*. Retrieved from <http://actg.org>.
- Miller, G., Franzen, C., Lieberman, J. & McLaughlin, C. (2010). *A chance to grow executive summary: SMART early childhood demonstration project*. Minneapolis, MN: A Chance to Grow. Retrieved from <http://www.actg.org>.
- Minnesota Department of Education. (2005). *The Minnesota school readiness year three study: Developmental assessment at kindergarten entrance fall 2004*. St. Paul, MN: Minnesota Department of Education.
- Minnesota Department of Education. (2007). *The Minnesota school readiness study: Developmental assessment at kindergarten entrance*. St. Paul, MN: Minnesota Department of Education.
- Minnesota Developmental Adapted Physical Education Leadership Committee and the Minnesota Department of Education. (2003). *Active learning: a resource guide for designing and implementing developmentally appropriate movement experiences for young children ages 3 to 5 in home, school and community environments*. Minneapolis, MN
- Missall, K. N., & McConnell, S. R. (2004). *Psychometric characteristics of individual growth and development indicators: Picture naming, rhyming, and alliteration*. Minneapolis, MN: Early Childhood Research Institute on Measuring Growth and Development.
- Morgan, E. (1989). *The insite developmental checklist: A comprehensive developmental checklist for multi-handicapped sensory impaired infants and young children*. Logan, UT: Hope, Inc.
- National Association for the Education of Young Children. (2009). *Play, policy, and practice interest forum*. Paper from the National Association for the Education of Young Children, Washington, DC.
- National Association for the Education of Young Children and the National Association of Early Childhood Specialists in State Departments of Education. (2002). *Early learning standards creating conditions for success*. Washington, DC: National Association for the Education of Young Children.

- National Research Council. (1999). *Starting out right: A guide to promoting children's reading success*. Washington, DC: The National Academy Press.
- National Symposium on Early Childhood Science and Policy. (n.d.). *The science of early brain development can inform investments in early childhood*. Retrieved from www.developingchild.harvard.edu.
- Nelson, C. A. (2014). *Romania's abandoned child. Deprivation, brain development and the struggle for recovery*. Harvard University Press.
- Neumann, S. B., Copple, C., & Bredekamp, S. (1999). *Learning to read and write: Developmentally appropriate practice for young children*. Washington, DC: National Association for the Education of young Children.
- Nodding, N. (2005). What does it mean to educate the whole child: In a democratic society, schools must go beyond teaching fundamental skills. *Educational Leadership*, pp. 8-13.
- Oden, A. (2006). *Ready bodies, learning minds*. Spring Branch, TX: David Oden.
- Owacki, G. (2001). *Make way for literacy*. Portsmouth, NH: National Association for the Education of Young Children.
- Pica, R. (1997). Beyond physical development: Why young children need to move. *Young Children*, 52(6), 4-11.
- Piek, J. P., Dawson, L., Smith, L. M., & Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human Movement Science* 27, 668-681.
- Piek, J. P., Dyck, M. J., Nieman, A., Anderson, M., Hay, D., Smith, L. M., McCoy, M., & Hallmayer, J. (2004). The relationship between motor coordination, executive functioning and attention in school-aged children. [abstract] *National Academy of Neuropsychologist*, pp. 361-370.
- Pieters, S., DeBlock, K., Scheiris, J., Eyssen, M., Desoete, A., Deboutte, D. & Roeyers, H. (2011). How common are motor problems in children with a developmental disorder: Rule or exception? *Child: Care, Health and Development*, 38, 139-145.
- Provence, S., & Lipton, R. C. (1962). *Study of the emotional reactions of children and family to hospitalization. Infants in Institutions*. London: Bay & Swinfen.

- Rampmeyer, K. (2000). *Appropriate practices in movement programs for young children ages 3-5*. Reston, VA: National Association for Sport and Physical Education.
- Ratey, J. (2011). Spark: The revolutionary new science of exercise and the brain. *Marin Medical Society, 57*(3).
- Sameroff, A. (Ed.). (2009). *The transactional model of development: How children and contexts shape each other*. American Psychological Association.
- Sanders, S. W. (2002). *Active for life: Developmentally appropriate movement programs for young children*. Washington, DC: National Association for the Education of Young Children.
- Sartell-St. Stephen Independent School District #748. (2013). *Academic and Activities Calendar, 2013-2014*.
- Shonkoff, J. P., & Hauser-Cram, P. (1987). Early intervention for disabled infants and their families: A quantitative analysis. *Pediatrics, 80*(5) 650-658.
- Shonkoff, J. P., & Phillips, D. A. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy of Sciences.
- Snow, K. (2011a). *Developing kindergarten readiness and other large-scale assessment systems: Necessary considerations in the assessment of young children*. Washington, DC: National Association for the Education of Young Children.
- Snow, K. (2011b). *Research news you can use: Debunking the play vs. learning dichotomy*. Retrieved from <http://www.naeyc.org>.
- Snow, K. (2012). *Research news you can use: More threats to preschoolers' play*. Retrieved from www.naeyc.org.
- Snow, K. L. (2006). Measuring school readiness: Conceptual and practical considerations. *Early Education and Development, 17*(1), 7-41.
- Staley, L., & Portman, P. A. (2000). Red rover, red rover, it's time to move over. *Young Children, 55*(1), 72.
- The White House. (2002). *Good start, grow smart: The Bush administration's early childhood initiative*. Retrieved from <http://www.georgewbush-whitehouse.archives.gov/infocus/earlychildhood.html>.

- Thompson, S. (2008). *Handy learning: Activities for hand development and curriculum enhancement*. Flower Mound, TX: Handy Learning Seminars.
- Trawick-Smith, J. (2010). *From playpen to playground: The importance of physical play for the motor development of young children*. Head Start Body Start: National Center for Physical Development and Outdoor Play.
- Tremarche, P. V., Robinson, E. M., & Graham, L. B. (2007). Physical education and its effect on elementary testing results. *Physical Educator*, 64(2), 58-64.
- US Department of Health and Human Services Programs and Initiatives. (2009). *Race to the top: Early learning challenge American recovery and reinvestment act*. Washington, DC: US Department of Health and Human Services.
- Warshaw, S. P. (2011). *HELP strands curriculum-based assessment birth to three*. Vort Corporation.
- Waters, N. S., Klintsova, A. Y., & Foster, T. C. (1997). Insensitivity of the hippocampus to environmental stimulation during postnatal development. *The Journal of Neuroscience*, 17(20), 7967-7973.
- Ziglar, E. F., & Bishop-Josef, S. J. (2006). *The cognitive child vs the whole child: Lessons from 40 years of Head Start*. Oxford University Press. 2006. Published on-line. DOI: 10.1093/acprof:oso/9780195304381.003.0002.
- Ziglar, E. F., Singer, D. G., & Bishop-Josef, S. J. (Eds.) (2004). *Children's play: The roots of reading. Zero to three*. Washington, DC.

Appendix A: Learning Triangle



Adapted from: Strauss 1985; Oden 2002

Appendix B: Parent Consent and Motor Program Information Sheet

Physical Activity/Pre-Literacy Study Parental/Guardian Consent Form

My name is Julie Hoppe, I am an Early Childhood Special Education Teacher in the Sartell School District and a Graduate student attending St. Cloud State University. This form is being sent to ask your permission to allow your child to participate in a study being conducted for my Master's Degree at St. Cloud State University. This form must be signed and returned to school before your child can participate in the study.

Background Information and Purpose

It is my intent to determine whether regular physical activity during the preschool day benefits cognitive skills, particularly pre-literacy skills. Collection of this data will provide information regarding curriculum planning and aligning K-12 standards.

Procedures

Two preschool classrooms will be selected for the study. All children in each classroom will be assessed using the Individual Growth and Development Indicators (IGDIs) as this is one of the assessment tools the early childhood program will be using to assess pre-literacy skills. One classroom will be considered the "control" group, meaning they will receive no interventions or treatments. The second classroom will participate daily in a motor curriculum called S.M.A.R.T. –E.C. (Stimulating Maturity through Accelerated Readiness Training- Early Childhood) for 8 weeks. This curriculum was introduced in the school readiness curriculum last school year. Attached to this form is a description of the basic scope of the curriculum, you may keep this information sheet for future reference. At the end of the 8 treatment weeks both groups will be assessed again using the IGDIs to determine whether there were gains in pre-literacy skills.

Risks

There are no foreseeable risks associated with participating in this study.

Benefits

Data will be collected during this study to compare pre and post treatment pre-literacy skills. It is anticipated that the data collected will be used for educational purposes and curriculum planning only.

Confidentiality

In addition to using data for the final thesis paper that will remain on permanent file at the St. Cloud State University Miller Learning Resources Center (library), data may also be published in professional journals at a later time. At no time during the study or reporting findings will your child's name be used in any manner.

Research Results

The data collected is anticipated to be used to inform current practice in early childhood education and guide curriculum development within the Sartell Early Childhood Program.

Contact Information

If you have questions or concerns regarding this study you may contact me at (320- or email me at Julie.hoppe@sartell.k12.mn.us. You may also contact the Sartell Early Childhood Program Coordinator Barb Eckberg at (320- or email at eckbergb@rocori.k12.mn.us.

Voluntary Participation

Participation in the study is completely voluntary and you can withdraw your child without any penalty or harm to him/her in regard to his/her participation in the school readiness program. Parents desiring not to have their child participate in the study will continue in the school readiness program with their class. My graduate advisor from St. Cloud State University, Dr. JoAnn Johnson, may come and observe the activity and/or preschool classroom and make suggestions as needed.

Acceptance to Participate

Your signature indicates that you have read the information provided here and have decided to allow your child to participate. You may withdraw your child from the study at any time without penalty or negative consequences after signing this form.

I look forward to having the children participate in this study and I thank you in advance for your cooperation as I continue to complete my graduate study at St. Cloud State University.

School Readiness Class Consent Form HOPPE Study

Please return to Julie Hoppe as soon as possible or at the latest by September, 21 2012.

- o I grant permission for my child to participate in the master's study conducted by Julie Hoppe.
- o I understand that the study involves several steps which are:
 - Students will be assessed pre-treatment and post-treatment using the IGDIs
 - Half the study sample will participate in the S.M.A.R.T.-E.C. activities as the treatment group
 - Half the study sample will not participate in the S.M.A.R.T.-E.C. activities as the control group
 - S.M.A.R.T.-E.C activities will be part of center time and the students involved will not miss any academic or socialization activities as they will be participating with their classmates and will have ample opportunities to participate in the center time activities.
- o I realize that data will be collected and may be used at educational conference/seminars, as well as courses at St. Cloud State University designed to train future early childhood/special education teachers.

- o I realize that the results of the study may be used in professional publications at a later date.
- o I understand that confidentiality will be maintained and that my child's name will not be used in any manner while conducting the study or reporting results of the study.
- o I further understand that I can withdraw my child from the study at any time if I desire without any harm in regard to his/her educational participation.
- o A copy of this signed consent will be sent home for your records.

Student Name (printed)

Parent/Guardian Name (printed)

Parent/Guardian Signature

Date

Fall 2013

Dear Family,

As part of the motor activity/pre-literacy study, your child will be participating in an exciting program called S.M.A.R.T. Pre-K, which stands for Stimulating Maturity through Accelerated Readiness Training. S.M.A.R.T. Pre-K is a multi-sensory approach to learning for 3 - 5 year olds that involves brain stimulation activities to help prepare your child to learn. This program develops visual, auditory, balance, fine and gross motor skills, which are all essential for classroom and academic success. The S.M.A.R.T. Pre-K Activities also improve your child's physical fitness, strength, coordination and ability to pay attention. Once these readiness skills are in place, your child will have the foundation necessary to succeed in school.

S.M.A.R.T. Pre-K Activities involve a number of purposeful exercises, including:

- Crawling
- Spinning
- Creeping
- Balancing

- Overhead Ladder

- Rolling

The S.M.A.R.T. Pre-K Activities will be integrated into the daily classroom schedule in a fun and positive way to help your child reach his/her learning potential. If you have any questions, please do not hesitate to contact me.

Sincerely,

Julie Hoppe, ECSE Teacher

Appendix C: Administration Program Permission

<p>DR. JOSEPH HILL 320-656-3715 Superintendent of Schools Fax 320-656-3785 Email joseph.hill@sartell.k12.mn.us</p>		<p>GREG JOHNSON 320-253-8303 Principal Fax 320-253-8303 Email johnsongreg@sartell.k12.mn.us</p>
---	---	--

Sartell-St. Stephen School District No. 748
PINE MEADOW ELEMENTARY
 1029 North 5th Street
 SARTELL, MN 56377

8/29/2012

To whom it may concern,

Julie Hoppe, Early Childhood Special Education staff member has permission to conduct a study of motor development and pre-literacy skills using children attending the early childhood school readiness program. She has discussed the plan of study with me and the coordinator of the early childhood programs and we are in agreement to allow Julie to conduct the study.

Sincerely,



Greg Johnson, Principal
 Pine Meadow Elementary
 Sartell-St. Stephen School District #748
 1029 N 5th Ave
 Sartell, MN 56377
 320-253-8303

Appendix D: Institutional Review Board Permission—St. Cloud State University



OFFICE OF RESEARCH AND
SPONSORED PROGRAMS
ST. CLOUD STATE UNIVERSITY

Institutional Review Board (IRB)

Administrative Services 210
Website: stcloudstate.edu/osp Email: osp@stcloudstate.edu
Phone: 320-308-4932

Name: Julie Hoppe
Address: 24228 County Road 75
St. Cloud, MN 56301
Email: mjahoppe@gmail.com

**IRB APPLICATION
DETERMINATION:
APPROVED**

Co-Investigator:

Project Title: Impact of Motor Activity on Pre-Literacy Skills

Advisor: JoAnn Johnson

The Institutional Review Board has reviewed your application to conduct research involving human subjects. Your project has been: **APPROVED**

--IRB approval of a project expires upon the date shown at the bottom of this letter. The researcher must submit a Continuing Review/Final Report form in advance of the expiration date to report conclusion of the research or to request an extension.

--Informed consent documents must display the IRB's official stamp which shows approval and expiration dates. A stamped copy of the informed consent documents will be provided to the researcher upon IRB approval of the study.

--The researcher must seek approval for any changes in the study (its design, the consent process, funding sources, etc.).


--Adverse events (research related injuries or other harmful outcomes) must be reported to the IRB as soon as possible.

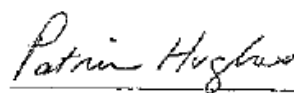
--The IRB reserves the right to review the research while it is in progress or when it is completed.

Good luck on your research. If we can be of further assistance, please contact the Office of Sponsored Programs at 320-308-4932 or email liddonnay@stcloudstate.edu. Please use the SCSU IRB number listed on any of the forms submitted which relate to this project, or on any correspondence with the IRB.

For the Institutional Review Board:

For St. Cloud State University:


Linda Donnay
IRB Administrator
Office of Sponsored Programs


Patricia Hughes,
Interim Associate Provost for
Research Dean of Graduate Studies

OFFICE USE ONLY

SCSUIRB# 1254 - 1509
Type of Review: Expedited

Today's Date: 12/19/2013
APPROVED: 12/12/2013
Expiration Date: 12/11/2014

St. Cloud State University IRB Continuing Review / Final Report



OFFICE OF RESEARCH AND
SPONSORED PROGRAMS
ST. CLOUD STATE UNIVERSITY.

Principal Investigator: Julie Hoppe

Co-Investigator:

Project Title: **Impact of Motor Activity on Pre-Literacy Skills**

1. Please indicate the status of your project:

This form serves as a *Final Report* -

Project has been completed.

Data collection has been completed but data analysis continues.

The project has not and will not be conducted. (Explain below.)

This form serves as a *Continuing Review* -

Subject recruitment/enrollment continues; current consent/assent required, please attach.

Data collection continues with enrolled subjects; no additional subjects will be recruited.
2. How many subjects have participated in your study? _____
3. Have any unexpected reactions, complications, or problems occurred during this research?
 No Yes (If yes, explain below.)
4. Have any subjects withdrawn from the research—either voluntarily or at the researcher's request?
 No Yes (If yes, explain below.)
5. Have any subjects complained about the research?
 No Yes (If yes, explain below.)
6. Has any new information been identified that may affect the willingness of current or future subjects to participate in this research?
 No Yes (if yes, explain and indicate how it was or will be conveyed to subjects.)
7. Have any changes been made to your research (including changes to informed consent documents, debriefing statements, recruitment materials, etc.) since it was approved by the IRB?
 No Yes (If yes, explain and indicate whether changes were submitted to the IRB.)

Principal Investigator's Signature _____

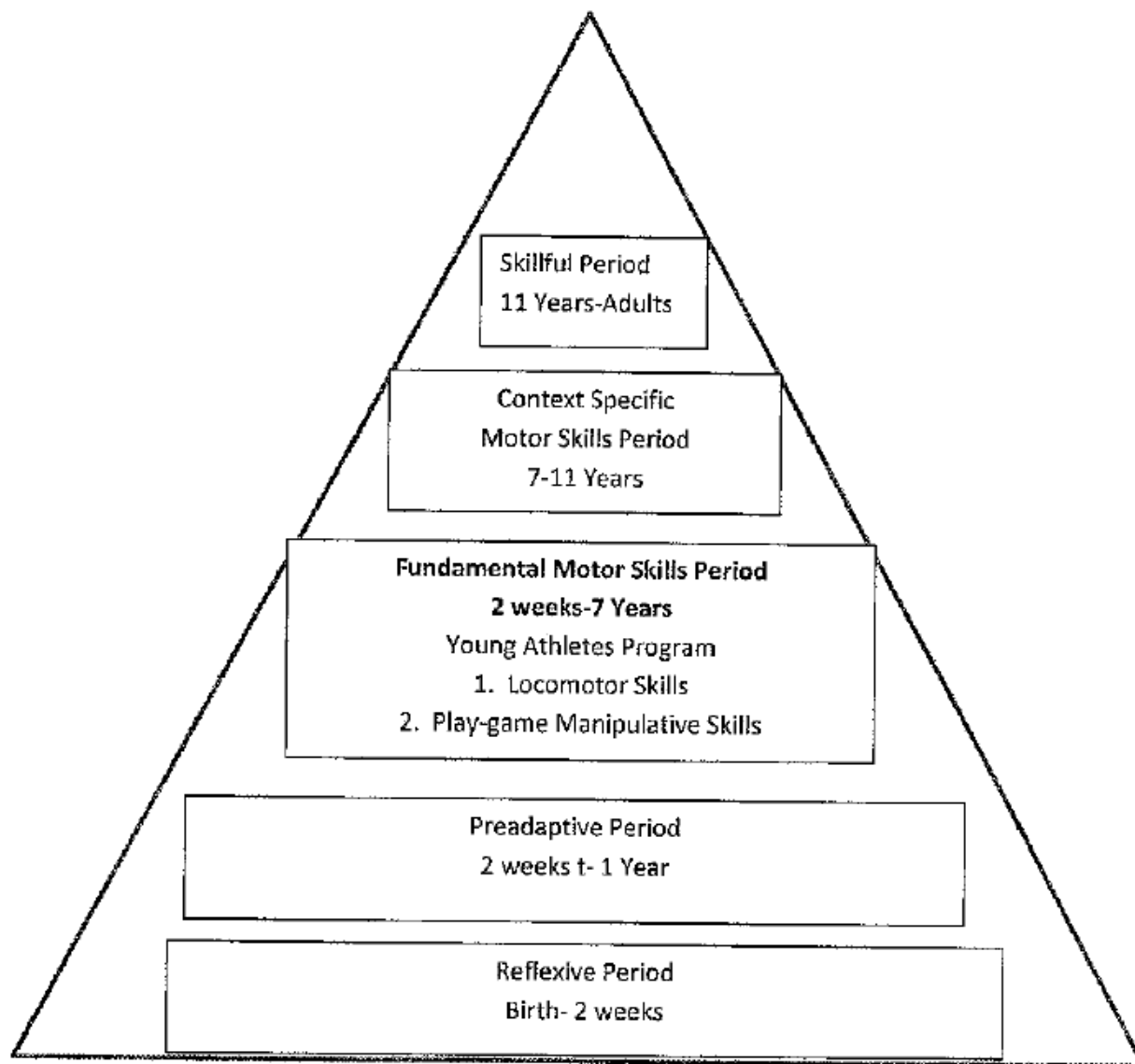
Date _____

SCSU/IRB# 1254 - 1509

Appendix E: Mountain of Motor Development

Mountain of Motor Development

(Adapted from Clarke, 1994, Clarke, 2005 and Metcalfe, 2002)



Appendix F: Sample of S.M.A.R.T. Movement Activities

Reflexive Activities

Superman

*Tonic Labyrinthine Reflex (TLR)
in prone Integration*



Popcorn

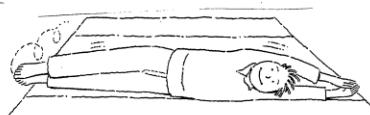
*Tonic Labyrinthine Reflex (TLR)
in supine Integration*



Balance and Vestibular Activities

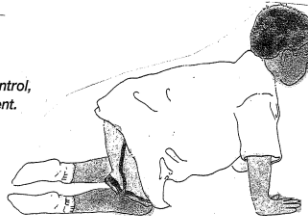
Pencil Rolls

*To develop proprioception
and low-level vestibular and
visual skills.*



Stable Table

*To improve body concept and
develop better balance and control,
both stationary and in movement.*



Gross Motor Activities

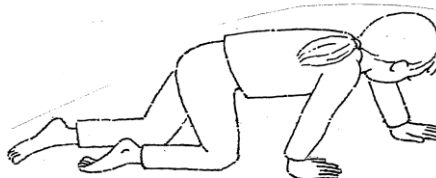
Alligator Crawl

*To develop coordination at the
basic level and integrate both
sides of the brain.*



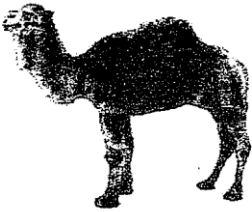
Free Creep

*To develop balance, depth
perception, eye-hand
coordination, bilateral
coordination and eye teaming.*

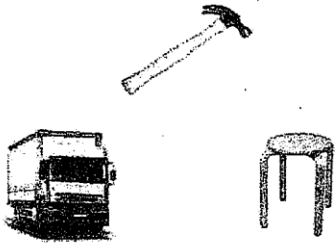


Appendix G: Sample of IGDl's Stimulation Flash Cards

Picture Naming

	<p style="text-align: right;">4 ID: 30175</p> <p style="text-align: center;">Camel</p>
---	---

Rhyming and Alliteration

	<p>Let's do some more. You show me which two rhyme.</p> <p style="text-align: center;">Tool</p> <p style="text-align: center;">Stool Truck</p> <p><small>Prompt: _____ rhymes with _____? Is it _____ (stool) or _____? (Remember: rhymes start to end except for the first letter.)</small></p>
--	---

Letter Recognition

<p style="text-align: center;">B E X</p>	<p style="text-align: right;">1 ID: 10099</p> <p>Okay, let's do some more.</p> <p style="text-align: center;">X E B</p> <p><small>Prompt: Which one makes the sound /.../?</small></p>
---	---