THE EFFECTS OF TWO MOTOR SKILL INTERVENTIONS ON PRESCHOOL CHILDREN’S OBJECT CONTROL SKILLS AND THEIR PERCEIVED MOTOR COMPETENCE

DISSERTATION

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Abstract

The purpose of this study was to investigate the effects of two motor skill interventions (center-based and center plus family) on children’s object control skill performance and their perceived motor competence. Children (N=72) were mostly African American (97%) and drawn from two Head Start centers in a large urban Midwestern city. Children (M age = 48.41 months) were randomly assigned to a motor skill intervention (MSI; n=22), a motor skill family intervention (MSFI; n=25) or a comparison group (n=25). All groups received the same regular Head Start curriculum. The MSI and MSFI groups received a motor skill program consisting of 16, 30-min. sessions over 8 weeks. The MSFI group also received the addition of a series of parent-child motor activities incorporating 24 sessions over 8 weeks. The Comparison group did not receive any structured motor skill program. The Object Control Skill (OC) subscale of Test of Gross Motor Development (TGMD-2; Ulrich, 2000) and the perceived motor competence subscale of the Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA; Harter & Pike, 1984) were utilized to assess participants’ OC skill performance and their perceived motor competence at the pretest, posttest and retention test. Prior to the interventions, children in all groups demonstrated developmental delays (below the 25%) in OC skills and had “pretty good” perceptions about their motor competencies. A 3 Group X 2 Gender ANOVA analysis showed a non-significant group and gender differences in OC skill performance and perceived motor competence in
groups at pretests. After the 8 week interventions, a 3 Group X 2 Time X 2 Gender of ANOVA with repeated measures was conducted on OC standard scores and perceived motor competence of children. The results indicated a significant Group X Time interaction for OC skills ($p = .00$) and perceived motor competence ($p = .00$) showing that Groups differed from pretest to posttest. Three separate contrasts were run to examine where the differences were reported. The MSI and the MSFI groups were significantly different from the Comparison group ($p < .017$), but both group were not significantly different in OC skills. The MSFI was significantly different ($p < .017$) from the MSI and the Comparison group in perceived motor competence. A non-significant gender differences was reported within and between the groups ($p > .05$) from pretest to posttest for both variables. A 3 Group X 2 Time X 2 Gender of ANOVA with repeated measures was also conducted for posttest to retention test changes in OC skill performance and perceived motor competence. The results indicated a significant Group X Time interaction for OC skills ($p = .00$) and perceived motor competence ($p = .01$) showing that Groups differed from posttest to retention test. Three separate contrasts were run to examine where the differences were reported. The MSI ($p = .00$) and the MSFI ($p = .01$) was significantly different from the Comparison group over time, but, both groups were not significantly different from posttest to retention test in OC skills. For perceived motor competence, a non-significant difference was found between the MSI and the Comparison ($p = .38$) and between the MSI and the MSFI ($p = .54$).
However, the MSFI was significantly different from the Comparison group over time \((p = .007)\). A paired sample \(t\)-test as a follow up showed a significant decrease in the MSFI \((p = .002)\) over the time. In a conclusion, children who were at risk improved their OC skill performance and perceived motor competence as a result of the interventions. Future research is warranted to examine the different instructional approaches in motor development to find effective approaches.
This document is dedicated to my Family and my Fiancé.
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CHAPTER 1
INTRODUCTION

Individuals use their movement repertoires to participate in various physical activities across their lifespan (Gallahue & Ozmun, 2006). This movement repertoire is developed as a result of combination of many factors such as experience, motor competencies, enjoyment, and environmental or individual constraints (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009). In this movement repertoire, fundamental motor skills (FMS) are the primary skills in which individuals ages 2-7 should gain a proficient level of competency in order to apply them for lifelong physical activities, sports and games (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009; Seefeldt, 1980; Stodden et al, 2009). In addition, research on FMS indicates that FMS proficiency may be positively associated with fitness (Barnett, Beurden, Morgan, Brooks, & Beard, 2008), body composition (Okely, Booth, & Chey, 2004), outside-school physical activity (Raudsepp & Pall, 2006), habitual physical activity (Fisher et al., 2004) and perceived motor competence of children (Goodway & Rudisill, 1997; Stodden & Goodway, 2007). It is argued that children with advanced levels of FMS proficiency are more likely to participate in physical activities and develop future habits for physical activities (Clark & Metcalf, 2002; Stodden et al., 2008).
Fundamental motor skills have been seen as the “building blocks” for lifetime physical activities (Payne & Isaacs, 2007) and as “the ABCs of movement” (Goodway & Robinson, 2006). A general misconception about FMS is that children acquire those skills naturally as a result of growth and maturation (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009; Goodway & Robinson, 2006). But, children need developmentally appropriate practice opportunities and specific skill related feedback in order to develop FMS (Gabbard, 2007; Payne & Isaacs, 2007). In other words, systematic motor skill instruction should be provided for children to learn and practice FMS during the early years. The motor development literature (Gallahue & Ozmun; Gabbard, 2007; Payne & Isaacs, 2007) suggests that the ideal time to teach FMS is the early childhood years (2-7 years of age).

The National Association for Sport and Physical Education (NASPE) also recognizes the importance of acquiring FMS and physical activity participation for young children. A series of national physical activity guidelines called “Active Start” have been developed for infants, toddlers and preschoolers (NASPE, 2009). Active Start includes five main guidelines for preschoolers (ages 3 to 5) suggesting that a) children should participate in 60 minutes of daily planned physical activity, b) children should participate in at least 1 hour (up to several hours) of daily unplanned physical activities, c) children should gain motor skill competency which is important to engage in more complex movement tasks, c) physical activity participation of children should be encouraged in safe and stimulating indoor and outdoor settings, and, d) the primary caregivers of children should understand the value of physical activity participation and motor skill
competency for their children by providing practice opportunities for both planned and unplanned physical activities (NASPE, 2009).

Unfortunately, children in certain populations do not have equal opportunities to participate in physical activities and develop FMS. There are disparities in the physical activity levels of different groups with low income and minority children having lower physical activity levels than their middle income and White peers (Taylor, Baranowski, & Young, 1998). One population of low income and predominantly minority children are a group known as preschoolers who are at risk. This group of children are identified as needing early intervention services to support their development. Preschool children who are at risk have been shown to demonstrate developmental delays in their FMS (Goodway & Branta, 2003; Hamilton, Goodway, & Haubenstricker, 1999; Goodway, Crowe, & Ward, 2003; Goodway & Rudisill, 1997). These developmental delays in FMS have been found to be true across geographic region and ethnicity for preschool children who are at risk (Goodway, Robinson, & Crowe, 2010). According to the Annie E. Casey Foundation (AECF), there are large numbers of children who are low income (39% in Ohio and 40% in USA) and from single parent families (33% in Ohio and 34% in USA). It is clear that there are a high number of children who are at risk in the population and their disadvantaged circumstances may lead to persistent developmental delays in physical, cognitive, social-emotional and communication development of children, if early interventions are not designed for children at-risk (AECF, 2008).

Children with assessed developmental delays are protected by the Individuals with Disabilities Education Act (IDEA). The general aim of IDEA is to provide free early intervention (Part C for ages 0 to 2) and early education services (Part B for ages 3 to 21)
for children with disabilities (IDEA, 2004). Under IDEA law, children showing developmental delays in physical, cognitive, communication, social and adaptive development are categorized as children with disabilities (IDEA, 2004). Fourteen disability categories are also identified with one being a child with a developmental delay (IDEA, 2004). In addition to Federal Regulations, each State defines its developmental delay definitions and eligibility criteria. However, there are commonalities in the criteria used for the definition across States. For instance, the State of Ohio uses the same developmental areas; physical, cognitive, communication, social or emotional and adaptive development (Ohio Department of Education [ODE], 2008). The State also use “cognitive disability, emotional disturbance, speech or language impairment” instead of those common developmental areas (ODE, 2008). If children are identified as having developmental delays in those developmental categories, they receive early intervention services based on their specific needs (IDEA, 2004).

Another piece of national legislation is that identified for the “Head Start Act”. Head Start legislation and services focuses on the importance of early intervention and provides educational services for children at-risk of developing delays (Head Start Act, 2007). Head Start Programs operated by the Head Start Act identifies the need to provide compensatory preschool programs “to promote the school readiness of low-income children by enhancing their cognitive, social, and emotional development” (Head Start Act, 2007, pp 2.). The goals of Head Start are twofold: 1) to promote a caring learning environment to support children’s whole development, and; 2) to assist families of low income children by offering specific educational, nutritional or health related services (Head Start Act, 2007). A distinct characteristics of Head Start Programs is that parents
are identified as key teachers of their children and as such, there is an expectation that parents get involved in their children’s education. It is believed that parental involvement in a child’s education is one of the strategies to contribute to students’ school success (Michael, Dittus, & Epstein, 2007). The National Association for the Education of Young Children supports this view of parental involvement into early childhood education (NAEYC, http://www.naeyc.org/ece/). In addition to parental involvement, the nature of the home environment in supporting or “affording” motor development may be of relevance (Gabbard, Cacola, & Rodrigues, 2008; Rodrigues, Saraiva, & Gabbard, 2005). Home environment is found to be associated with children’s well being (Bradley, Corwyn, Burchinal, McAdoo, & Coll, 2001). However, little data is available with respect to involving parents in children’s motor skill development or the potential impact of affordances in the home environment on motor skill development.

The body of research on motor skill development of children has shown that children at-risk demonstrate developmental delays in FMS (Connor-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Goodway, et al., 2003; Goodway, et al., 2010; Goodway & Rudisill, 1996, 1997; Hamilton et al., 1999). The same literature also indicates that these children, when provided with motor skill instruction, significantly improved their locomotor and object control skill performances (Connor-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Goodway et al., 2003; Robinson & Goodway, 2009). However, only one study has been conducted that involved parents in the intervention process (Hamilton, et al., 1999). This study revealed that when parents provided instruction to their child (under the guidance of an expert in motor development), the children significantly improved their object control skills (Hamilton et al., 1999). This
study was limited in that the sample size was small and not randomly selected. There appears to be great potential for involving parents in promoting the motor development of young children, but limited data is available to guide this process.

A child’s motor competence is important to promoting physical activity engagement; however another important variable to consider in supporting physical activity behaviors is perceived motor competence (Stodden et al., 2008). Perceived motor competence is defined as children’s self perceptions about their capabilities in physical or motor domains (Harter, 1982; Harter & Pike, 1984). Perceived motor competence is a key motivational factor in supporting engagement in physical activities and sports (Harter, 1978; Harter & Pike, 1984; Stodden et al., 2008). It is argued that low levels of perceived motor competence might lead to disengagement in physical activities whereas high levels of perceived motor competence might lead to sustained engagement in physical activities (Goodway & Rudisill, 1997; Rudisill, 1989; Stodden & Goodway, 2007; Stodden et al., 2008).

During the preschool years, young children tend to have a high level of perceived motor competence as they are believed to have limited cognitive capacity to accurately assess their motor development (Goodway & Rudisill, 1997). However, as children get older and increase their cognitive capacities, their perceived motor competence becomes more accurate and aligned to their actual motor competence (Benenson & Dweck, 1986). For this reason, children with low actual motor competence will tend to have low perceived motor competence which in turn may negatively impact their engagement in physical activities and motor tasks during the early years (Harter, 1982; Harter & Pike, 1984; Stodden et al., 2008). One study has of children who were at-risk of developmental
delays in their motor skills had correspondingly low levels of perceived motor competence (Robinson, Rudisill, & Goodway, 2009). However, limited research is available on the relationship between actual motor skill competence and perceived motor competence. Thus, assessing children’s actual and perceived motor competence provides a better understanding of this relationship.

Summary

In summary, a large number of children are considered at risk of developmental delay in their early childhood years. Research has shown that preschool children who are at risk start preschool with developmental delays in their FMS. Research on young children shows that exposure to early intervention is effective in helping children remediate developmental delays and promote FMS development. The majority of these interventions has been taught by motor development experts and have not engaged parents in the intervention process. Furthermore, national organizations such as the NAEYC and NASPE highlight the importance of engaging parents in the intervention process. Due to the limited number of studies on parental involvement in motor skill development, the value of involving parents in motor intervention is not known. More research is needed to examine the influence of motor skill intervention on FMS development and additionally to understand whether parents can make a difference on their children’s motor development and their perceived motor competence.

Significance of the Study

This study is significant in that it focuses on the FMS development of a population of children for whom we have limited information, preschool children who are at risk. This study proposes to provide further evidence that early motor skill
intervention will impact both FMS development and also perceived motor competence. More specifically, it will also examine the role of parents in promoting actual motor competence. Only one study has been conducted in the motor development area investigating parental involvement in motor skill intervention for young children (Hamilton, et al., 1999). Thus, further work in this area is warranted. This study has the potential to change Head Start curriculum about the types of instructional activities that may be valuable in promoting the motor development and perceived motor competence of young children enrolled in a Head Start program.

Purpose of the Study

There were four primary purposes to the study. First, to identify baseline data on the object control (OC) skills and perceived motor competence of preschool children who are at risk. Second, the primary purpose of this study was to examine the effects of two motor skill interventions (motor skill intervention and motor skill family intervention) on the OC skills and perceived motor competence of young children. Third, this study aimed to examine the retention of any intervention effects on the OC skills and perceived motor competence of young children. Last, the study aimed to investigate the affordances in home environment for descriptive purposes.

Research Questions

The following are the research questions driving this study. They have been broken down into pretest, pretest to posttest differences, posttest, posttest to retention test differences and retention test.
Pretests Questions

1. To what extent do young children who are at risk present developmental delays in OC skills and low perceived motor competence?

2. Are there gender differences in pretest OC skills and perceived motor competence of young children who are at risk?

3. Are there group differences in pretest OC skills and perceived motor competence of young children who are at risk?

Pretest to Posttest Differences

4. Are there significant differences among groups from pretest to posttest for OC skills and perceived motor competence of young children who are at risk?

5. Are there significant group by gender differences from pretest to posttest for OC skills and perceived motor competence for young children who are at risk?

Posttest Questions

6. Are there group differences in posttest OC skills and perceived motor competence of young children who are at risk?

7. Are there gender differences in posttest OC skills and perceived motor competence of young children who are at risk?

Posttest to Retention Test Differences

8. Are there significant differences among groups from posttest to retention test for OC skills and perceived motor competence for young children who are at risk?

9. Are there significant group by gender differences from posttest to retention test for OC skills and perceived motor competence for young children who are at risk?
Retention Test Questions

10. Are there group differences in retention test OC skills and perceived motor competence of young children who are at risk?

11. Are there gender differences in retention test OC skills and perceived motor competence of young children who are at risk?

Question for Home Environment

12. What are the affordances in the home environment for young children who are at risk?

Delimitations of the Study

Delimitations of the study were as follows:

1. The children who participated in this study were from two Head Start Centers in a large Midwest urban city. Most participants were African American preschoolers (4 to 5 years old) from low income families.

2. The motor skill intervention was run by an instructor who had experience with children who have special needs and had two years experience in assisting a university course of motor development.

3. The motor skill intervention was implemented over an 8-week period with 16 sessions. Each session took 30 minutes and two object control skills were instructed in each session. The total instructional time for each object control skill was 65 min in total.

4. The motor skill instruction was provided in a mid-sized room with adequate developmentally appropriate equipment for everyone.
5. The motor skill family intervention was implemented over an 8 week period with 24 sessions in the child’s home environment. Each session, conducted by parents, took around 10 to 15 minutes.

Limitations of the Study

Limitations of the study were listed as follows:

1. The motor skill intervention was conducted at only one Head Start Center. The results of the study might be affected by the characteristics of that Head Start Center.

2. A multi-purpose room was utilized at the intervention site of Head Start Center because no gymnasium was located in the center. For skills like kicking and striking, space limitations influenced the selection of instructional activities.

3. The motor skill family intervention was conducted by the parents at the family home. The inability to control for the home environment and the appropriateness of the home environment to movement might limit the effectiveness of motor skill family intervention and intervention integrity.

4. Parents' education level and motivation to engage in the activities might limit the intervention integrity and adherence to the lesson plans. The inability to evaluate if the parent actually delivered the lesson plan as intended means that it is hard to determine intervention integrity.
Definition of Terms

1. **Fundamental Motor Skills**: Those skills are known as building blocks to more complex movement skills and necessary to develop in early ages to participate in a variety of physical activities and sports (Payne & Isaacs, 2007). It includes both object control and locomotor skills.

2. **Object Control (OC) Skills**: Object control skills contain object manipulation (Payne & Isaacs, 2007). Throwing, catching, kicking, striking, rolling and bouncing are the object control skills included in this study.

3. **Locomotor Skills**: Locomotor skills refers to movements to change body positions from one place to another place (Haywood, & Getchell, 2009). Running, walking, jumping, hopping, skipping, sliding, and leaping are locomotor skills.

4. **Perceived Motor Competence**: It refers to individuals’ perceptions about their motor capabilities or competencies on motor activities or certain motor skills (Harter, 1982; Harter & Pike, 1984). Perceived motor competence is related to individuals’ achievement motivation (Harter, 1978, 1982).

5. **Actual Motor Competence**: It refers to individual’s actual performance on motor activities or certain motor skills (Goodway & Rudisill, 1997).

6. **Children At-Risk of Developmental Delay**: Those children are identified as being at risk of a developing delay in one or more developmental categories (e.g. physical or social) due to biological and/or environmental situations (IDEA, 2004).

7. **Early Intervention**: An early intervention is a special instruction or program designed to enhance physical, cognitive, social or emotional development of
children who are categorized as children with developmental delays (Sandall, Hemmeter, Smith, & McLean, 2005).

8. *Family Based Intervention*: Family based interventions include all or some of family members to achieve their missions (Kitzman & Beech, 2006). Interactions between children and family members are key to perform set of practices together (Sandall et al., 2005; Ward, Saunders, & Pate, 2007).

9. *Parent*: The primary caregiver is considered as a parent in this study. Father, mother, grandmother or grandfather might be a primary caregiver of children.

10. *Direct Instruction*: Direct instruction is a highly structured instructional technique in which teachers decide all aspects of their learning environment (e.g. start time, stop time, task, pace of the class, or class organization) (Graham, Holt-Hale, & Parker, 2007).

11. *Affordances in the home environment*: Affordances refers to opportunities in a home environment that supports motor development of children. For example, availability of toys, materials, objects and space are categorized as affordances (Rodrigues et al., 2005).
CHAPTER 2
LITERATURE REVIEW

This chapter explains the theoretical frameworks of the study including the Dynamical and Ecological Systems Theories. Each theory provides unique support for this study. The basic characteristics of young children who are at risk, the importance of fundamental motor skills and the perceived motor competence are discussed. Subsequently, fundamental motor skills interventions and early childhood family interventions are explained to focus on the role of early intervention for children who are at risk with regard to their motor skill development and perceived motor competence. A general summary of Chapter 2 is provided at the end of the chapter.

Dynamical Systems Theory

The primary theory in the explanation of motor development is dynamical systems theory (DST) (Newell, 1984, 1986; Thelen & Ulrich, 1991). Dynamical systems theory is a complex theory explaining the basis of new behavior patterns and the role of interactions of many subsystems to emerge completely new behaviors from old behaviors (Thelen & Ulrich, 1991). Based upon DST, a child is seen as a self organizing system and the complex interactions of many subsystems shape this self-organizing system (Gallahue & Ozmun, 2006). Dynamical systems theory identifies many concepts in order to explain the motor development of children. Behavioral attractors, phase shift, control parameters,
rate limiters and the constraints model are the main concepts of DST that will be explained as part of this chapter. Each concept provides a unique understanding of the complexity of the development of new motor behaviors.

**Behavioral Attractors.** During the early years, children develop a variety of common and observable motor patterns in particular situations and these are known as behavioral attractors. A behavioral attractor may be stable (always seen) or unstable (sometimes seen and sometimes not seen). A common set of behavioral attractors for young children that need to be learned in the early childhood years are fundamental motor skills (FMS). In considering the different behavioral attractors for FMS, one can go to the stage literature to understand the possible behavioral attractors (Roberton, 1978). Each stage can be re-conceptualized as a possible behavioral attractor from which the children can select. For example, throwing has 5 possible behavioral attractors that are stage 1 (wind-up from ear level, feet stationary, no trunk rotation, & chopping action), stage 2 (entire body rotates & sling action), stage 3 (wind-up from ear level, ipsilateral arm-leg movement, little or no trunk rotation), stage 4 (wind-up from ear level, contralateral arm-leg movement, some trunk rotation), stage 5 (wind-up from leg level, contralateral arm-leg movement, body rotation from lower to upper parts) and kicking has 4 possible behavioral attractors that are stage 1 (little or no wind up, feet stationary, no kicking-just push, step backward after kicking), stage 2 (leg wind-up, feet stationary, opposition of arm and leg), stage 3 (moving to the ball, opposition of arm and leg, step forward after kicking) and stage 4 (rapid approach, backward trunk lean in wind up, leap before kicking, hop or leap after kicking) (Payne & Isaacs, 2007). Children in certain populations may demonstrate inefficient behavioral attractors or a more limited repertoire.
of behavioral attractors because of lack of exposure to movement opportunities or having a high risk of developing delays (Goodway & Branta, 2003; Goodway et al., 2003; Goodway & Rudisill, 1996; Hamilton et al., 1999). In order to promote physical activity, the goal for children would be to have a more extensive selection of behavioral attractors from which to choose and also more efficient behavioral attractors (Stodden et al., 2008). A larger array of behavioral attractors and more efficient behavioral attractors would allow the child to efficiently apply these skills in games and sports across their lifespan.

*Phase Shifts and Control Parameters.* A phase shift refers to changes in one movement form to another movement form that is a new form of movement and different from the old form of movement in a qualitative manner (Thelen & Ulrich, 1991). Phase shifts might occur suddenly or in a discontinuous way (Thelen & Ulrich, 1991). From a developmental perspective, when children show a high variability of behavioral attractors from trial to trial, it is really common to see a phase shift occurring shortly after because phase shifts represent a period of transition for new motor patterns based on DST. In this transition period, control parameters are essential factors that influence pattern change (Southard, 2002). Changing control parameters from the individual, task or environment might cause a behavioral attractor to become unstable and shift to a new more stable behavioral attractor (Southard, 2002). Control parameters can limit an individual’s ability to demonstrate an efficient behavioral attractor or can enhance a person’s ability to demonstrate a more efficient behavioral attractor. In other words, control parameters can enhance or retard the system. Especially, Southard (2002) emphasized that “encouraging individuals to scale up on control parameters may be the best strategy for improving performance of fundamental motor skills” (p.28).
Rate Limiters. Rate limiters are the variables that can limit an individual’s movements capacities to demonstrate high levels of behavioral attractors (Thelen & Ulrich, 1991). Internal (individual) and external (environmental) rate limiters might cause developmental delays in FMS. Unfortunately, children who are at risk tend to have more rate limiters because of their underserved conditions (Goodway & Branta, 2003). Lack of developmentally appropriate instruction (an environmental rate limiter) or low birth weight (an individual biological rate limiter) might impact the level of behavioral attractors of children who are at risk. Identifying the rate limiters of children who are at risk might contribute to being able to create appropriate motor skill interventions to meet their developmental needs.

Constraints Model. Newell (1984) developed a model to explain the role of constraints on action as ‘boundaries or features that limit motion of the entity under consideration” and “constraints reduce the number of possible configurations of a system” (p.347). This model explains the impacts of constraints on multiple movement systems and on the development of movement coordination. Newell’s model (1984) identifies three categories of constraints showing the possible interactions of constraints in controlling and coordinating physical movements. Organismic (individual), task and environmental constraints are the three major categories in Newell’s model (Figure 2.1).
Organismic constraints are also called as individual constraints. Body shapes, weight, height, balance, motivation, gender, and socioeconomic status of children (SES) are some examples of organismic constraints. Biological and functional constraints influence the coordination of individuals’ movements (Newell, 1984, 1986). For this reason, individuals’ constraints have been critically determined in this study. The numbers of risk factors identified for a child, gender, SES, body mass index (BMI), perceived motor competence are the main individual or organismic constraints considered in this study.

Environmental constraints are not internal to the organisms as are organismic constraints. According to Newell (1984, 1986), environmental constraints are external and task specific. Gravity, temperature, air pressure, or lightening are general examples provided by Newell for environmental constraints (Newell, 1984, 1986). However, subsequent to this initial paper, environmental constraints have been viewed more broadly and consist of factors such as equipment and activity spaces. For this study,
environmental features might include the amount of equipment, type of equipment, facilities or space that can be manipulated in a developmentally appropriate way to achieve a specific task or tasks for preschoolers.

Tasks constraints are also external and related to the purpose of the activity (Newell, 1984, 1986). Tasks can be defined more broadly such as throwing or catching. However, tasks can also be defined more precisely such as throwing a tennis ball to a target 15 feet away or kicking a milk jug around a gymnasium. In this study, in order to develop appropriate tasks, environmental and individual constraints were considered to develop meaningful tasks and to consider the interactions of the individual, environment and task. Three concepts of task constraints are specified to achieve any task: task purpose, the implicit rules, and the implementation procedures (Newell, 1984). These concepts were utilized in the design of developmentally appropriate tasks for this study.

**The Role of Constraints in the Motor Skill Intervention.** The interactions among the individual, task and environment should be considered in order to help children develop a large movement repertoire of FMS (Newell, 1984, 1986; Thelen & Ulrich, 1991). The changes in the subsystems within the learner (individual), the task and the environment might lead to positive or negative outcomes regarding motor skill development (Gallahue & Osmond, 2006, Newell, 1984, 1986). In other words, the relationships within and between those systems might lead to the development of new behaviors or reduce the probability of new behaviors (Langendorfer & Roberton, 2002). Given the powerful influence of the interactions of these three systems, motor development specialists interested in developing FMS must organize their motor skill interventions to maximize the relationships between and within these systems (Goodway & Branta, 2003; Goodway
et al., 2003; Goodway & Rudisill, 1996; Hamilton et al., 1999). Similar to DST, Ecological Systems theory (EST) defines the importance of many systems in children development (Bronfenbrenner, 2005).

Ecological Systems Theory

Family is defined as a social system in which family members interact with each other and dynamic interactions reflect the changing nature of the family environment (Berk, 2009). In this study, Ecological Systems theory (EST) provides an explanation to address the role of parents and the home environment in child development. Ecological systems theory was developed by Urie Bronfenbrenner (1917-2005). Bronfenbrenner (2005) emphasized that EST is “a bioecological model” addressing the interactions of children’s biology with their environment. Ecological systems theory is a system theory that explains the complex role of interactions among the many systems in the child’s environment (Berk, 2009). Five main systems serve as the central part of this theory. These five systems consist of the: microsystem, mesosystem, exosystem, macrosystem and chronosystem that interact together and serve as the main systems in the child’s environment (Bronfenbrenner, 1979).

Microsystem. The microsystem is the closest system (i.e. immediate environment) to the child in EST. Family, child care setting, school or neighborhood play area are the immediate environment for children (Bronfenbrenner, 1979). Reciprocal relationships between child and these settings impact child development in this system. The family environment is the first environment for children to interact with adults who might be parents or a primary care giver (e.g. grandmother or grandfather). Reciprocal relationships are inevitable in the microsystem. In other words, children are influenced by
the adults in the family but also the adults are influenced by the children (Berk, 2009). Clearly, family is one of the systems known to be an essential component of childhood development within the child’s natural environment. It is not a surprise that family involvement has been widely utilized in interventions being provided for young children and their families. A growing body of literature shows that family based interventions have a positive impact on children with language and behavioral problems (Chao, Bryan, Burstein, & Ergul, 2006), children with Down Syndrome (Torres & Buceta, 1998), children with autism (McConachie, Randle, Hammal, & Le Couter, 2005), children with intellectual disabilities (Guralnick, 2005), and children with mental illnesses (Hoagwood, 2005).

Mesosystem. The mesosystem refers to interactions between subsytems that are family, home environment, child-care settings, schools, or neighborhood (Berk, 2009). The rationale of this system is that the cooperation among family and other settings in which children spend more time definitely contribute to child development in many ways. Based on this perspective, changing some aspects of child development such as motor development of children, one might consider those settings and impact the particular systems. For example, recognizing the importance of cooperation between family environment and child-care setting, a family component has been added into a motor skill intervention for this study.

Exosystem. Social networks exist in the exosystem. Workplace, community health services, extended family, friends and neighbors are social networks in which children are influenced by their systems (Berk, 2009). If a break down (e.g. losing the job or
closing the child care setting) occur in one of them, child development is affected by the break down.

**Macrosystem.** The outermost level of the system in EST is the macrosystem (Bronfenbrenner, 1979). Customs, values, cultural beliefs, societal values are the source of macrosystem (Swick & Williams, 2006). It is worth noting that that researchers should consider the impact of this system on children and families in the development and implementation of child and family interventions (Berry, Sheehan, Heschel, Knafl, Melkus, & Grey, 2004).

**Chronosystem.** The chronosystem explains temporal dimensions of a child’s environment. Ecological systems theory suggests that dynamic and interactive events that occur during a child’s lifetime may contribute to the child’s overall development over time, not just at the period of the event (Bronfenbrenner, 1979). In other words, the history of families or past events might explain current events in the environment or a child’s developmental level.

The dynamic interaction of all systems interacting with each other and with the child contributes to our understanding of the many variables that may influence a child’s development. Berk (2009) emphasized that “children’s characteristics join with environmental forces at multiple levels to mold development in unique ways” (p. 31). In this respect, being aware of basic characteristics of young children at risk, their family and environmental situations help us recognize their developmental needs and remediate their developmental delays by arranging early interventions.
Young Children At Risk

The Annie E. Casey Foundation (2008) in their report on children who are at risk “2008 Kids Count Data Book”, identified that nationally, 40% of children are from low-income families and 8% of children are being raised in extreme poverty (AECF, 2008). Thirty two percent of children (almost 22 million) live with a single parent. In Ohio, these data show that 39% of children are from low-income families. This report also shows the disparities in child well-being by race and ethnicity. African American and Hispanic children are more likely to have environmental conditions that act as barriers and disadvantage for the children and limit their ability to be successful in their life (AECF, 2008). These children are also more likely to live in dangerous neighborhoods (AECF, 2003). Table 2.1 shows the recent data on child well-being nationwide and in the state of Ohio. Race and ethnicity data in nationwide are also provided in this table (AECF, 2008). Obviously, a high number of children are being raised in disadvantaged circumstances and that these children are exposed to a wide range of risk factors. Risk factors refer to situations that might cause unwanted outcomes or increase the probability of developing negative outcomes associated with child development (Kazdin, 1995).
<table>
<thead>
<tr>
<th>10 indicators of child well-being</th>
<th>Nationwide</th>
<th>Ohio</th>
<th>Black-African American</th>
<th>Hispanic-Latino</th>
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<tbody>
<tr>
<td>1. Low birth weight among the babies</td>
<td>8.2</td>
<td>8.7</td>
<td>13.6</td>
<td>6.9</td>
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<td>2. Death rate among infants</td>
<td>6.9</td>
<td>8.3</td>
<td>13.7</td>
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<td>3. Death rate among children</td>
<td>20</td>
<td>20</td>
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<td>4. Death rate among teens</td>
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<td>61</td>
<td>84</td>
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<td>5. Birth rate among teens</td>
<td>40</td>
<td>39</td>
<td>62</td>
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<td>6. High school dropout rate among teens</td>
<td>7</td>
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<td>7. Rate for teens not working and going to school</td>
<td>8</td>
<td>7</td>
<td>12</td>
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<tr>
<td>8. Children with parents having no full-time job</td>
<td>33</td>
<td>34</td>
<td>50</td>
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<td>9. Children in poverty</td>
<td>18</td>
<td>19</td>
<td>35</td>
<td>28</td>
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<tr>
<td>10. Children with only one parent</td>
<td>32</td>
<td>33</td>
<td>65</td>
<td>37</td>
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</table>

Note. Adapted from 2008 Kids Count Data Book (AECF, 2008) and numbers are pertinent to %.

Table 2.1 Child Well-Being Report

The Annie E. Casey Foundation selected 10 key indicators to describe the child well-being in their report as seen in Table 2.1 (AECF, 2008). However, the number of risk factors among children is not limited. Other risk factors associated with developmental delays include child, family and school factors (Kazdin, 1995). Child factors include the temperament of the child, neuropsychological problems (e.g motor coordination), cognitive problems, prematurity, low birth weight, and chronic illness during childhood (Kazdin, 1995). Family factors includes genetic dispositions, psychopathology criminal behaviors, alcoholism, drug abuse, quality of parent-child
interactions, marital situation, family size, birth order, socioeconomic status and inadequate parent interest and supervision (Kazdin, 1995). School risk factors are school conditions such as school location, school practices and teacher-student ratio (Kazdin, 1995). The degree of developmental delays depends to some extent on the number of risk factors a child has (Kazdin, 1995). However, children with having a number of risk factors do not always develop developmental delays or educational problems because of protective factors that might be individual (e.g. high self confidence), family (e.g parental style) or external support (e.g. significant others) (Kazdin, 1995). Overall, identifying child risk factors helps researchers and professionals organize more appropriate programs focusing on children’s needs to prepare them for their future lives. The main educational outcome of developmentally appropriate programs for children who is at risk is decreasing the probability of having developmental delays due to the risk factors in which they are embedded.

Developmental delays of children who are at risk may occur in several developmental areas such as physical, cognitive, social-emotional or communication (IDEA, 2004). In terms of physical development, it is known that children at risk demonstrate delays in FMS (Goodway & Branta, 2003; Goodway et al., 2003; Goodway & Rudisill, 1996; Hamilton et al, 1999; Robinson & Goodway, 2009). Stodden and Goodway (2007) argue that children with FMS delays may also have low levels of perceived motor competence that might set these children up for physical inactivity and low fitness levels later in childhood and adulthood. Thus, a low developmental motor trajectory is a major concern as it may predispose the child to be physically inactive later
in life. Stodden and Goodway (2007) argue that promoting FMS competence is critical in the early years if we are to get children physically active for their future life.

Head Start programs have been developed and provided in order to buffer children from the negative effects of their disadvantaged situations. These federally funded Head Start programs are designed to provide comprehensive educational opportunities for children who are at risk (Child Development Council of Franklin County [CDCFC], 2009). The general aim of Head Start programs is to address children's needs by providing an array of different services including early childhood education, health and family support. Eligibility requirements of the program are determined by the federal regulations. Title 45 (Public Welfare) - Part 1305 (Eligibility, recruitment, selection, enrollment and attendance in Head Start), dictates that a child should be at least three years old and from a low income family to become eligible for a Head Start center (Head Start Act, 2007). Parental status and social service needs of the family are critical to become eligible as well. According to 2009 Fiscal Year, 904,153 (30.0% African American, 35.9% Hispanic/Latino) children are currently enrolled in Head Start programs across the country (U. S. Department of Health and Human Services [USDHHS], 2009). In Ohio, 37,072 children have been enrolled in Head Start programs in 2009. Approximately 25 million children have participated in Head Start programs since 1965.

Head Start programs are particularly important to break down the intergenerational cycle of failure and poverty that persist in young children who are disadvantaged. Specifically, high quality early intervention programs are necessary to diminish the negative effects of risk factors on those vulnerable children. Head Start programs offer a unique place to provide motor skill intervention services to young
children who are disadvantaged. Given the large numbers of children serviced by Head Start centers, including motor skill intervention into the curriculum would promote motor development for a large population of children.

Fundamental Motor Skills

Motor development has been defined as “the changes in motor behavior over the lifespan and the processes which underlie these changes” (Clark & Whitall, 1989, p.194). Payne and Isaacs (2007) have described motor development “as a human process, motor development refers to changes that occur in our ability to move and our movement in general as we proceed through the lifespan” (p.2). Motor development is also defined by Gallahue and Ozmun (2006) as “continuous change in motor behavior throughout the life cycle, brought about by interaction among the requirements of the movement task, the biology of the individual, and the conditions of the environment” (p.5). A recent definition of motor development by Haywood and Getchell (2009) is that “continuous, age related process of change in movement, as well as the interacting constraints (factors) in the individual, environment, and task that drive these changes”.

The changes that occur in motor behavior are clearly distinct in the early childhood years. The early childhood period provides a movement foundation period in which children should develop FMS (Gabbard, 2008). Fundamental motor skills are the building blocks to more advanced level of movement activities that are necessary to engage in physical activities, games and sports (Gabbard, 2008; Payne & Isaacs, 2007). The most common misunderstanding of FMS is that children just gain those skills as a result of their natural development. However, FMS should be taught in a developmentally appropriate way for children to gain a high level of proficiency in FMS. Fundamental
motor skills are categorized into two groups listed as locomotor skills and object control skills (Payne & Isaacs, 2007). Locomotor skills are motor skills that children perform to move from one point to another point in physical environment. For example, locomotor skills are walking, running, jumping, leaping, skipping, galloping and hopping (Gabbard, 2008; Payne & Isaacs, 2007). Object control skills include throwing, catching, striking, kicking, rolling and dribbling and are motor skills in which a child manipulates an object (e.g ball or a bean bag) by hands, and/or feet (Gabbard, 2008; Payne & Isaacs, 2007). Both locomotor and object control skills are vital in normal motor functioning. One might evaluate children motor development by observing those skills. In motor development literature, the role of FMS in motor development is described by various models. Each model has distinctive contributions to our understanding in terms of progressions and developmental mechanisms of FMS.

Models of Motor Development

Four main models of motor development explain the progressions of FMS and the developmental mechanisms of FMS (Clark & Metcalfe, 2002; Gallahue & Ozmun, 2006, Seefelt, 1980; Stodden et al., 2006). The models are the Progression of Motor Proficiency Skill Levels (Seefeldt, 1980), the Mountain of Motor Development (Clark & Metcalfe, 2002), the Hourglass Model (Gallahue & Ozmun, 2006), and the Conceptual Model of Developmental Factors Influencing Physical Activity (Stodden et al., 2008). All of the models demonstrate that FMS are the basis to more specialized movement skills. Furthermore, each model has a unique perspective that contributes to our knowledge and understanding of FMS in at risk children.
Seefeldt (1980) described the progression of motor skill proficiency based on the specific time periods. This model shows age specific periods to work on particular skills and the importance of developing FMS during the early childhood period. According to this model, the first movements of individuals are reflexes and reactions during the first year of life (neonatal period). After this period, children in the early childhood years begin to focus on the obtainment of FMS. Seefeldt (1980) hypothesized that gaining competence in FMS is necessary to break through a conceptual proficiency barrier to apply these FMS in more advanced levels of motor activities such as transitional sports and games during middle childhood to adulthood. Transitional motor skills in the model are conceptualized as a transition phase between FMS and specific sports skills and dances. Based on the model, having low competence in FMS might cause delays in developing specialized motor skills. From this perspective, the implications of the model are huge for teachers, practitioners and early childhood teachers suggesting that our focus should be on the attainment of FMS during early childhood. A similar model developed by Gallahue and Ozmun (2006) support the notion of motor development as a lifelong process in which individuals gain motor competencies as a result of their experiences and genetic make-up. Similar to the first stage of the Seefeldt model (1980), the reflexive movement phase is the first phase of the Hourglass model. Reflexes are seen as a precursor to more voluntary movements called rudimentary movements (Payne & Isaacs, 2007). The second phase of the Hourglass model describes rudimentary movements that are the first patterns of voluntary movements such as crawling, creeping, sitting, standing or walking (Gallahue & Ozmun, 2006). This phase is predictable in terms of the movements seen and their time frames, however, individual variations are highly
common (Gallahue & Ozmun, 2006). The third phase is the fundamental movement phase where children actively discover a variety of movements and learn about their bodies’ capacities. This FMS phase is seen as a critical phase in the early childhood years. It is suggested that “most children must have some combination of opportunities for practice, encouragement, and instruction in an ecologically sound environment” (Gallahue & Ozmun, 2006, pp.56) to develop FMS. The final phase of the model is the specialized movement phase. This part of the model is built on the fundamental movement phase as it requires that children have a high level of competency in FMS in order to perform more advanced levels of sports skills and tasks. The basic characteristics of the model is that hourglass might proceed in the opposite direction (it turns over) for some individuals because of individual, environmental or task constraints that lead to inactivity and disengagement in physical activity, sports and games (Gallahue & Ozmun, 2006).

Another model designed by Clark and Metcalfe (2002) expressed the complexity of motor skill development and the adaptability of characteristics of individuals to the environment as a result of development. A mountain is used as a metaphor to define the progression of motor development. In this model, motor skill development is represented by the integration of process and product of development. Climbing the mountain is a long period in which sequential and cumulative process of development have been observed (it is the process) and individuals, not all of them, become skilful (it is the product) (Clark & Metcalfe, 2002). Six main periods in the model (mountain) are listed as: reflexive, preadaptive, fundamental motor patterns, context-specific and skillful. Basically, the progression of the phases in the model is described as highly individualized
but at the same time individuals follow a typical developmental progression in terms of motor development (Clark & Metcalf, 2002). Each individual has a unique mountain (motor development) because of having unique experiences and constraints in their life. For example, some individuals might reach the skillful phase very rapidly as a result of a wide variety of experiences while others need more time to reach this level or some never reach this phase in their lifespan. From this developmental perspective, the role of developing FMS in early childhood years is very important to reach higher levels of the mountain and developmentally appropriate instruction is crucial to change behaviors in a productive way in terms of motor skill development.

The models identified above typically focus on the development of motor skill competence and the role of FMS in more specialized motor skills. However, limited or no model addresses the importance of FMS in developing physical activity habits and the other important variables of motor skill competence and physical activity. Stodden et al. (2008) proposed a conceptual framework for the role of motor competence in physical activity. In this model, FMS competence is linked to physical activity engagement and poor FMSs are linked to physical activity disengagement. In addition, perceived physical competence and health related fitness act as essential variables influencing by actual motor competence and physical activity participation in the model. A dynamic and reciprocal relationship exists between motor competence and physical activity at the heart of the model (Stodden et al., 2008). The assumption is that children’s physical activity levels may be influenced by their motor competence. Once children learn and develop FMS, they can apply those skills in their physical activities. Children also may develop their motor skills as a result of their experiences in physical activities. In this reciprocal
relationship, perceived motor competence plays a crucial role. Children with a low level of motor competence might show low levels of perceived motor competence and less physical activity participation compared to their peers with high levels of perceived motor competence. In addition physical activity participation and motor skill competence might contribute to the health-related fitness of children. Obesity fits into the model in that obesity may be more likely as a result of the negative spiral of disengagement or obesity may be less likely as a result of the positive spiral of engagement. The main argument in the model that actual and perceived motor competence have been seen as some of the underlying factors situated in developing positive or negative physical activity behaviors (Stodden et al., 2008). Thus, more research is needed to discover the function of actual motor competence and perceived motor competence in physical activity engagement.

Perceived Motor Competence

In addition to actual motor competence, perceived motor competence is a critical variable as it contributes to whether a child will persist in motor skill activities (Stodden et al., 2008; Harter, 1999). Perceived competence is a developmental phenomenon that changes as children get older and have more cognitive capacity to make meaningful self-evaluations about themselves (Harter, 1982; Harter & Pike, 1984). Specifically, perceived competence is defined as children’s self-perceptions about their capabilities in many domains such as cognitive, social, physical, or personality traits (Harter, 1982; Harter & Pike, 1984). Self-concept is highly domain specific which means that children have separate self-perceptions about different skill domains (Harter & Pike, 1984). Furthermore, domains in self-perception differ based on the age level of the children and
their cognitive capacities. For instance, physical appearance is not important until elementary school years (Harter & Pike, 1984). In order to analyze children’s self perceptions on different domains, a Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA) was developed by Harter and Pike (1984). This scale has two versions for preschoolers/kindergartens and for first/second graders. Both scales consist of four major domains involving cognitive competence, peer acceptance, motor competence, and maternal acceptance to describe children’ self perceptions.

Self-perception is the central focus of Harter’s motivation theory (Harter, 1978, 1982). According to this theory, children’s perceived competence is a key element in task persistence (Ulrich, 1987). Basically, children who have positive perceptions about their competencies are more likely to perform and persist in a task in which they feel competent (Harter, 1978; Klint & Weiss, 1987). However, if children do not perceive themselves as competent to complete the task, they probably will not enjoy participating in the task and may be more likely to dropout of it (Harter, 1978; Rudisill, 1989). From this perspective, perceived motor competence is an important variable in teaching FMS for children in order to obtain persistency in participation of motor skills and physical activities.

During the early childhood years, preschoolers tend to have high levels of perceptions of their competence, perhaps due to their limited cognitive abilities to judge accurately their competence (Harter & Pike, 1984). However, if actual competence is low, by around 7 to 8 years old, the level of perceived competence decreases as children’s cognitive capacity allows them to make more realistic evaluations about themselves (Harter & Pike, 1984; Stodden et al., 2008). In other words, by 7 to 8 years
old, the mismatch between perceived competence and actual competence begins to disappear and a child’s perceived competence is tied to their actual competence (Rudisill et al., 1993). Although children in early years having unrealistic perceptions of actual competence, Stodden and his colleagues (2008) argue that high level of perceptions might be one of the reasons to engage in motor skills and physical activities during the early childhood years. Based on that, children with low perceptions of competence are less likely to perform and persist at practicing an activity or a skill. This is especially true for children who are at risk or defined as disadvantaged because they are found to have low levels of actual competence (Goodway & Rudisill, 1997; Robinson & Goodway, 2009) and low levels of perceived motor competence (Jambunathan, & Burts, 2003; Robinson, Rudisill, & Goodway, 2009).

A number of studies have addressed the role of perceived motor competence and actual motor competence of children in lifelong physical activity engagement (Barnett, Morgan, van Beurden, & Beard, 2008; Rudisill et al., 1993; Sollerherd, Apitzsch, Rastam, & Ejlertsson, 2008; Southall, Okely, & Steele, 2004; Ulrich, 1989; Weiss, & Amorose, 2005; Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2006). However, limited research exists on perceived motor competence of young children who are at risk (Goodway & Rudisill, 1996; Goodway & Rudisill, 1997; Robinson, et al., 2009; Ulrich, 1987; Valentini & Rudisill, 2004b).

One study investigated the effects of a motor skill intervention on perceived motor competence and social acceptance of children who were at risk (Goodway & Rudisill, 1996). Thirty one children (16 girls, 15 boys) in an intervention group and 28 children (14 girls, 14 boys) in a comparison group participated in this study. A 12 week
motor skill intervention was provided for at risk African American children from an urban district. The motor skill intervention had 24 instructional sessions with 45 min instruction time for each session. Locomotor skills (gallop, hop, jump) and object control skills (bounce, catch, kick, throw) were the central focus of the intervention. The PSPCSA was used to assess children’s perceived competence at pretest and posttest (Harter & Pike, 1984). The results indicated that the intervention group significantly improved their perceive competence in all domains (motor competence, peer acceptance, cognitive competence, maternal acceptance) as a result of the motor skill instruction. No gender differences were observed in the study. This study showed the benefits of early motor skill interventions on children who were at risk.

Another study conducted by Goodway and Rudisill (1997) examined the associations between perceived motor competence and actual motor skill competence of children who were at risk. Fifty nine ($M_{age}=4.79$) African American children at risk in developing delays or educational failures were the participants of this study. Perceived motor competence of children were measured by the motor competence part of PSPCSA (Harter & Pike, 1984) and actual motor competence of children were measured by the first version of Test of Gross Motor Development (Ulrich, 1985). The results revealed that children demonstrated developmental delays in motor competence although they had high perceptions about their motor competence, which were consistent with a previous research (Ulrich, 1987). Correlations between perceived motor competence and actual motor competence (locomotor and object control skills) were found as low. Similar to the previous research (Goodway & Rudisill, 1996), no gender differences were found in perceived motor competence. One important argument of this study was that children had
limited physical activity opportunities to develop their motor skills due to the family and environmental conditions (Goodway & Rudisill, 1997). For this reason, they might not accurately describe their motor skill abilities. If motor skill instruction with ongoing feedback and full encouragement is provided for this young population, they might accurately describe their capabilities (Goodway & Rudisill, 1997).

Valentini and Rudisill (2004b) also investigated perceived motor competence of 49 kindergarten children who had developmental delays. Different from the other studies mentioned above, the researchers examined the effects of two 12 weeks motor skill interventions (high and low autonomy) on motor competence and perceived motor competence of children ($M_{\text{age}}=5.42$). The results of this study were consistent with previous research (Goodway & Rudisill, 1996). Children from both intervention groups showed improvement in motor skill competency and perceived motor competence. It should be noted that children from high autonomy intervention (mastery motivational climate) had better scores than the children from other intervention group (direct instruction). A recent study found the same results that mastery motivational climate approach was effective to improve children’ perceived motor competence (Robinson, et al., 2009). Those studies show that applying various instructional strategies for children who are at risk is vital to find effective motor skill interventions. It is also clear that more research is needed to explore the relationship between perceived motor competence and actual motor competence and how motor skill interventions might impact on these variables (Stodden & Goodway, 2007).

**Fundamental Motor Skill Intervention**

Fundamental motor skills (FMS) are essentials for children to engage in lifelong physical activities, sports and games (Haywood & Getchell, 2009; Payne & Isaacs, 2007).
It is known that certain populations are at greater risk of developing delays in FMS (IDEA, 2004). Especially, children who are at risk have demonstrated developmental delays in FMS (Goodway & Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999; Robinson & Goodway, 2009). Substantial evidence support that when these children receive well designed motor skill instruction, they have demonstrated significant improvement in FMS (Connor-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999; Robinson & Goodway, 2009). In addition, motor skill instruction has been found to bring about a more realistic match between actual motor competence and perceived motor competence (Goodway & Rudisill, 1996). However, few studies have been conducted on the FMS of children who are at risk. Related studies are given in Table 2.2.

A variety of instructional techniques have been documented to deliver motor skill interventions for children who are at risk. Direct instruction (Connor-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Goodway et al., 2003; Goodway & Rudisill, 1996) and mastery motivational climate (Robinson et al. 2009; Valentini & Rudisill, 2004a; Valentini & Rudisill, 2004b) are the most common techniques used in various motor skill interventions. Direct instruction has a long history in research on teaching and reported as the most effective way to teach (Rosenshine, 1979; Becker & Carnine, 1981). In this approach, a structured instruction is delivered to the children by a very clear format and students do not have any choices or preferences to select a task or activity (Graham et al., 2007). The instructor controls each element of the lesson during instruction and students follow the directions and complete the task in a given format (Graham et al., 2007). On the other hand, students in a mastery motivational climate approach control their own
learning through student-centered instruction in which they have high autonomy to complete tasks and activities based on their preferences (Valentini & Rudisill, 2004a, 2004b). Several levels of challenge are also incorporated into the instruction (Valentini, Rudisill, & Goodway, 1999). The rationale behind this approach is that mastery motivational climate promotes students’ motivation to engage in tasks and decide their own pace of learning.

Parental involvement is another approach to deliver motor skill instruction in the motor development literature (Hamilton et al., 1999). Parent assisted instruction basically includes “parents” (i.e. father, mother, or primary caregiver) as the instructors to perform motor skill instruction for their children after a training session or workshop designed for parents. There is only one study that has involved parents in motor skill instruction (Hamilton et al., 1999). Parents were responsible for delivering the lesson plans to the children with the assistance of a motor development specialist and paraprofessionals (Hamilton et al., 1999).

Instructional approaches (direct instruction, mastery motivational climate and parent assisted) of motor skill interventions are quite different regarding their rationale and focus. However, effective motor skill interventions share similar characteristics in terms of methodological issues. It is well documented that an effective motor skill instruction should have duration of around 8 to 12 weeks meeting two days per week. Typically, 16 to 24 instructional sessions should be arranged to deliver the intervention and each session should take 30 to 45 minutes. The methods of motor skill interventions for children who are at risk are given in Table 2.2
Motor Skill Interventions for Children Who Are At Risk or Disadvantaged

In this section significant findings from motor skill interventions are provided to address the necessity of motor skill instruction for children who are at risk of developing delays.

Hamilton et al., (1999) involved parents in an 8-week motor skill intervention for African American children aged between 3 to 5 years old. Parents (mostly mothers) were responsible for delivering the lesson plans to their children. For this purpose, parents were trained on the lesson plans aiming to improve OC skills of children. Prior to the intervention, the children were evaluated on the OC subscale of the TGMD (Ulrich, 1985) and found as being at the 20th percentile in OC. In other words, the children had developmental delays in OC skills. However, by the end of the parent motor skill intervention, the children significantly improved their OC performance from the 20th percentile to the 67th percentile. In contrast, the participants in the control group who did not receive any motor skill intervention did not improve their object control skills. It might be concluded that including parents in promoting children’s motor development in the early years is an effective strategy.

Another study related to motor skill development of preschool children who are disadvantaged was conducted by Goodway and Branta (2003). They found consistent results with Hamilton et al. (1999) in terms of the effects of motor skill intervention on preschool children who were at risk. A 12 week intervention was delivered through 24 instructional sessions that lasted for 45 minutes each. Prior the intervention, 59 children were pretested on the TGMD. Children in the intervention group (n=31) increased their locomotor performances from the 15th percentile to the 80th percentile and their OC
performances from the 17th percentile rank to the 80th percentile at the end of the instruction. The findings of the study concluded that children demonstrated developmental delays in FMS, but were able to take advantage of the motor skill instruction designed to deliver developmentally appropriate practice with a lot of equipment, and opportunities for practice (Goodway & Branta, 2003).

Goodway et al., (2003) also revealed the similar results as Hamilton et al. (1999) and Goodway and Branta (2003). A 9-week motor skill program consisting of 18 lessons lasting 35 min was delivered to preschoolers identified as disadvantaged. Preschoolers (N=63) from a Pre-Kindergarten program showed developmental delays in FMS at or below the 25th percentile at the pretest measures. Children in the intervention group (n=33) improved their locomotor performances from the 7th percentile to the 50th percentile and their OC performances from the 11th to 60th percentile. The intervention group significantly improved their locomotor skills (p<.001) and OC skills (p<.001) as a result of the intervention supporting the effectiveness of motor skill instruction for preschoolers who are disadvantaged. Similar to the other studies, the Comparison group did not show any improvement with regard to motor skill development.

Connor-Kuntz and Dummer (1996) also found that disadvantaged children showed developmental delays in motor development. An 8 week physical activity intervention with a language development included 24 sessions created for children from a Head Start (n=35), preschool special education (n= 26), and typical preschool (n=11) setting. Children in the intervention groups showed significant improvement in their motor skill performance at the end of the intervention as compared to a Comparison
The findings showed that motor instruction brought about significant pre-post differences and that adding language did not detract from the motor instruction.

A recent study supports the importance of early interventions on children who are at risk as well (Robinson & Goodway, 2009). Two motor skill interventions (one was mastery motivational climate, other was low autonomy) were designed to improve children OC skill performances. Prior to the interventions, children were diagnosed having developmental delays at between 19th and 23rd percentiles in OC. Both interventions were successful to improve children’ OC. No significant differences were observed between two interventions with regard to children performance in OC at posttest. One of the strongest parts of this study was that retention tests were conducted for the participants. In addition, children were randomly assigned into the intervention groups. Those points increase the quality of the interventions that plays a vital role in motor skill development of children. In line with this, a systematic review of literature on the efficacy of motor skill interventions was completed by Riethmuller, Jones and Okely (2009). Seventeen studies were included based on the inclusion criteria of the study. In general, 71% of studies found motor skill improvement in children from the intervention groups at follow up tests.

General information of motor skill interventions conducted with children who are at risk is summarized in Table 2.2.
<table>
<thead>
<tr>
<th>Research</th>
<th>Participants</th>
<th>Intervention</th>
<th>Methods of Intervention</th>
<th>Who Intervened</th>
<th>Comparison Group</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coonor-Kuntz &amp; Dummer (1996) - Influence of a motor skill intervention with language enhancement on children’s fundamental motor skills</td>
<td>25 girls &amp; 18 boys from a Head Start, preschool special education and typical preschool setting</td>
<td>Direct instruction approach</td>
<td>A 8 week intervention with 24 sessions with 30 min each, two days in a week</td>
<td>A motor development specialist with assistance of classroom teachers and paraprofessionals</td>
<td>10 girls &amp; 19 boys</td>
<td>Done in 3 months after the intervention</td>
</tr>
<tr>
<td>Hamilton et al. (1999) - Effect of a motor skill instruction with parental involvement on object control skills of children at risk</td>
<td>6 girls &amp; 9 boys, mostly African American from a Head Start and at risk prekindergarten setting, M age = 47.1</td>
<td>Parent assisted motor skill intervention with direct instruction approach</td>
<td>A 8 week instruction, 16 sessions with 45 min each, two days in a week</td>
<td>Parents with assistance of a motor development specialist</td>
<td>5 girls &amp; 7 boys, M age = 47.5 mo.</td>
<td>No follow-up</td>
</tr>
<tr>
<td>Goodway et al. (2003) - Influence of a motor skill intervention on children’s locomotor and object control skills</td>
<td>16 girls &amp; 17 boys, 84.8% Hispanic children from a mandatory Pre-Kindergarten, M age=4.6</td>
<td>Direct instruction approach</td>
<td>A 9 week instruction, 18 sessions with 35 min each, two days in a week</td>
<td>Motor development specialist with classroom teacher and paraprofessionals</td>
<td>18 girls &amp; 12 boys, 61.3% Hispanic children, M age=5</td>
<td>No follow-up</td>
</tr>
<tr>
<td>Goodway &amp; Branta, 2003 - An investigation of a motor skill instruction on preschoolers’ motor skill development</td>
<td>16 girls &amp; 15 boys from an urban mandatory preschool setting, mostly African American, M age = 4.9</td>
<td>Direct instruction approach</td>
<td>A 12 week instruction, 24 sessions with 45 min each, two days in a week</td>
<td>Motor development specialist</td>
<td>14 girls &amp; 14 boys, children, mostly African American, M age = 4.9</td>
<td>No follow-up</td>
</tr>
<tr>
<td>Robinson &amp; Goodway, 2009 - The effects of two motor skill interventions on object control skills of children</td>
<td>20 girls &amp; 19 boys in Mastery motivation group, M age = 3.88 18 girls &amp; 20 boys in low autonomy group, M age = 3.96 mostly African American</td>
<td>Mastery Motivational Climate &amp; Direct instruction approach</td>
<td>Two 9 week instruction, 18 sessions with 30 min each, two days in a week</td>
<td>Motor development specialist</td>
<td>16 girls &amp; 24 boys, African American, M age = 4.0</td>
<td>Done in 3 weeks after the intervention</td>
</tr>
</tbody>
</table>

Table 2.2 A General Summary of Motor Skill Interventions
Summary of the Motor Skill Interventions

The motor skill interventions designed for children who are at risk showed that children improved their motor skills performances as a result of exposure to structured motor skill instructions (Connor-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999; Robinson & Goodway, 2009). However, there is little evidence showing the long-term effects of the motor skill interventions on the motor development of children. Only two studies conducted retention tests for the intervention to assess learning of motor skills (Connor-Kuntz & Dummer, 1996; Robinson & Goodway, 2009). Moreover, there is still a need to investigate the effects of motor skill interventions and some important variables connected to motor skill development. Perceived motor competence (Stodden et al., 2008), home environment and parents (Gabbard et al., 2008) might be seen as the primary variables that powerfully influence young children’s development. In the motor development area, there is only one study conducted with parents in order to determine the effects of parental involvement on the FMS development of children (Hamilton et al., 1999). However, this study involved an extremely small $N$ (27) and it is not clear the real effects of parental involvement on the motor skill development of children. The number of studies involving parents should be increased in the literature.

Gender Differences in Motor Skill Development

Gender differences are another aspect of motor skill development of children. Numerous studies have been investigated gender differences in motor skills (Branta, Haunbenstricker, & Seefeldt, 1984; Hall & Lee, 1984; Garcia, 1994; Garcia & Garcia, 2002; Junaid & Fellowes, 2006; Lorson & Goodway, 2008; Thomas & French, 1985;
Thomas, Michael, & Gallagher, 1994). Most of these studies revealed gender differences in object control skills in favor of boys (Garcia & Garcia, 2002; Lorson, & Goodway, 2008; Thomas & French, 1985; Nelson, Thomas, & Nelson, 1991). In particular, considerable research had focused on throwing because of being a common sport skill in many sports, games and activities.

A meta-analysis was conducted by Thomas and French (1985) to examine possible causes of gender differences in motor skill development. Biology, environment and their interaction effects on the motor skill development were analyzed among 63 studies including 31444 subjects and yielding 702 effect sizes. Gender differences in catch, balance, shuttle run and vertical jump were found as mostly related to environment prior to the puberty. However, throwing performance in boys and girls was more biological reported in 21 studies examining accuracy (5 studies), velocity (5 studies), and distance (11 studies). Effect sizes were 2.18 for throwing velocity and 1.98 for throwing distance. It was reported that boys had better scores than girls in terms of throwing velocity around 4 to 7 years old and throwing distance around 2 to 4 years old (Thomas & French, 1985). The findings of this meta-analysis aligned with an earlier research, which examined the changes in throwing performance of 100 kindergarten children (48 girls and 52 boys) over 3 years (Nelson et al., 1991). The researchers reported that boys were more proficient in their throwing performance including throwing distance, differentiated rotation and taking opposite step.

Gender differences in throwing have been also seen for different age groups. An international comparative study examining throwing in Germany and United States reported that throwing velocities of boys were higher than the girls in both countries and
German girls ($M_{age}=14$) failed to show humerus, forearm and backswing action (Ehl, Roberton, & Langendorfer, 2005). Roberton and Konczak (2001) also reported gender differences in developmental sequences of throwing among 13 years old girls. Their developmental level was found as low for throwing. Recently, Lorson and Goodway (2008) found consistent findings with regard to gender differences in throwing for 124 first and second graders. Gender differences were seen at pretest for the throwing components of step, trunk and forearm in favor of boys (Lorson & Goodway, 2008). Junaid and Fellowes (2006) also found better scores in ball skills examined by the Movement Assessment Battery for Children Test for 7 to 8 years of boys.

Overall, those gender differences were explained by biological and environmental factors or constraints in these studies. Arm muscle, leg muscle and shoulder hip ratio were associated with the throwing performance (Nelson et al., 1991; Thomas & French, 1984). As an environmental factor, an existence of a male at home was positively associated with girls’ throwing performance (Nelson et al., 1991). In addition to this, Garcia and Garcia (2002) claimed that high quality instruction including encouragement, motivation, and modeling were effective for girls and the number of practice trials should be increased for better performances among the children. Socio-cultural factors (e.g. different expectations from children) may also play a role in emerging gender differences in fundamental motor skills (Lorson & Goodway, 2008).

Another explanation in gender differences might be children’s interactions in the engagement of fundamental motor skills (Garcia, 1994). A qualitative research study conducted by Garcia (1994) examined 34 preschool children to show how children interact with each other while learning fundamental motor skills. Boys were competitive,
individualized and egocentric. On the other hand, girls demonstrated cooperative, caring, and sharing behaviors. Social aspect of learning environment might have some effects on the motor skill development of children, that’s why, the interactions of children should be taken into consideration while teaching fundamental motor skills and organizing early interventions for children (Garcia, 1994).

Early Childhood Family Intervention

Parents are recognized as a key factor in their children’s development during the early childhood years (Adkins, Sherwood, Story & Davis, 2004; Kitzman & Beech, 2006). From an ecological systems theory perspective, children are directly influenced by their parents and home environment (Bronfenbrenner, 1979). Research also supports this perspective (Bagley, Salmon, & Crawford, 2006; Brotman, Gouley, Huang, Kamboukos, Fratto, & Pine, 2007; Ransdell, Detling, Taylor, Reel, & Shultz, 2004). Parents might impact their children’s physical activity behaviors via social support (Beets, Vogel, Chapman, Pitetti, & Cardinal, 2007) and family structure (e.g. number of siblings or single parent) (Bagley et al., 2006). In addition, antisocial behaviors decreases as a result of family practices (Brotman et al., 2007) and health-related fitness improves in home based physical activity programming (Ransdell, Taylor, Oakland, Schmitd, Moyer-Mileur, & Shultz, 2003; Ransdell et al., 2004). For this reason, there are a growing number of studies emphasizing the importance of family based interventions on changing physical activity behaviors of children (Marcus et al., 2006), obesity prevention (Stegelin, 2008), promotion of healthy behaviors (Perry et al., 1988) and motor skill development of children (Hamilton et al., 1999).
Generally, family based interventions have been seen with respect to the promotion of physical activity and obesity prevention in the literature. In terms of the motor development of young children, only one study has been conducted with parents to examine the role of parental involvement in motor skill development (Hamilton et al., 1999). Family based interventions are challenging because of intervention application difficulties and inconsistent results of the studies (Kitzmann & Beech, 2006). For example, a review of family based intervention in childhood obesity was conducted by Berry et al., (2004). Family based interventions between the years of 1980 and 2004 were analyzed and selected based on including the components of nutrition education, and exercise and behavior modifications. Thirteen family based intervention studies were found. The studies showed differential results in terms of the effectiveness of the intervention. Behavioral modifications and behavioral therapy interventions focused on both parents and children were found to be effective forms of interventions (Berry et al, 2004). However, problem solving interventions including both parents and their children or children only was not found to be effective (Berry et al., 2004). Methodological weakness of the studies were also reported in the review and included: a) limited number of participants in the studies, b) lack of data on the ethnicity and socio economic status (SES) of children, and c) lack of explanation on the randomization process of participants.

Another review by Salmon, Booth, Phongsavan, Murphy, and Timperio (2007) was conducted to identify physical activity interventions for two different age groups (4-12 and 13-19 years). Studies were selected between the years 1986 to 2006. Nine family based interventions were found for physical activity promotion. Only one study was
found for the second age group of children (13-19 years). The basic characteristics of the studies reported: a) a majority of studies built their interventions based on theory, b) participants of the studies were from low SES and ethnic minority populations, c) the retention rate was a problem in one study, and, d) lack of a control group existed in a number of studies. Similar limitations were reported in a home and community based physical activity intervention designed for adolescent girls and their mothers (Ransdell et al., 2003). The main limitations of this study were that there was: a) a small sample size, b) no control group, and, c) no randomization in the sample size (self-selected participants).

A similar systematic review was examined on the effectiveness of physical activity interventions for children and adolescents (Sluijs, Mcminn, & Griffin, 2008). Four family based interventions were found. However, only one study found a significant intervention effect (Sluijs et al, 2008). Kahn et al. (2002) also found inconsistent results in twelve studies designed for social support of the family to change health behaviors.

Family based interventions are also common in early childhood special education area. Positive effects of family based interventions are reported in a review of 41 studies consisting of children with cognitive deficits (Hoagwood, 2005), a study of siblings of children with developmental problems (Lobato & Kao, 2005), and another review of family based interventions for children with disabilities (Dempsey & Keen, 2008). However, there is still a need to increase family based interventions in the population of children with special needs to find consistent results (Demsey & Keen, 2008). Early interventions play an essential role to diagnose developmental delays of children and to design family based interventions for families and their children. Children can take
advantage of family based interventions in which the positive outcomes of families are inevitable (Bailey & Bruder, 2005). It is worth noting that if family based interventions are organized in a high quality manner, researchers or practitioners possibly achieve positive outcomes of interventions. For this reason, best practices for family based interventions in early intervention and early childhood special education has been suggested by Division of Early Childhood (DEC).

**Best Practices for Family Based Interventions**

Family based intervention is one of the most common ways to support and enhance a child’s development by educating families, providing necessary supports, and appropriate resources (Trivette & Dunst, 2005). DEC has identified a series of principles and recommendations to demonstrate how researchers or practitioners might work with families to deliver a program, education, knowledge, or resources during family based interventions (Sandall, Hemmeter, Smith, & McLean, 2005). Those principles are summarized in Table 2.3.

The conceptual framework of the recommended practices is derived from four major principals that help produce best results in high quality interventions (Sandall et al., 2005). These principles are: “a) a shared responsibility and collaboration, b) strengthened family functioning, c) individualized and flexible practices, and d) strengths-and asset-based practices” (p.110). Based on the DEC recommended practices, developmentally appropriate practices and services should support the whole child by focusing on a family as a system within their natural home environment, which is parallel the basis of Ecological Systems theory (Bronfenbrenner, 1979). These principles are important guidelines in order to achieve the main goals of any family based interventions.
It should be noted that these principles have been empirically derived (Sandall et al., 2005).

<table>
<thead>
<tr>
<th>Main Principles*</th>
<th>Sub-Titles of Main Principle*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sharing responsibility with families</td>
<td>Defining appropriate family outcomes</td>
</tr>
<tr>
<td></td>
<td>Working together with families to reach family outcomes</td>
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<tr>
<td></td>
<td>Sharing information related to outcomes</td>
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<td></td>
<td>Providing options and opportunities for families to make decisions</td>
</tr>
<tr>
<td></td>
<td>Providing information and resources for parents</td>
</tr>
<tr>
<td></td>
<td>Providing services recognized cultural or personal differences</td>
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<tr>
<td>Increasing family functioning</td>
<td>Providing practices, information, knowledge and support for families to make decisions</td>
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<tr>
<td></td>
<td>Giving opportunities for family participation</td>
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<tr>
<td></td>
<td>Providing informal, formal or community opportunities for parents</td>
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<td></td>
<td>Providing support to increase families knowledge, skills and abilities</td>
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<tr>
<td>Providing individualized practices</td>
<td>Providing opportunities based on families’ needs</td>
</tr>
<tr>
<td></td>
<td>Providing appropriate support based on families’ choices</td>
</tr>
<tr>
<td></td>
<td>Recognizing individual and cultural differences</td>
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<tr>
<td></td>
<td>Arranging practices and resources by recognizing families’ values</td>
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<tr>
<td>Increasing families’ abilities and competencies</td>
<td>Providing opportunities to enhance families’ confidence</td>
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<tr>
<td></td>
<td>Recognizing families abilities to identify family based practices</td>
</tr>
<tr>
<td></td>
<td>Providing new knowledge and skills</td>
</tr>
</tbody>
</table>

Note. *Adapted from DEC Recommended Practices (Sandall et al., 2005).

Table 2.3 DEC Recommended Practices: Family Based Practices

An understanding of these principles helps researchers, practitioners and families work together effectively. In addition to DEC recommendations, research on family based interventions has showed a variety of techniques and procedures to implement the
programs effectively. The following section summarizes the methodological procedures used in family based interventions.

Methodology of Family Based Interventions

Family based interventions require several components during implementation procedures. A variety of techniques (e.g. dealing with lack of compliance or communication with parents) being used in the interventions are well documented in the limited literature (Ransdell et al., 2004; Rodaarmel et al., 2006; Shaw, Dishion, Supplee, Gardner, Arnds, 2006; Teufel et al., 1999). The same literature shows how researchers implement their family based interventions and what procedures are followed in the studies.

For example, a home based and community based interventions for physical activity promotion were designed by Ransdell et al. (2004). Participants in the home based intervention received a packet including a calendar for recommended activities, a series of activity pictures and suggestions for dealing with physical activity barriers. In order to track participants’ physical activity, participants in the home based intervention sent or faxed their physical activity logs to the researchers. If not, they received phone calls to get their physical activity logs. Incentives (e.g. sports tickets, books or sports equipment) were also used to promote compliance in the study. Another study by Teufel et al. (1999) followed similar strategies to examine the effects of a family intervention on American Indian children to promote healthy behaviors. A family pack, family events, and school-based family advisory councils were organized for the family intervention. Family packs had lesson plans for physical activity participation and healthy eating habits. Return cards were included in family packs to check for the compliance of the
intervention. Small incentives (e.g. novelty shoelaces) were given for returning 4 out of 6 cards. A family fun night was also organized to build cooperation and connection among children, parents, school members and researchers. An advisory council was provided in the school for giving feedback about the intervention to the participants.

Rodaarmel et al. (2006) followed similar intervention strategies in a family based intervention on obesity prevention for children. Educational logs were created for participants to write down their steps and cereal consumption. Educational logs included cartoon characters to encourage participants to complete the tasks in the intervention. Families were responsible for returning educational logs after the 3rd and 10th week of the intervention. Refrigerator magnets and stickers for mirrors were given in order to remind the participants to fill out the educational logs. Home visits are another common strategy in family based interventions. In a family based intervention on the prevention of early behavior problems during the early childhood period, 2.5 hour home visits were planned to apply the intervention (Shaw et al., 2006). Parents were paid to be able to perform intervention in this study.

Overall, working with parents is not an easy procedure. In fact, there are many challenges for researchers, professionals and families to conduct family based interventions or studies. Sometimes, maintaining parent participation is a really difficult part of family based interventions. Home based visits, phone calls, and reminder messages or notes from classroom teachers or researchers might be some key strategies to keep parents active and engaged in the study. In addition to the problems of parent participation, interventions are not always appropriate for parents’ expectations or their daily schedules or programs (Bailey & Bruder, 2005). Thus, it can be difficult to fully
implement the programs or interventions for them (Bernheimer & Keogh, 1995). Parent’s lifestyles should be considered prior to the interventions (Kitzmann & Beech, 2006). Furthermore, professional cooperation should be developed with the families at the beginning of the intervention by explaining all aspects of the study. Chao et al. (2006) conducted a study to investigate the effect of a family based intervention on young children with language and behavior problems. The study revealed that the intervention was effective if family lifestyle was recognized as a key dimension of an early intervention process.

Another challenge reported in a literature review is that professionals or researchers sometimes have a hard time understanding parents’ points of view or their preferences (Minke & Scott, 1995). Clear communication between professionals and parents plays an essential role throughout the program implementation and evaluation in order to solve any conflicts between them. Freeman and Vakil (2004) recommended that regular meetings might help to build clear and open communication that involves reports of children’ progress (e.g. journals). Electronic communication (e.g. email) is also suggested by the researchers.

In summary, family based interventions are generally created to help parents understand their children’s needs and provide opportunities to acquire professional knowledge and training to contribute to the physical, cognitive, social, and emotional development of their children (Dunst, 2002). Once interventions meet the needs of children and families, it is possible to see the positive effects of family based interventions on children (Dunst, 2002).
A General Summary of Literature Review

Dynamical Systems theory and Ecological Systems theory explains the systems contribute to children’s development in many ways. In this study, the roles of many systems (e.g. individual, family, environment, school) were recognized in two motor skill interventions to promote the motor skill development of children who are at risk and encourage future physical activity participation. Considering the high number of children with developmental delays, early intervention programs become crucial to facilitate children’s life in positive ways.
CHAPTER 3

METHODS

The purpose of this study was to examine the effects of two motor skill interventions on preschool children’s object control skill (OC) performance and their perceived motor competence. In this chapter the theoretical frameworks of the study are explained, followed by setting, participants, design of the study, procedures and data analysis. Detailed information about the variables collected, intervention, instrumentation, measurement techniques and testing procedures are also provided in this section.

Setting

_CDC Head Start Program_

This study was conducted in two Head Start Centers in a large Midwest urban city of United States. Head Start is a nationwide education program created for low-income children and their families. The general aim of the program is “to promote school readiness by enhancing the social and cognitive development of children through the provision of educational, health, nutritional, social and other services to enrolled children and families” (USDHHS, 2010). In order to achieve its mission, Head Start programs provide two main services which are “Early Childhood Development and Health” and “Family and Community Partnerships” (USDHHS, 2010). Basically, a healthy learning
environment is provided by considering the developmental needs of children at the Head Start Centers. The program focuses on the social, emotional, physical, cognitive and language development of children (CDCFC, 2009). In addition to early childhood development, parent involvement is also recognized as a key factor in children’s education by building a trustful collaboration among teachers, parents and staff at the Head Start Centers (USDHHS, 2010).

Families and children in this study met the eligibility criteria to get involved in Head Start Services based on Title 45- Public Welfare, section 1305 (USDHHS, 2010). The children were from low income families and aged between 3 and 5 years old. Risk factor assessment and a readiness test were also applied for those children to determine their eligibility to attend the Head Start Centers.

A standardized Head Start Curriculum and a team teaching approach are followed by the Head Start Centers with 2 teachers (typically a lead teacher and an assistant teacher) for an average of 17 children in classes. The daily schedule of the centers is provided in Table 3.1. As can be seen in Table 3.1, there is no structured motor skill development program provided for children in the Head Start Centers. For this study, two different Head Start Centers were selected as an intervention site and a comparison site. However, both centers were part of the same overall child development council consisting of 27 Head Start centers. All centers had the same eligibility requirements for entry into the program and the same curriculum.
<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:45 am</td>
<td>Staff arrival and preparation</td>
</tr>
<tr>
<td>7:00 am</td>
<td>Arrival: Staff greets children and parent, conduct visual health check, and document child’s arrival on the attendance sheet.</td>
</tr>
<tr>
<td>7:15 am</td>
<td>Breakfast available</td>
</tr>
<tr>
<td>7:30 am</td>
<td>Limited free choice activities</td>
</tr>
<tr>
<td>8:30 am</td>
<td>Large group/talk time</td>
</tr>
<tr>
<td>8:50 am</td>
<td>Choice time and small groups</td>
</tr>
<tr>
<td>10:00 am</td>
<td>Clean-up</td>
</tr>
<tr>
<td>10:25 am</td>
<td>Story time</td>
</tr>
<tr>
<td>10:45 am</td>
<td>Group meeting/transition</td>
</tr>
<tr>
<td>11:30 am</td>
<td>Family Style Lunch</td>
</tr>
<tr>
<td>12:15 pm</td>
<td>Outdoor and large muscle activity</td>
</tr>
<tr>
<td>1:00 pm</td>
<td>Rest/nap time</td>
</tr>
<tr>
<td>3:00 pm</td>
<td>Transition/music</td>
</tr>
<tr>
<td>3:15 pm</td>
<td>Open snack available</td>
</tr>
<tr>
<td>3:50 pm</td>
<td>Group activity</td>
</tr>
<tr>
<td>4:15 pm</td>
<td>Choice time/small group activities</td>
</tr>
<tr>
<td>5:30 pm</td>
<td>Clean-up</td>
</tr>
<tr>
<td>5:45 pm</td>
<td>Departure</td>
</tr>
</tbody>
</table>

*Note. From the CDCDF 2008-2009 Parent Handbook Calendar (www.cdcheadstart.org/Handbookonly.pdf).*

Table 3.1 Daily Schedule of the Head Start Centers

**Participants**

All participants (N=72) in the study were enrolled in two Head Start centers that were part of a Head Start program in a large urban Midwestern city. Participants were randomly drawn from two Head Start centers. Parent permission forms were given to 62 students at the Center A. 58 parent consent forms were received from the parents. Four children did not want to attend the data collection procedure. Two children left the center during the implementation period of interventions and 5 children did not participate in the post-tests because of being absent, having family issues or attending kindergarten. For the data to be included for overall the analysis, the participants must have performed the both
pre-tests and post-tests. The total number of participants in Center A was 47 including 21 girls and 26 boys. The races of children were 93.62% of African American, 6.38% of Caucasian and the ethnicity of children was 100% not Hispanic or Latino. Center A had three preschool classes (Class 1, 2, 3). Within Center A, participants from the three classes were randomly assigned to a Motor Skill Intervention group (n=22, 11 girls & 11 boys; MSI) and a Motor Skill and Family Intervention group (n=25, 10 girls & 15 boys; MSFI). Then, 3 classes (Class A, B, C) involving children from both MSI and MSFI groups were created. Figure 3.1 shows the process of randomization in the study.

In Center B, parent consent forms were given to 30 children. 26 parent consent forms were received from the parents. One child left the center after the pre-tests. 25 children (15 girls & 10 boys) were included for the data analysis for the Comparison group. Their race was African American (%100) and ethnicity of children was categorized as not Hispanic or Latino (100%). Within Center B, 25 children randomly assigned to the Comparison group (Figure 3.1).

A number of participants were lost from the study between the posttest and retention test. This population of young disadvantaged students typically has high rates of transiency due to factors such as change in residence, inability to pay for the program, and changes in caregiver. The number of the participants for the MSI group went from 22 at the posttest to 15 (6 girls, 9 boys) at the retention test. The number of the participants for the MSFI group went from 25 at the posttest to 20 (8 girls, 12 boys) at the retention test.
STEP 1. Creation of MSI & MSFI Groups

<table>
<thead>
<tr>
<th>Classes</th>
<th># of children</th>
<th>MSI</th>
<th>MSFI</th>
<th># of children</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17</td>
<td>7</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>7</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

STEP 2. Creation of Class A, B, & C for the interventions

<table>
<thead>
<tr>
<th>Class 2 (n=17)</th>
<th>Class 4 (n=16)</th>
<th>Class 5 (n=14)</th>
<th>Total (n=47)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>4 MSI &amp; 5 MSFI</td>
<td>2 MSI &amp; 4 MSFI</td>
<td>15</td>
</tr>
<tr>
<td>Class B</td>
<td>3 MSI &amp; 5 MSFI</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Class C</td>
<td>5 MSI &amp; 5 MSFI</td>
<td>3 MSI &amp; 4 MSFI</td>
<td>17</td>
</tr>
</tbody>
</table>

Figure 3.1 The Randomization Process of the Study

The MSI group consisted of 22 children with a mean age of 48.05 months. There were 11 girls (50%) and 11 boys (50%) with 100% of the group being African American. The MSFI group consisted of 25 children with a mean age of 49.47 months. There were 10 girls (40%) and 15 boys (60%) with 88% of the group being African American. The Comparison group consisted of 25 children with a mean age of 47.68 months. There were 15 girls (58%) and 10 boys (42%) with 100% of the group being African American. The demographic characteristics of children for all groups are provided in Table 3.2.
### Demographic and Anthropometric Characteristics of Participants by Group

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>Total (All participants)</th>
<th>MSI</th>
<th>MSFI</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Children</td>
<td>72</td>
<td>22</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Sex</td>
<td>36 Girls</td>
<td>11 Girls</td>
<td>10 Girls</td>
<td>15 Girls</td>
</tr>
<tr>
<td></td>
<td>36 Boys</td>
<td>11 Boys</td>
<td>15 Boys</td>
<td>10 Boys</td>
</tr>
<tr>
<td>Race</td>
<td>69 African American</td>
<td>22 African American</td>
<td>22 African American</td>
<td>25 African American</td>
</tr>
<tr>
<td></td>
<td>3 Caucasian</td>
<td>3 Caucasian</td>
<td>3 Caucasian</td>
<td>3 Caucasian</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>72 Not Hispanic/Latino</td>
<td>22 Not Hispanic/Latino</td>
<td>25 Not Hispanic/Latino</td>
<td>25 Not Hispanic/Latino</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (months)</td>
<td>48.41</td>
<td>6.62</td>
<td>48.05</td>
<td>6.45</td>
<td>49.47</td>
<td>6.41</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>103.48</td>
<td>6.44</td>
<td>103.92</td>
<td>5.93</td>
<td>104.34</td>
<td>4.99</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>17.77</td>
<td>3.21</td>
<td>18.30</td>
<td>4.14</td>
<td>17.61</td>
<td>2.35</td>
</tr>
<tr>
<td>BMI</td>
<td>16.29</td>
<td>2.68</td>
<td>16.76</td>
<td>2.22</td>
<td>15.49</td>
<td>3.57</td>
</tr>
<tr>
<td>Grip Strength (R)</td>
<td>1.04</td>
<td>1.52</td>
<td>1.38</td>
<td>1.77</td>
<td>1.28</td>
<td>1.62</td>
</tr>
<tr>
<td>Grip Strength (L)</td>
<td>0.70</td>
<td>1.04</td>
<td>0.79</td>
<td>0.99</td>
<td>1.00</td>
<td>1.16</td>
</tr>
<tr>
<td># of Risk Factors</td>
<td>2.42</td>
<td>2.06</td>
<td>2.23</td>
<td>1.09</td>
<td>2.55</td>
<td>2.52</td>
</tr>
</tbody>
</table>

#### Table 3.2 Demographic and Anthropometric Characteristics of Participants by Group

### Instrumentation

The main dependent variables were object control skills of children and their perceived motor competence. The OC subscale of the Test of Gross Motor Development 2 (TGMD-2; Ulrich, 2000) and the motor competence subscale of the Pictorial Scale for Perceived Competence and Social Acceptance Scale (PSPCSA; Harter & Pike, 1984) were used to examine these variables. A number of other variables were identified as being important. An additional test was applied to identify children’s home environment relative to the motor development (outside space, inside space, variety of stimulation, fine motor toys and gross motor toys). Anthropometric measures (height, weight, BMI,
grip strength) were also taken during the study. Table 3.3 provides information about the instrumentation used in this study.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Variable Measured</th>
<th>Type of Data Used in Analysis</th>
<th>Time/ Who Administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGMD-2 (Ulrich, 2000)</td>
<td>Object Control Skills</td>
<td>Raw score (0-48)</td>
<td>10-15 min/ Researcher and Research Assistants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard Score (1-12)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentile Score</td>
<td></td>
</tr>
<tr>
<td>Pictorial Scale of Perceived Competence and Social Acceptance (Harter &amp; Pike, 1984)</td>
<td>Perceived Motor Competence</td>
<td>Mean Score of 6 Items (range between 1-4)</td>
<td>5-6 min/ Researcher</td>
</tr>
<tr>
<td>AHEMD-SR/Home Inventory (Rodrigues et al., 2005)</td>
<td>Affordances in Home Environment for Motor Development</td>
<td>Standard Score for 5 Factors (1-4)</td>
<td>15-20 min/ Researcher</td>
</tr>
<tr>
<td>Anthropometric Measures</td>
<td>Height, Weight, BMI, &amp; Grip Strength</td>
<td>cm, kg, kg/m2, the maximum score of Grip Strength</td>
<td>5-7 min/ Researcher and Research Assistants</td>
</tr>
</tbody>
</table>

Table 3.3 Instrumentation of the Study

Test of Gross Motor Development 2 (TGMD-2)

The TGMD-2 was used to assess the object control (OC) skills of the participants at the pretest, posttest and retention test. The TGMD-2 is a norm referenced test designed to assess fundamental motor skills of children between ages 3 to 10 years (Ulrich, 2000). The TGMD-2 includes two subtests, the locomotor and OC subtests. For the purposes of this study only the OC subtest will be utilized. The OC subtest includes six OC skills: striking a stationary ball, stationary dribble, catch, kick, overhand throw and underhand roll.

Each fundamental motor skill in the TGMD-2 has between 3 and 5 performance criteria. For example, there are three performance criteria for catching: a) “preparation
phase where hands are in front of the body and elbows are flexed, b) “arms extend while reaching for the balls as it arrives”, and, c) “ball is caught by hands only”. Each child is evaluated on whether they meet the performance criteria or not. If a performance criterion is met, a 1 is awarded. If a performance criterion is not met a 0 is awarded. Each child attempts two trials for each of the six OC skills and is scored on the performance criteria. The total numbers of 1s are summed with a possible range between 0 and 48 points.

From the raw score, standard score and percentile rank were calculated based upon the child’s age and gender. High skill scores indicate children met performance criteria and low skill scores indicate children did not meet performance criteria for the OC skills. A child who had a percentile rank below the 25\textsuperscript{th} percentile was considered developmentally delayed (Ulrich, 2000).

The reliability and validity of TGMD-2 were tested on a representative group of children (50% of male, 50% of female, 77% of white, 17% of black, 6% of other, 77% urban and, 23% rural) from 10 different states of America (Ulrich, 2000). The mean internal consistency reliability of the OC subtests were .80 for children ages 3 to 10 years. The range was from .85 to .92 (Ulrich, 2000). The content validity of the test was confirmed by conducting an item analysis and providing a rationale for the items. The construct-identification validity was also confirmed by factor analysis (Ulrich, 2000).

*Testing Procedures*

Before the data collection, the researcher and the assistants were trained by an expert from the motor development area to use the TGMD-2. Testing procedures, conditions, scoring and interpretation of the results were taught during the training sessions.
The same standardized testing procedures (Ulrich, 2000) were followed by the researchers in order to test all children. Test materials such as playground balls, plastic bats and cones were organized for the test at the Head Start Centers prior to the testing. All precautions were taken to limit the distractions and provide a safe environment for the children. Four children were tested at the same time. The testing procedures included:

a) Child came to the testing area and did some warm up activities such as stretching,
b) After the warm up, the researcher explained the skill and then demonstrated the skill with all critical elements,
c) One practice trial was provided for the child.
d) Two main trials were performed by the child and videotaped by the researcher.
e) No feedback about the child’s performance was given to the child during the testing process other than positive feedback like “good job” regardless of the performance criteria demonstrated.

*Inter and Intra Observer Agreement Reliability*

All testing procedures were videotaped and coding of the performance criteria were analyzed from the videotape by the researchers. Two independent observers (the researcher and the assistant) analyzed the OC skills of children. Thirty percent of trials from the pretest, posttest and retention test were examined and independently scored by both observers. The formula to calculate the inter-observer reliability was the agreements divided by the total score of agreements and disagreements (House, House, & Campell, 1981). Inter observer reliability was reported 96.73% on pre-test, 94.44% on post-test and 96.20% on retention test. The primary researcher also calculated intra observer agreement on 30% percent of the trials with 10 days between the two viewings for all tests. The intra
observer agreement was found as 96.61% on pre-test, 95.22% on posttest and 96.16% on retention test.

_The Pictorial Scale for Perceived Motor Competence and Social Acceptance for Young Children_

The PSPCSA was used to measure the participants’ perceived motor competence at the pretest, posttest and retention test. The PSPCSA is a valid and a reliable instrument developed to assess preschool children’s perceptions about cognitive competence, peer acceptance, motor competence and maternal acceptance (Harter & Pike, 1984). The PSCPCSA has different versions of the scale depicting boys and girls, and also children from different ethnic backgrounds. For each participant, an appropriate (matched) pictorial scale was applied such as an African American female version or African American male version.

The PSPCSA also has two different versions of the scale for preschoolers/kindergartners (4 to 5 years old children) and first/second graders (6 to 7 years old children) (Harter & Pike, 1984). The P-K version of this scale was used in this study because the participants were preschoolers. The instrument was composed of four subscales: cognitive competence, peer acceptance, motor competence, and maternal acceptance. Each subscale had six items with regard to its domain area (a total of 24 items in the instrument).

For the purposes of this study, only the perceived motor competence (only 6 items) subscale was utilized. The six items of motor competence included: “good at swinging, good at climbing, can tie shoes, good at skipping, good at running, and good at hopping” (Harter & Pike, 1984). Each item in a picture booklet includes two separate
pictures demonstrating one high skilled child and one low skilled child. A set of
descriptions are located under each picture. For example, item “good at swinging” has
two pictures showing that one high skilled child is swinging and one low skilled child is
swinging. First, the participant was read the descriptions and pointed out the pictures
regarding the swinging pictures: “this boy/girl is pretty good at swinging by
himself/herself” and this boy/girl is not very good at swinging by himself/herself”.
Second, the child was asked to select the child who is most like him or herself (good or
not good). Third, the child was asked to describe his/her level of performance in this skill.
If the child selected the high skilled child in the picture, the child pointed out his/her
swinging performance as “pretty good” (3 points) or “really good” (4 points). If the child
selected the low skilled child, he/she pointed out his/her performance as “not too good”
(1 point) or “sort of good” (2 point). A score of 1 indicated a low level of perceived
competence and a score of 4 indicated a high level of perceived competence in the motor
skills. The total score of perceived motor competence ranged from 6 to 24. The mean
scores were calculated and ranged from 1 to 4 points. Harter and Pike (1984) reported the
internal consistency reliability of the total scale (24 items) between .85 and .89 for both
forms. The internal consistency reliability scores of perceived motor competence were
reported as .66 for preschoolers (N=90) and as .55 for kindergartners (N=56). The
combined score (preschoolers and kindergartners, N=146) of internal consistency
reliability score was .62 for perceived motor competence. Validity of the instrument was
verified for convergent validity, discriminant validity and predictive validity (Harter &
Pike, 1984). This scale has been widely used with African American preschoolers
(Goodway & Rudisill, 1996; Godway & Rudisill, 1997; Harter, 1999). For this study, the
test-retest reliability was performed on 20 children in a two week period. The score of test-retest reliability was 95.80%.

**Testing Procedures**

Prior to the data collection, the researcher and the assistants were trained to administer the instrument. The same standardized test protocols were followed for each participant in this study and took approximately 5 to 6 minutes to administer at the pretest, posttest and retention test:

1. The appropriate version of the test was used in a quiet available space. The child was seated with the pictures in front of the participant and the verbal descriptions in front of the researcher. Figure 3.2 shows the format of pictorial scale booklet for a sample item demonstrated before the test items.

![A sample Item](image)


Figure 3.2 The Pictorial Scale Booklet Format for a Sample Item
2. A sample item (not a test item) with verbal descriptions was implemented to the child to ensure the child understood the questions and the directions before the motor competence scale was administered.

3. The motor competence items were asked to the participant to determine his/her perceptions about motor competence. The order of the items were: swinging, climbing, shoe tying, skipping, running, and hopping” (Harter & Pike, 1984). The scores of each item were recorded to the scoring sheet.

Affordances in the Home Environment for Motor Development Self-Report (AHEMD-SR)

Affordances in the Home Environment for Motor Development were assessed using AHEMD-SR questionnaire (Rodrigues et al., 2005). This instrument is a valid and reliable self report questionnaire designed for parents to report their home affordances and events that might influence motor development of children between the ages of 18 and 42 months. The AHEMD-SR consists of five subscales and 67 questions. The subscales are: outside space, inside space, variety of stimulation, fine motor toys and gross motor toys. The questionnaire includes child and family demographics. Different types of questions exist in the instrument. For example, a four point likert type scale is used to describe the time children spent in different situations (such as in a seating device, in a playpen or in any space of the house). Simple dichotomic choice questions (yes-no questions) are used to determine daily activities children and families might have performed at home. Description based questions are used to describe play materials in the home such as stuffed toys, dolls, vehicles, and musical toys. In addition, a variety of toy pictures related to fine and gross motor skills are illustrated in the questionnaire to help
parents identify their toys at home. Time to complete the questionnaire was approximately 15 to 20 min. Standard scores (1 through 4) were used for data analysis to describe affordances in home environment for each subscale (outside space, inside space, variety of stimulation, fine motor toys and gross motor toys). If one subscale was categorized as 1, it referred to no opportunities available for child’s motor development in that subscale. Four referred to very good opportunities available for child’s motor development in the subscale.

The face validity of the instrument was tested by two ways. The first one was expert opinion about the items and the second one was a pilot study (Gabbard, Cacola, & Rodrigues, 2008). Gabbard et al. (2008) also verified the construct validity by a confirmatory factor analysis. Five factor analyses (outside space, inside space, variety of stimulation, fine motor toys and gross motor toys) were reported and exceeded .90 for each factor. The scale reliability coefficient was reported as .85 (Gabbard et al., 2008).

Procedures for the questionnaire

The questionnaire was given to the parents in the intervention groups at the Head Start Center when they came to the center to pick up their child. The researcher explained the purpose of the questionnaire and how to respond to each of the questions. Parents’ questions with regard to the questionnaire were answered. Parents completed the questionnaire in approximately 10-15 minutes. During this time the researcher rotated around to parents answering individual questions. Some parents would like to fill out the questionnaire at home and return it the next day. However, some of them did not return it. One parent did not want to fill out the questionnaire and she claimed that the questionnaire was designed for younger children, not for her child’s age group. In
addition, the questionnaire was given to the parents in the Comparison group and they fill out the forms at home. Only 13 parents returned the questionnaire. The total number of received questionnaire was 51.

Anthropometric Measurements

Anthropometric measurements were taken consisting of height, weight, body mass index (BMI), grip strength and percent body fat.

*Height, Weight and Body Mass Index*

The guidelines from the Centers for Disease Control and Prevention (CDC, 2008) were followed to take height and weight measures of the participants. Height was taken without socks or shoes by a stadiometer to the nearest 0.1 cm. According to CDC (2008) guidelines, the participants stood with straight legs, arms at sides, head in the cranial plane, shoulder, buttocks and heels against the wall. Weight measures were also taken without socks or shoes by an electronic scale to the nearest 0.1 kg. The participant was placed in the center of electronic scale (CDC, 2008). Height and weight scores were also used to calculate the participants’ body mass index (BMI). BMI is a widely used measurement to determine the relative body fatness of children (CDC, 2008). It is calculated by body weight in kilograms divided by height in meters squared.

*Grip Strength*

Grip strength was measured by a hand grip dynamometer at the pretest, posttest and retention test (Baumgartner & Jackson, 1999). The participants were asked to relax their arms by side and hold the hand grip dynamometer in the groove of the fingers to ensure that an appropriate fit for the dynamometer was achieved prior to testing. The
participants then performed their maximal contraction of bar twice. The maximum score was used in data analysis.

Design and Implementation of the Intervention

All children in the study were enrolled in a Head Start program in a large Midwestern city. This Head Start program had 27 centers throughout the city and used standardized admission criteria and a standardized curriculum for all Head Start centers. For the purposes of this study two of the larger centers that had similar demographic characteristics were selected.

Comparison Group

The children in the Comparison group were in Center B and received the regular Head Start curriculum. The general goal of the curriculum is to improve school readiness of preschoolers through a variety of educational opportunities focusing on cognitive, emotional, social and language development of children. The regular curriculum is implemented for 42 weeks in a year, September through May. More specifically, preschoolers attend the Center five days in a week (Monday through Friday), 7:00 am 5:45 pm. A typical day includes breakfast, lunch, nap time, limited free choice activities, small and large group activities, story time, outdoor activities and large muscle activities. Detailed information about a daily schedule is provided in Table 3.1

The children in the Comparison group did not receive any structured motor skill program during the intervention. They just participated in their outdoor activities and large muscle activities as part of their regular curriculum. During those sessions, the playground area was generally being used for the activities if the weather conditions were appropriate to go outside. The preschoolers were free to do whatever they wanted in the
playground area. The researcher randomly observed their outdoor activities at the playground area and verified that the children did not receive any skill instruction or any feedback by their classroom teachers. Children generally engaged in running, jumping, climbing, using monkey bars, using slides and playing with the over head ladder at the playground area.

*Intervention Groups*

Two intervention packages were designed to apply to the preschool children in Center A. Package 1 was the Motor Skill Intervention (MSI) and provided a series of activities to improve the object control skills of children. On the other hand, Package 2 was the Motor Skill Family Intervention (MSFI). The MSFI consisted of the same motor skill intervention in Package 1 and the addition of a series of home activities with parental involvement. In the following sections, the rationale and explanation of the MSI and MSFI are explained in detail.

*Motor Skill Intervention (MSI) and Motor Skill Family Intervention (MSFI) Groups*

All children in the study received the same Head Start curriculum with the two intervention groups (MSI and MSFI) being in Center A and the Comparison in Center B. The primary difference between Center A (Intervention site) and Center B (Comparison site) Head Start programs was the addition of a motor skill program at Center A. This program was part of an university collaboration and had been organized at the site for the past four years. The rationale and organization of the motor skill program (e.g. time, sessions, and organization) was grounded on previous research studies (Hamilton et al., 1999; Goodway, et al., 2003; Goodway & Branta, 2003; Valentini & Rudisill, 2004b;
The motor skill program typically took place twice per week for 30 minutes over an 8 week period during the quarter.

**Motor Skill Intervention**

The MSI program was designed to develop the object control skills of preschoolers through developmentally appropriate instruction and practices. All children in the MSI and MSFI groups received the same MSI program. Children were randomly assigned to MSI and MSFI groups from three classrooms at Center A. Children were then split into three classes to receive the MSI intervention. Each class had children from the MSI and MSFI groups (see Figure 3.1). The MSI intervention consisted of 16 sessions in an 8 week period. Each session lasted 30 minutes on Tuesdays and Thursdays mornings. The total amount of instructional time for the intervention was 480 minutes (60 minutes for each week). In order to implement the intervention, a multi-purpose room and an outdoor playground area based on the availability of weather were utilized. All preschoolers had their own space and equipment while receiving the motor skill instruction.

The focus of the MSI program was the development of six object control skills: throwing, catching, kicking, striking, bouncing and rolling. Table 3.4 shows the distribution of instructional time to the six OC skills over the 8 week period. The lesson plans for each session contained warm-up, motor skill instruction and closure activities. A typical lesson began with a variety of games such as the body part game or jumping in hula-hoops and lasted around 2-3 min. A 24 min motor skill instruction for two object control skills (12 min for each OC skill) was followed by closure activities lasting 2-3 min. The instructional time allocated in the lesson plans was based on recommended
motor skill instruction time in the motor development literature (Hamilton et al., 1999; Goodway & Branta, 2004; Robinson & Goodway, 2009).

<table>
<thead>
<tr>
<th>OCS Week. Session</th>
<th>Throw</th>
<th>Kick</th>
<th>Catch</th>
<th>Strike</th>
<th>Bounce</th>
<th>Roll</th>
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<tbody>
<tr>
<td>1.1</td>
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<td>8.2*</td>
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<tr>
<td><strong>Total Min</strong></td>
<td>65</td>
<td>65</td>
<td>65</td>
<td>65</td>
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</table>

Note. X designates the skill was taught in that session. *This session included an obstacle course for each skill and 5 minutes were allocated time for each skill.

Table 3.4 Block Plan of Object Control Skills (OCS) in Motor Skill Intervention

Lesson plans were developed by the researcher who had 3 years of teaching experience in the motor development of young children. Two experts having experience with disadvantaged children in the motor development area checked the lesson plans with regard to content, task analysis, critical elements of skills and equipment modifications. A task analysis of each skill was conducted to develop instructional activities ranging from simple to more complex.
Lesson plans were developed based upon the critical elements of the skill, task analysis of the skills being taught, and the pretest level of the children in the intervention groups. Critical elements were embedded into the lesson plans in terms of providing feedback. For each skill, a task analysis was conducted developing a series of activities that could go from easy to more complex. The task analysis involved manipulating different factors for a skill. For example, for throwing, the factors that were manipulated included distance from target, size of the target, physical prompts such as a scarf tied to the opposite leg, and complexity of the environment in which the skill is being performed. A convention was developed for each skill indicating which factors would be manipulated first. Appendix A provides the conventions developed for each of the six OC skills. The example below illustrates the convention developed for throwing (see Figure 3.3).
Skill: THROW

Critical Elements:
1. Wind-up with downward arm/hand
2. Throwing arm straight back behind body before throwing
3. Trunk rotation from lower body to upper body
4. Shift weight forward with opposite foot
5. Follow through after releasing ball

Key Words for Instruction:
Throw hard, step forward and throw, step with opposite leg, swing arm back and over, reach behind, swing arm and throw, follow through, transfer body weight

Factors we manipulated

1. Distance: 5, 8, 10, 12, 15, 20 feet
2. Object: Bean bag, yarn ball, tennis ball
3. Target: Large (e.g. wall), medium (e.g. hoops on wall, picture sheets), small (e.g. shapes, numbers, letters on paper)
4. Physical Prompts: Scarf tied to leg, foot print, sticker on foot and hand, poly spot, hula-hoop, lines on floor, no prompt
5. Complexity: Individual practice, partner activity, game like activity

Convention (simple to complex):
In the beginning distance and the type of object was manipulated. Throughout the intervention a variety of physical prompts were used to assist the child. As children became proficient physical prompts were removed, and distance was increased along with the introduction of targets. Complexity was added to the lesson plans in terms of the environment in which the task was performed.

Figure 3.3 Conventions of Throwing

The motor skill intervention was implemented by a trained motor skill instructor at Center A. The instructor had 2 years of experience in assisting a university course of motor development and experience in teaching and working with children who had special needs. The instructor had Adapted Physical Education Endorsement Certificate and P-12 Teacher Licensure. The objectives of this study were clearly discussed with the instructor and a training session was conducted to identify the purpose of the study, the
A typical lesson applied by the instructor was as follows:

1. Preschoolers came from their classrooms to participate in the motor skill instruction.

2. The motor skill instruction began with some warm-up activities and games such as the body part game, jumping in hula-hoops or doing jumping jacks. All preschoolers had their own space to participate in warm-up activities. The activities lasted approximately 2 to 3 min.

3. Preschoolers were randomly split into two object control skill stations. Each half of the class spent 12 min at one skill. After 12 min, the preschoolers were switched to the other OC station. In total, preschoolers spent 24 minutes on two object control skills. The object control skills were instructed by the direct instruction approach (Rink, 2006).

4. The motor skill instruction was followed by closing activities including some balance activities and stretching lasted around 2-3 min. Critical elements of skills were emphasized at the end of each session by asking questions to the children. After closing, children left the area and another group reached the
area for their motor skill instruction. The same lesson plan was used for the following groups (Appendix B)

The motor skill instruction sessions were randomly selected and videotaped to check for intervention integrity.

Pedagogy of the Motor Skill Intervention

A traditional instructional approach was followed by the instructor in the motor skill intervention (MSI). It is also called interactive teaching (Rink, 2006). The student autonomy was low during the instruction in which the instructor controlled all aspects of learning environment such as start time, stop time of the activities or the task modifications. The instructor used a variety of effective teaching strategies such as demonstrations, explanations, feedback, cue words, tasks modifications (e.g. extending and refining) and manipulation of factors such as object, distance, target, movement of ball or person, physical prompts and complexity of the task during the implementation of the MSI (Graham et al. 2007).

Intervention Integrity of Motor Skill Intervention

Intervention integrity was examined to ensure the intended intervention was delivered to the children in the Center A. Intervention integrity data was collected from sessions 3.2, 4.2, 5.2, 6.1, 7.1, and 8.1 by videotaping of the sessions. The videotapes were analyzed right after each session by the researcher and a research assistant. A checklist was developed and used to compare between the implemented lesson plans and actual lesson plans (see Appendix C). The checklist contained the parts for warm-up, skill instruction, demonstrations, teacher feedback, task manipulations, physical prompts, allocated time, equipment availability, critical elements, and closing. The implemented
lessons were checked by two independent observers to ensure that the objectives of the lessons were met by the instructor.

Motor Skill Family Intervention (MSFI)

The MSFI group received the MSI intervention described above and also received an additional motor intervention delivered by the primary caregiver in the child’s home. The aim of the family intervention was to provide motor skill activities with parent involvement to provide additional opportunities to improve the children’s object control skills. Parents are recognized as a key factor in their children’s development during the early childhood years (Adkins, Sherwood, Story & Davis, 2004; Kitzman & Beech, 2006). The MSFI intervention consisted of 24 sessions in an 8-week period. Each session lasted 10 to 15 minutes on a weekend or weekday. This schedule depended on the parents’ own schedule during a week. In order to implement the intervention, parents used their available spaces at home such as the living room, kitchen or bedroom or yard. It was not possible to dictate a standardized space for all preschoolers because of the variations in the home environments. All preschoolers and their parents were provided with standardized equipment and lesson plans in a bag prior to the intervention as a part of this study. This bag consisted of a variety of equipment (playground ball, tennis balls, bean bags, scarves, balloons, milk jugs, rolled paper bats, bubble wrap, and paper spots) and all lesson plans of the MSFI.

Content of Motor Skill Family Intervention

The family intervention lesson plans were created by the researcher and two motor development specialists. The organization of the lesson plans were grounded by previous experiences of the experts and their previous studies (Robinson & Goodway,
2009). Lesson plans were also based on the parents’ ability to apply the activities in their home environment.

A typical lesson plan of family intervention included a skill or skills focus for the lesson (e.g. catching, rolling or jumping), a list of specific equipment, a picture of desirable performance with critical elements, a detailed description of the activities with pictures of real performers, and an evaluation form (game sheets) of the child’s performance (Appendix D). A typical family intervention lesson plan was applied with parental involvement as follows:

a) The primary caregiver took the lesson plans and the equipment bag from the researcher. The researcher showed all equipments and lesson plans with evaluation forms (game sheets) to the primary caregiver. Then, the researcher explained the lesson plans and the purpose of game sheets. A calendar was also provided for the primary caregiver to show the possible week days and weekend days to perform the activities and the dates for submitting the lesson game sheets.

b) The organization of the lesson plan was set up by the primary caregiver at home.

c) Activities described in the lesson plan were performed by the primary caregiver and child together.

d) During the session, the primary caregiver assessed the child’s performance based on the criteria on the evaluation form (game sheet) and completed the game sheet.
e) The game sheet was returned by the child to get small rewards (stickers, pencils, or erasers) in that week.

The MSFI included instruction in both locomotor and object control skills. The block plan for lesson plans is given in Table 3.5.

<table>
<thead>
<tr>
<th>OCS Week. Session</th>
<th>Throw</th>
<th>Kick</th>
<th>Catch</th>
<th>Strike</th>
<th>Bounce</th>
<th>Roll</th>
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</table>

Note: X designates the skill was taught in that session.

Table 3.5 Block Plan of Object Control Skills (OCS) in Family Intervention

The early lesson plans for the MSFI began with easy instructional tasks and then progressed to more difficult tasks as the MSFI progressed. Critical elements of skills
were emphasized for each activity in the lesson plans. Cue words of critical elements were included for parents to mention to their children. The number of activities in the lesson plans varied based on the nature of the activity. Generally, one lesson plan lasted around 10 to 15 min.

**Pedagogy of MSFI**

The primary caregiver was provided a variety of teaching strategies in the lesson plans. For instance, catching lesson plan included a desirable picture showing how to catch a ball. Critical elements of catching were also explained followed by descriptions of activities. Verbal prompts were provided for parents to reinforce their child. For example, in a catching activity cue words were provided for parents to tell their children such as “reach for scarf”, “eyes on scarf”, and “good job”. Basic tasks modifications (e.g. extending and refining) and manipulation of factors such as object, distance, target, movement of ball or person, physical prompt and complexity of task were also incorporated in the MSFI lesson plans. Appendix D provides sample lesson plans for the intervention.

**Pilot Study of Motor Skill Family Intervention**

The MSFI lesson activities were piloted to help ensure they were appropriate for the target population. These pilot activities consisted of in order:

1. Activities were read by two motor development experts to ensure the activities were developmentally appropriate. The experts made modifications and activity suggestions for the lesson plans. They also included practical equipment for the activities in the lesson plans.
2. All lesson plans were then read by a classroom teacher for comprehension by the parents and ease of administration by the parents. The teacher suggested changing some of the language to simplify it as the reading level of some parents was low.

3. All lesson plans were read by at least 1 parent for comprehension and ease of administration.

After the initial piloting of the MSFI lesson plans, adaptations to the lesson plans were made. These new lesson plans were checked by another classroom teacher. She had 7 years teaching experience in this population. She read the lesson plans, game sheets of each lesson plan and checked the family equipment bag to test the ease of administration of the lessons. After the implementation of some lesson plans with a small number of children, the teacher was interviewed to get feedback on any changes to the lesson plan. She made suggestions to simplify the game sheets. A motor development expert read the game sheets again and made easy yes/no questions for the game sheets of lesson plans. In conclusion, the final versions of lesson plans were developed from feedback of this pilot study (see Appendix D).

*Implementation of Motor Skill Family Intervention*

Prior to the implementation of the family intervention, a “parent night for motor skill development” was conducted as a workshop for parents to explain the importance of children’s motor development and to demonstrate how to perform activities at home each week. Short sessions of activities (3-4 minutes) from each lesson plan were prepared by the researcher for the workshop. However, a limited number of parents (n=7) participated in the workshop and thus the development of other measures to train the parents were necessary. A variety of time slots were provided for parents to get a short training session
and take their equipment. Classroom teachers asked parents to pick a time slot and all parents came to the center based on their time slots to receive the information about the MSFI.

During the implementation phase of family intervention, a parent-child motor activity calendar of each month was provided for the parents. This calendar included the days of the lesson plans to implement and the days of the game sheets to return by the parents. Earning small rewards (like pencils and stickers) were also included in this calendar to encourage parents to return their activity game sheets. Reminder notes for each week were also put into children’s file to remind parents to complete the activities and to fill out the game sheets. A bright orange file called “game sheets” was put near the children’s file to collect those game sheets and to remind parents to return their game sheets. Additionally, a reminder note was put on a classroom wall/door for each classroom to remind parents to perform the family intervention lesson plans and return their game sheets to earn small rewards for their children. Children also received prompts in the classrooms to do the activities at home and were told they could earn small rewards if they completed the activities. In sum, an activity calendar, reminder notes in the children’s file, a reminder note on the classroom wall/door, prompts to children, and a reward system were the strategies to ensure parents’ compliance.

*Intervention Integrity of Motor Skill Family Intervention*

Data on intervention integrity of the MSFI were hard to collect because of the nature of the family intervention being conducted at home and not readily available to the investigators. However, specific strategies were created to help promote parent compliance with the activities provided in the lesson plans.
Each lesson plan of family intervention had an evaluation form (called a game sheet). Parents were required to fill out the game sheet after the completion of the lesson activities. The evaluation form had a set of questions related to specific activities (Appendix C). For example, lesson plan 4 contained three activities for rolling. Parents were asked to fill out an evaluation form of rolling and to answer the following questions for activity 2:

a) Did your child take a step with non dominant foot? Yes or No
b) Did your child swing arm down and back? Yes or No
c) Did your child bend the knees? Yes or No
d) Did your child release the ball low to ground? Yes or No

In addition, parents indicated how long this activity took place and whether their child had fun or not. Parents were also responsible for sending the evaluation form to the class after they were done with the activity to ensure whether they performed the activities or not. It should be noted that the parents earned credit for time in doing those activities in the Head Start Center.

Overall Procedures of the Study

The Human Subjects Institutional Review Board (IRB) approval was obtained prior to the data collection of the study (#2002B224, Appendix E). The parent permission forms and child assent forms to participate in the study were also gathered. Once all permissions were obtained, pretests were conducted between September 30th and October 19th. A random assignment was then performed to create a comparison group and two intervention groups for this study. The comparison group did not receive any motor skill intervention. However, an 8 week motor skill intervention and motor skill intervention
with family practices began for the intervention groups on October 20th and ended on December 10th. Posttests assessments were conducted at the end of the intervention sessions. The retention test assessments were taken after one month of the intervention. All data collection procedures were videotaped and analyzed by trained researcher and the research assistant in accordance with the procedures outlines above. The overall study design is presented in Table 3.6.

Table 3. 6 The Overall Study Design

Data Analysis

A cleaning process was conducted followed by checking parametric assumptions. This process included: a) all data columns were manually viewed for errors, b) the descriptive statistics were ran to examine the ranges and frequencies to ensure that all
data were within expected ranges and c) the assumptions for the analysis of variance tests were checked. Data was also analyzed to examine if any outliers existed. For this purpose, Scatter plot analysis was performed. Five outliers were found in the pretest OC skill scores and two were found in the pretest perceived motor competence scores. Outliers were pulled out and the data analysis was conducted again. Similar findings were found in both variables. The researcher choose to leave the outliers in the data set for following reasons: a) the scores of the outliers were close, b) there were a low number of participants in the study, and c) for ecological validity reasons, the researcher wanted to include all data.

The research questions were analyzed under the headings of pretest, pretest-to-posttest, posttest, and posttest-to-retention test and retention test. The research questions with appropriate data analysis techniques are presented in Table 3.7.
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<thead>
<tr>
<th>Pretest</th>
<th>Data Analysis</th>
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<tbody>
<tr>
<td><strong>Research Questions</strong></td>
<td><strong>Data Analysis</strong></td>
</tr>
<tr>
<td>To what extent do young children who are at risk present developmental delays in OC skills and low perceived motor competence?</td>
<td>Descriptive statistics</td>
</tr>
<tr>
<td>Are there gender differences in pretest OC skills of young children who are at risk?</td>
<td>M, SD</td>
</tr>
<tr>
<td>Are there group differences in pretest OC skills of young children who are at risk?</td>
<td>3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVA – Examine the Gender main effect</td>
</tr>
</tbody>
</table>

Examine the Group main effect

<table>
<thead>
<tr>
<th>Pretest to Posttest</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Are there significant differences among Groups from pretest to posttest of OC skills?</td>
<td>3 Group (MSI, MSFI, Comparison) X 2 Time (pre, post) X 2 Gender (girls, boys) ANOVA with repeat measures</td>
</tr>
<tr>
<td>Are there significant Group by Gender differences from pretest to posttest of OC skills?</td>
<td>- Examine the Group X Time interaction – if significant – follow up tests were performed by Statistical Analysis Software (SAS) to examine where the differences lie:</td>
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<tr>
<td></td>
<td>- Examine the Group X Time X Gender interaction- if significant – follow up tests were conducted by SAS to examine where the differences lie:</td>
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<td>- Three separate contrasts were conducted</td>
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<td>- Paired sample t-tests for pre- post within each group</td>
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<table>
<thead>
<tr>
<th>Posttest</th>
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<tbody>
<tr>
<td>Are there Group differences in posttest OC skills of young children who are at risk?</td>
<td>3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVA</td>
</tr>
<tr>
<td>Are there Gender differences in posttest OC skills of young children who are at risk?</td>
<td>- Examine the Group main effect. If significant- post-hoc Tukey analysis was conducted.</td>
</tr>
<tr>
<td></td>
<td>- Examine the Gender main effect.</td>
</tr>
<tr>
<td></td>
<td>- Examine the Group by Gender interaction.</td>
</tr>
</tbody>
</table>

Table 3.7 Data Analysis for Research Questions

Continued
Table 3. 7 (Continued)

<table>
<thead>
<tr>
<th><strong>Posttest to Retention Test</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there significant differences among Groups from posttest to retention test of OC skills?</td>
</tr>
<tr>
<td>Are there significant Group by Gender differences from posttest to retention test of OC skills?</td>
</tr>
<tr>
<td>3 Group (MSI, MSFI, Comparison) X 2 Time (post, retention) X 2 Gender (girls, boys) ANOVA with repeat measures-</td>
</tr>
<tr>
<td>- Examine the Group X Time interaction – if significant – follow up tests were performed by SAS.</td>
</tr>
<tr>
<td>– Examine the Group X Time X Gender interaction- if significant – follow up tests were conducted by SAS to examine where the differences lie.</td>
</tr>
<tr>
<td>- Three separate contrasts were conducted</td>
</tr>
<tr>
<td>- Paired sample t-tests for within (post-retention) each group</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Retention Test</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there significant Group differences in retention test of OC skills?</td>
</tr>
<tr>
<td>Are there significant Gender differences in retention test of OC skills?</td>
</tr>
<tr>
<td>3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVA</td>
</tr>
<tr>
<td>- Examine the Group main effect</td>
</tr>
<tr>
<td>- Examine the Gender main effect</td>
</tr>
<tr>
<td>- Examine the Group by Gender interaction</td>
</tr>
</tbody>
</table>

The same data analysis was conducted on perceived motor competence. In addition, data analysis for the home inventory is shown in Table 3.8.

<table>
<thead>
<tr>
<th><strong>Research Questions</strong></th>
<th><strong>Data Analysis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Examine the affordance in home environment of children who are at risk</td>
<td>Descriptive Statistics</td>
</tr>
<tr>
<td></td>
<td>$M, SD$</td>
</tr>
</tbody>
</table>

Table 3.8 Data Analyses for Home Inventory
CHAPTER 4

RESULTS

The primary purpose of this study was to examine the effects of a motor skill intervention (MSI) and a motor skill family intervention (MSFI) on object control (OC) skills and perceived motor competence of young children. Results will be presented by: process measures of intervention integrity; pretest; pretest to posttest differences; post test; posttest to retention test; and retention test.

Process Measures of Intervention Integrity

MSI

Thirty percent of MSI sessions were observed to check the intervention integrity. Table 4.1 shows that lesson plans were implemented as intended in the sessions. In some sessions (3.2, 4.2, 5.2, & 6.1), closing activities did not perform because of having limited time at the end of the sessions. Inter-observer agreement was 100% on observed sessions between the researcher and the research assistant. It should be also noted that children’s attendance rate was 77.79% in the MSI.
<table>
<thead>
<tr>
<th>Session Class</th>
<th>3.2</th>
<th>4.2</th>
<th>5.2</th>
<th>6.1</th>
<th>7.1</th>
<th>8.1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Warm-up</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Skill intro. with critical elements</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Skill demos.</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Teacher feedback</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Task manipulations</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Physical prompts</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Allocated time for skills</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Key words for the skills</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Equipment availability for each child</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Emphasizing critical elements of the tasks in the closure</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Closing activities</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>% Adherence</td>
<td>91</td>
<td>91</td>
<td>91</td>
<td>91</td>
<td>91</td>
<td>91</td>
</tr>
</tbody>
</table>

Note: 1) ✓ refers to performed, 2) X refers to not performed and, 3) * refers to missing data in the videotape.

Table 4.1 Intervention Integrity of the Implementation of the MSI

In addition, MSI instruction was checked in all three classes (A, B, & C) in Center A in order to ensure all children received the similar instruction and MSI focused on individualized instruction. Results indicated that all three classes received similar instruction in the sessions. Table 4.2 shows the number of practice trials provided for children in randomly selected sessions. One high skilled and one low skilled child were randomly selected and their practice trials were observed. The data showed that low skilled children were provided more practice trials in some sessions and if they had less trials, observations revealed that they had more explanations and more demonstrations in those sessions.
Table 4.2 Number of Practice Trials in the MSI

<table>
<thead>
<tr>
<th>Session</th>
<th>3.2</th>
<th>4.2</th>
<th>5.2</th>
<th>6.1</th>
<th>7.1</th>
<th>8.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skill Class</td>
<td>Kick</td>
<td>Roll</td>
<td>Catch</td>
<td>Strike</td>
<td>Kick</td>
<td>Bounce</td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS/P</td>
<td>13</td>
<td>17</td>
<td>45</td>
<td>14</td>
<td>19</td>
<td>96</td>
</tr>
<tr>
<td>HS/S</td>
<td>13</td>
<td>10</td>
<td>30</td>
<td>12</td>
<td>18</td>
<td>68</td>
</tr>
<tr>
<td>LS/P</td>
<td>10</td>
<td>12</td>
<td>49</td>
<td>23</td>
<td>12</td>
<td>92</td>
</tr>
<tr>
<td>LS/S</td>
<td>9</td>
<td>3</td>
<td>28</td>
<td>15</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS/P</td>
<td>12</td>
<td>10</td>
<td>13*</td>
<td>22</td>
<td>17</td>
<td>81</td>
</tr>
<tr>
<td>HS/S</td>
<td>11</td>
<td>4</td>
<td>7</td>
<td>10</td>
<td>14</td>
<td>55</td>
</tr>
<tr>
<td>LS/P</td>
<td>10</td>
<td>15</td>
<td>13**</td>
<td>27</td>
<td>40</td>
<td>78</td>
</tr>
<tr>
<td>LS/S</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>10</td>
<td>21</td>
<td>33</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS/P</td>
<td>14</td>
<td>23</td>
<td>23</td>
<td>15</td>
<td>25</td>
<td>84</td>
</tr>
<tr>
<td>HS/S</td>
<td>14</td>
<td>12</td>
<td>19</td>
<td>14</td>
<td>19</td>
<td>51</td>
</tr>
<tr>
<td>LS/P</td>
<td>18</td>
<td>22</td>
<td>25</td>
<td>20</td>
<td>24</td>
<td>102</td>
</tr>
<tr>
<td>LS/S</td>
<td>16</td>
<td>15</td>
<td>12</td>
<td>10</td>
<td>22</td>
<td>55</td>
</tr>
</tbody>
</table>

Note. HS refers to high skilled child, LS refers to low skilled child, P refers to practice trials, S refers to number of success for trials, A, B, and C refer to Classes. * child was not cooperative in the session, ** more practices were given but not in the camera angle, *** hard to control the ball for the child, more demonstrations and explanations were given to the child.

The intervention integrity of the MSFI was measured by gathering game sheets (evaluation sheets) from parents. The expected game sheets were 24 from each parent and 600 in total from 25 parents in the MSFI. Fourteen parents returned their game sheets and the number of returned game sheets are provided in Table 4.3. Overall, the return rate was 16.66%.
In order to conduct Analysis of Variance tests, the normality assumption and equality of variance assumptions were met for both the OC skills and the perceived motor competence in three groups (MSI, MSFI, Comparison) by this study (Norusis, 2008).

The number of participants by group and gender is provided for all three tests in Table 4.4. As can be seen from Table 4.4 there was a drop in the number of participants from posttest to retention test.

<table>
<thead>
<tr>
<th>Test Group</th>
<th>Gender</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Retention Test (OC)</th>
<th>Retention Test (PC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSI</td>
<td>Girls</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>11</td>
<td>11</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>22</td>
<td>22</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>MSFI</td>
<td>Girls</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>15</td>
<td>15</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>25</td>
<td>25</td>
<td>20</td>
<td>19</td>
</tr>
<tr>
<td>Comparison</td>
<td>Girls</td>
<td>15</td>
<td>15</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>25</td>
<td>25</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Total #</td>
<td>Girls</td>
<td>36</td>
<td>36</td>
<td>28</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>36</td>
<td>36</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>72</td>
<td>72</td>
<td>59</td>
<td>58</td>
</tr>
</tbody>
</table>

Note. OC refers to Object Control Skills, PC refers to Perceived Motor Competence

Table 4.4 The Number of Participants in the Pretest, Posttest and Retention Test

Table 4.3 The Number of Returned Game Sheets from Parents in the MSFI
Research Question 1: To what extent do young children who are at risk present developmental delays in OC skills and low perceived motor competence?

Standard scores of OC skill were utilized for the data analysis. Standard scores of OC skills shows the participants’ real performances based on their age and gender and factors out the impact of age on OC performance (Ulrich, 2000). Table 4. 5 shows the descriptive statistics of standard scores for OC skills and the mean scores of perceived motor competence of children in the intervention groups (MSI & MSFI) and the Comparison group.

| Tests | Groups | Pretest | | Posttest | | Retention Test | |
|----------------|--------|---------|----------------|---------|----------------|---------|
| | | OC | PC | OC | PC | OC | PC |
| | M | SD | M | SD | M | SD | M | SD | M | SD |
| MSI (G) | 6.27 | 1.90 | 3.38 | .53 | 9.73 | 1.73 | 3.57 | .38 | 8.83 | .98 | 3.66 | .44 |
| MSI (B) | 6.55 | 1.03 | 3.34 | .61 | 9.55 | 1.03 | 3.57 | .28 | 10.00 | 1.32 | 3.54 | .32 |
| MSI (T) | 6.41 | 1.50 | 3.36 | .55 | 10.14 | 1.45 | 3.57 | .33 | 9.53 | 1.30 | 3.60 | .37 |
| MSFI (G) | 5.60 | 1.43 | 3.01 | .45 | 9.50 | 2.06 | 3.68 | .31 | 10.13 | 1.55 | 3.37 | .17 |
| MSFI (B) | 5.53 | 1.76 | 3.24 | .52 | 9.07 | 1.66 | 3.75 | .27 | 8.92 | 1.50 | 3.47 | .45 |
| MSFI (T) | 5.56 | 1.60 | 3.15 | .49 | 9.24 | 1.80 | 3.72 | .28 | 9.40 | 1.60 | 3.43 | .35 |
| Comp. (G) | 5.80 | 1.14 | 3.42 | .36 | 6.40 | 1.35 | 3.41 | .41 | 6.93 | 1.07 | 3.39 | .33 |
| Comp. (B) | 5.50 | 1.26 | 3.31 | .42 | 5.20 | 1.39 | 3.28 | .56 | 7.00 | 1.88 | 3.53 | .34 |
| Comp. (T) | 5.68 | 1.18 | 3.37 | .38 | 5.92 | 1.47 | 3.35 | .47 | 6.96 | 1.42 | 3.45 | .33 |

Note. OC refers to Object Control Skill, PC refers to Perceived Motor Competence, MSI refers to Motor Skill Intervention, MSFI refers to Motor Skill Family Intervention, Comp. refers to Comparison group, G refers to girls, B refers to Boys, T refers to Total, M refers to mean, SD refers to standard score.

Table 4.5 Standard Scores of Object Control Skill and Mean Scores of Perceived Motor Competence
The pretests results of OC skill (Table 4.5) showed that the children in all groups demonstrated developmental delays in OC skill performance according to the descriptive ratings of standard score in TGMD-2 (Ulrich, 2000). In the TGMD-2, the standard scores of 4 and 5 refer to “poor performance” and the scores of 6-7 refer to “below average” (Ulrich, 2000). Based on the percentile ranks, children were at 14.14% in the MSI, 9.56% in the MSFI and 8.92% in the Comparison Group. Overall, girls were at 10.94% and boys were at 10.53%. In terms of the perceived motor competence, children in all groups showed relatively high perceived motor competence at the beginning of the study. In the PSPCSA, the level of perceived competence was reported as low (1, not very good) to high (4, really good) (Harter & Pike, 1984).

Research Question 2: Are there gender differences in pretest OC skills and perceived motor competence of young children who are at risk?

Research Question 3: Are there group differences in pretest OC skills and perceived motor competence of young children who are at risk?

Two 3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVAs were conducted to examine any Gender or Group differences between and within the groups for the OC skill performance and the perceived motor competence prior to the interventions. The ANOVA results indicated a non-significant Group difference ($F_{[2, 66]} = 2.26, p = .11, \eta^2 = .06$) and a non-significant Gender difference ($F_{[1, 66]} = .008, p = .92, \eta^2 = .00$) on the OC skill performance of children. Although no Gender differences were observed for the OC skill standard scores, significant Gender differences ($F_{[1, 66]} = .72, p = .04, \eta^2 = .06$) were obtained for the OC skill raw scores in favor of boys. In addition, a
non-significant Group X Gender interaction was observed in the OC skill performance ($F_{[2, 66]} = .22, p = .80, \eta^2 = .00$).

Similar results were found for the perceived motor competence. The ANOVA results revealed a non-significant Group difference ($F_{[2, 66]} = 1.84, p = .16, \eta^2 = .05$) and Gender difference ($F_{[1, 66]} = .06, p = .79, \eta^2 = .00$) on the perceived motor competence of children. No Group X Gender interaction was observed in the perceived motor competence of children ($F_{[2, 66]} = .76, p = .46, \eta^2 = .02$). Thus, all three groups were considered statistically similar in OC skills and perceived motor competence prior to the intervention and both girls and boys were considered statistically similar in these skills.

Pretest to Posttest Differences

Research Question 4: Are there significant differences among groups from pretest to posttest for OC skills and perceived motor competence of young children who are at risk?

Research Question 5: Are there significant group by gender differences from pretest to posttest for OC skills and perceived motor competence for young children who are at risk?

OC Skill Performance

A3 Group (MSI, MSFI, Comparison) X 2 Time (pretest, posttest) X 2 Gender (girls, boys) of ANOVA with repeated measures was conducted on OC standard scores and perceived motor competence to test research questions 4 and 5. Table 4.2 shows the pretest, posttest and retention test scores for OC skills. The ANOVA analysis revealed a significant Time main effect ($F_{[1, 66]} = 142.72, p = .00, \eta^2 = .68$). This result shows that OC skill performance of children significantly changed from pretest to posttest. The statistic of interest was a significant Group X Time interaction ($F_{[2, 66]} = 32.06, p = .00, \eta^2$
showing that groups differed from pretest to posttest for the OC skill performance of children. Follow-up tests were conducted between the groups to examine where the differences were reported. Three separate contrasts were run between the groups and a Bonferroni adjustment of the alpha (.05/3) resulted in a new alpha level of $p = < .017$. The first contrast between the MSI and the Comparison group revealed a significant difference between Groups over time ($F_{[1, 69]} = 45.81, p = .00$). The second contrast between the MSFI and the Comparison group showed a significant difference between Groups over time ($F_{[1, 69]} = 47.61, p = .00$). The final contrast showed that there were no significant differences between the MSI and MSFI groups over time ($F_{[1, 45]} = 0.01, p = .93$). Three separate paired sample $t$-tests indicated that the children in MSI ($t_{[22]} = -10.31, p < .001$ [2-tailed]) and MSFI ($t_{[25]} = -8.53, p < .001$ [2-tailed]) significantly improved their scores on OC skill performance from pretest to posttest. However, the children in the Comparison group did not improve their OC skill score ($t_{[25]} = -0.90, p = .37$ [2-tailed]) from pretest to posttest. Figure 4.1 shows the pretest to posttest differences in OC skill performance of children in the groups.
Figure 4.1 Pretest to Posttest Changes in OC Skill Performance of Children in the Intervention and Comparison Groups

Figure 4.2 shows the percentile scores of OC skill performance between the pretest and posttest scores of children in the groups (Figure 4.2).
The analysis of ANOVA with repeated measures also indicated a non-significant Time X Gender interaction \( (F_{1, 66} = .32, \ p = .57, \ \eta^2 = .00) \) and Group X Gender interaction \( (F_{2, 66} = 1.60, \ p = .20, \ \eta^2 = .04) \). These results indicate that no significant Gender differences were observed from pretest to posttest between the groups. In addition, a non-significant Group X Time X Gender interaction was reported \( (F_{2, 66} = .97, \ p = .38, \ \eta^2 = .02) \), which means that both genders within the groups performed similar OC skill performance from pretest to posttest. In summary, children in the MSI and the MSFI group enhanced their OC skill performance as result of the interventions.
(MSI & MSFI). However, the children in the Comparison group did not develop their OC skill performance across the intervention period. In addition, no gender differences within and between the groups were observed in terms of the OC skill performance. A general summary of the results is provided in Table 4.6.

<table>
<thead>
<tr>
<th>Multivariate Tests</th>
<th>Effect</th>
<th>$F$</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>$p$</th>
<th>$\eta^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td>142.72</td>
<td>1</td>
<td>66</td>
<td>.00*</td>
<td>.68</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Time X Gender</td>
<td>.32</td>
<td>1</td>
<td>66</td>
<td>.57</td>
<td>.00</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>Time X Group</td>
<td>32.06</td>
<td>2</td>
<td>66</td>
<td>.00*</td>
<td>.49</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Time X Gender X Program</td>
<td>.97</td>
<td>2</td>
<td>66</td>
<td>.38</td>
<td>.02</td>
<td>.21</td>
</tr>
</tbody>
</table>

Test of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Gender X Group</th>
<th>$F$</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>$p$</th>
<th>$\eta^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.60</td>
<td>2</td>
<td>66</td>
<td>.20</td>
<td>.04</td>
<td>.32</td>
</tr>
</tbody>
</table>

Note.* $p < .05$

Table 4.6 The Results of ANOVA with Repeated Measures for OC Skill in Pretest to Posttest Changes

**Perceived Motor Competence**

A 3 Group (MSI, MSFI, Comparison) X 2 Time (pretest, posttest) X 2 Gender (girls, boys) ANOVA with repeated measures was performed in order to determine the pretest to posttest changes for the perceived motor competence of children. A significant Time main effect was observed in the perceived motor competence scores from pretest to posttest ($F_{[1, 66]} = 19.23, p = .00, \eta^2 = .22$). The ANOVA with repeated measures showed a significant Group X Time interaction ($F_{[2, 66]} = 9.30, p = .00, \eta^2 = .22$) showing group differences over time for the perceived motor competence of children. Follow-up tests were conducted between the groups to examine where the differences were reported.
Three separate contrasts were run between the groups and a Bonferroni adjustment of the alpha (.05/3) resulted in a new alpha level of $p = < .017$. The first contrast between the MSI and the Comparison group revealed a non-significant finding ($F_{[1, 69]} = 2.67, p = .10$). The second contrast between the MSFI and the Comparison group showed a significant difference between Groups over time ($F_{[1, 69]} = 18.62, p = .00$). The final contrast showed that there was non-significant difference between the MSI and the MSFI groups over time ($F_{[1, 45]} = 5.30, p = .02$). As a follow up, three paired sample $t$-tests were applied to determine the pretest to posttest changes of the perceived motor competence of children in the three groups. These analyses demonstrated that children in the MSFI had higher scores in the perceived motor competence ($t_{[25]} = -5.57, p = .000$ [2-tailed]) from pretest (3.15) to posttest (3.72). However, the children in the MSI ($p = .09$) and the Comparison group ($p = .79$) did not significantly increase their scores from pretest to posttest. Figure 4.3 illustrates the pretest to posttest differences in the perceived motor competence of children in the three groups.
The ANOVA with repeated measures also revealed a non-significant Time X Gender interaction ($F_{[1, 66]} = .15, p = .69, \eta^2 = .002$) and a non-significant Group X Time X Gender interaction ($F_{[2, 66]} = .22, p = .80, \eta^2 = .007$). Basically, no Gender differences in perceived motor competence were obtained from pretest to posttest. Both genders had similar perceived motor competence scores within the groups from pretest to posttest. In addition, a non significant Gender by Group difference ($F_{[2, 66]} = .83, p = .43, \eta^2 = .02$) was reported for perceived motor competence. Table 4.7 presents the results of ANOVA.
with repeated measures for the perceived motor competence. Overall, only the children in the MSFI increased their perceived motor competence scores from pretest to posttest.

<table>
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Test of Between-Subjects Effects

| Gender X Group | .83 | 2 | 66 | .43 | .02 | .18 |

Note: $^* p < .05$

Table 4.7 The Results of ANOVA with Repeated Measures for Perceived Motor Competence in Pretest to Posttest

Posttest

*Research Question 6:* Are there group differences in posttest OC skills and perceived motor competence of young children who are at risk?

*Research Question 7:* Are there gender differences in posttest OC skills and perceived motor competence of young children who are at risk?

*OC Skill Performance*

A 3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVA analysis was conducted to determine any group, gender and group by gender differences between and within the groups for OC skills at the posttest. The ANOVA analysis demonstrated a significant Group difference ($F_{[2, 66]} = 50.49, p = .00, \eta^2 = .60$) in the OC skills. Post-hoc Tukey analysis was performed to describe the group differences on the OC skill
performance. Significant differences were found between the MSI and the Comparison group \( (p = .00) \) and between the MSFI and the Comparison Group \( (p = .00) \). However, no significant difference were found between the MSI and the MSFI groups \( (p = .13) \). The ANOVA analysis also showed a non-significant Gender effect \( (F_{[1, 66]} = .52, p = .47, \eta^2 = .00) \) and Group by Gender interaction \( (F_{[2, 66]} = 2.41, p = .09, \eta^2 = .06) \) for the OC skill performance at the posttest. Overall, the children in the MSI and the MSFI had higher OC skill scores than the children in the Comparison group.

**Perceived Motor Competence**

For perceived motor competence, the ANOVA analysis indicated a significant Group effect \( (F_{[2, 66]} = 5.87, p = .00, \eta^2 = .15) \) at the posttest. Post-hoc Tukey analysis was performed to identify the group differences in the perceived motor competence. The results showed a significant difference between the MSFI and the Comparison group \( (p = .00) \). However, there were no significant differences between the MSI and the MSFI groups \( (p = .37) \) and between the MSI and the Comparison groups \( (p = .13) \). In addition, non-significant Gender differences \( (F_{[1, 66]} = .03, p = .85, \eta^2 = .00) \) and a Group X Gender interaction \( (F_{[2, 66]} = .43, p = .65, \eta^2 = .01) \) were found. The ANOVA analysis showed that the children in the MSFI group had higher perceived motor competence than the children in the Comparison group at the end of the interventions. Gender differences within and between the groups did not exist.
Posttest to Retention Test Differences

Research Question 8: Are there significant differences among groups from posttest to retention test for OC skills and perceived motor competence for young children who are at risk?

Research Question 9: Are there significant group by gender differences from posttest to retention test for OC skills and perceived motor competence for young children who are at risk?

OC Skill Performance

A 3 Group (MSI, MSFI, Comparison) X 2 Time (posttest, retention test) X 2 Gender (girls, boys) ANOVA with repeated measures was performed to examine the research questions 10 and 11. A non-significant Time main effect was revealed ($F_{[1, 53]} = .00, p = .98, \eta^2 = .00$) from posttest to retention test. The ANOVA analysis demonstrated a significant Group X Time interaction ($F_{[2, 53]} = 14.48, p = .00, \eta^2 = .35$) showing group differences in OC skills from posttest to retention test. Follow-up tests were conducted between the groups to examine where the differences were reported. Three separate contrasts were run between the groups and a Bonferroni adjustment of the alpha (.05/3) resulted in a new alpha level of $p = < .017$. The first contrast between the MSI and the Comparison group revealed a significant difference between Groups over time ($F_{[1, 59]} = 21.97, p = .00$). The second contrast between the MSFI and the Comparison group showed a significant difference between Groups over time ($F_{[1, 56]} = 6.59, p = .01$). The final contrast between the MSI and the MSFI showed a non-significant difference between Groups over time ($F_{[1, 33]} = 2.05, p = .16$). As a follow up, three paired sample t-tests were conducted to examine posttest to retention test changes in OC skills. A paired sample t-
test reported that the OC skill scores of MSI ($t = 2.69, p = .017$ [2-tailed]) and MSFI ($t = .00, p = 1.00$ [2-tailed]) did not significantly change from posttest to retention test. A paired sample $t$-test showed a significant posttest (5.88) to retention test (6.96) changes for the Comparison group ($t = -3.84, p = .001$ [2-tailed]) in OC skill performance. However, their OC skill performance still reflected a “poor performance category” in the TGMD-2. Figure 4.4 shows the differences from posttest to retention test for the OC skill performance of children in the three groups ($N=59$).

![Graph showing changes from posttest to retention test for OC skill performance](image)

Figure 4.4 The Changes from Posttest to Retention Test for the OC Skill Performance
In addition, the ANOVA with repeated measures indicated a significant Time X Gender interaction ($F_{[1, 53]} = 5.38, p = .02, \eta^2 = .09$) for the OC skill performance from posttest to retention test. Girls’ mean scores decreased from 9.05 to 8.62 and boys’ means scores increased from 8.22 to 8.63. However, there was a non-significant Group X Time X Gender interaction ($p = .25$) and no Group X Gender interaction ($F_{[2, 53]} = 1.84, p = .16, \eta^2 = .06$) were obtained as a result of ANOVA analysis. Table 4.8 summarizes the results of ANOVA analysis.

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**Test of Between-Subjects Effects**

| Gender X Group            | 1.84| 2              | 53         | .16      | .06      | .36            |

Note: * $p < .05$

Table 4.8 The Results of ANOVA with Repeated Measures for OC Skill Performance in Posttest to Retention Test

**Perceived Motor Competence**

A 3 Group (MSI, MSFI, Comparison) X 2 Time (posttest, retention test) X 2 Gender (girls, boys) ANOVA with repeated measures was conducted to examine the changes in the perceived motor competence of children from posttest to retention test. A non-significant Time main effect ($F_{[1, 52]} = 2.38, p = .12, \eta^2 = .04$) was also obtained for the perceived motor competence of children in the three groups from posttest to retention
test. A significant Group X Time interaction ($F_{[2, 32]} = 4.48, p = .01, \eta^2 = .14$) was found for the perceived motor competence of children from posttest to retention test. Follow-up tests were conducted between the groups to examine where the differences were reported. Three separate contrasts were run between the groups and a Bonferroni adjustment of the alpha (.05/3) resulted in a new alpha level of $p = < .017$. The first contrast between the MSI and the Comparison group revealed a non-significant difference between Groups ($F_{[1, 32]} = .77, p = .38$). The second contrast between the MSFI and the Comparison group showed a significant difference between Groups ($F_{[1, 32]} = 7.70, p = .007$). The final contrast between the MSI and the MSFI showed a non-significant difference between Groups ($F_{[1, 32]} = .37, p = .54$). As a follow up, three paired sample $t$-tests were conducted to describe posttest to retention test changes in perceived motor competence. A paired sample $t$-test indicated a non-significant decrease for the MSI ($p = .49$) and the Comparison group ($p = .55$). However, a paired sample $t$-test showed a significant decrease in the MSFI ($p = .002$). Figure 4.5 shows the differences from posttest to retention test for the perceived motor competence of children in three groups ($N=58$).
The ANOVA with repeated measures revealed a non-significant Time X Gender interaction ($F_{1, 52} = .57, p = .45, \eta^2 = .01$) showing no gender differences from posttest to retention test. A non-significant Group X Time X Gender interaction ($F_{2, 52} = 1.74, p = .18, \eta^2 = .06$) and no Group X Gender interaction ($F_{2, 52} = .49, p = .61, \eta^2 = .01$) were also revealed. In summary, both genders between and within the groups had similar perceived motor competence scores from posttest to retention test. Table 4.9 illustrates...
the summary of ANOVA analysis for the perceived motor competence from posttest to retention test.

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Test of Between-Subjects Effects

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Note:* $p < .05$

Table 4.9 The Results of ANOVA with Repeated Measures for Perceived Motor Competence in Posttest to Retention Test

Retention Test

*Research Question 10:* Are there group differences in retention test OC skills and perceived motor competence?

*Research Question 11:* Are there gender differences in retention test OC skills and perceived motor competence?

*OC Skill Performance*

A 3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVA analysis was performed for the OC skill performance of the children in the groups. A significant Group effect was found ($F_{[2, 53]} = 21.43, p = .00, \eta^2 = .44$). Post-hoc Tukey analysis showed that there were significant difference between the MSI and the Comparison group ($p = .00$) and between the MSFI and the Comparison group ($p = .00$). However, no
significant difference was found between the MSI and the MSFI \((p = .95)\). The ANOVA analysis also revealed non-significant Gender effect \((F_{[1, 53]} = .00, p = .98, \eta^2 = .00)\) and Group X Gender interaction \((F_{[2, 53]} = 2.91, p = .06, \eta^2 = .09)\) for the OC skill performance at the retention test. Both the MSI and MSFI groups were better than the Comparison group at the retention test.

**Perceived Motor Competence**

A 3 Group (MSI, MSFI, Comparison) X 2 Gender (girls, boys) ANOVA analysis was conducted for the perceived motor competence of children at the retention test. The ANOVA analysis showed no significant differences for the Group main effect \((F_{[2, 52]} = 1.18, p = .31, \eta^2 = .04)\), Gender \((F_{[1, 51]} = .14, p = .70, \eta^2 = .00)\) and Group X Gender interaction \((F_{[2, 51]} = .67, p = .51, \eta^2 = .02)\).

**Descriptive Question for Home Environment**

**Research Question 12:** What are the affordances in the home environment for young children who are at risk?

Fifty one participants (parents) of this study filled out the AHEMD-SR questionnaire. Descriptive statistics of five components (outside space, inside space, variety of simulations, fine motor toys and gross motor toys) in the AHEMD-SR were provided in Table 4.10. The descriptive statistics shows that parents provided sufficient opportunities for their children motor development in the categories of outside space, inside space, variety of simulations and gross motor toys. Few opportunities were provided in fine motor toys at home. The standard scores of AHEMD-SR categories are 1 (no opportunities), 2 (few opportunities), 3 (sufficient opportunities) and 4 (good opportunities) (Rodrigues et al., 2005).
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Table 4.10 Descriptive Statistics of Home Environment

A General Summary of the Results

The results of this study indicated that children in all groups (MSI, MSFI, Comparison group) children had developmental delays in OC skill prior to the interventions. The children in the MSI increased their OC standard scores from 6.41 to 10.14 and children in the MSFI increased their OC standard scores from 5.56 to 9.24. However, non-significant changes were reported in OC scores of the children in the Comparison group. The MSI and the MSFI group were similar at pretest, from pretest to posttest, posttest, from posttest to retention test and retention test. However, both groups were significantly different from the Comparison group on OC skill standard scores. No gender and group by gender differences were reported at the pretest, pretest to posttest and posttest and retention test. However, a Time X Gender interaction was found from posttest to retention test. Figure 4.6 represents the changes from pretest to retention test for each group.
For descriptive purposes, the raw scores of each OC skill were provided in Figures 4.7, 4.8 and 4.9. Raw scores refer to the possible performance criteria for each skill and consist of throw (8), catch (6), strike (10), roll (8), kick (8), and bounce (8).
Figure 4.7 The Raw Scores of Throw and Catch at Pretest and Posttest
Figure 4.8 The Raw Scores of Strike and Roll at Pretest and Posttest
Children in each group demonstrated high level of perceived motor competence prior to the interventions (Table 4.2). The MSFI group significantly increased their perceived motor competence score from pretest to posttest. However, the MSI group was not significantly different from the Comparison Group from pretest to posttest. At posttest, the MSFI was significantly different from the Comparison group in terms of the perceived motor competence. From posttest to retention test, the MSFI had significant decrease on their perceived score. No significant differences were observed in all groups.
at the retention test. It should be also mentioned that no gender differences were reported in perceived physical competence of children in the tests.

Figure 4.10 The Differences of Perceived Motor Competence from Pretest to Retention Test
Chapter 5 focuses on the findings of this study. The findings of the study are discussed under two main headings of the object control (OC) skill performance and the perceived physical competence of children. The main heading of OC skill performance is divided into the parts of baseline information (pretest results), gender (pretest results), the effects of motor skill interventions (MSI & MSFI), and retention effects. Perceived motor competence of children is discussed in the parts of baseline information and the effects of motor skill interventions (MSI & MSFI). At the end of the chapter, theoretical implications, implications for practice and future research suggestions are provided.

OC Skill Performance of Children

Baseline Information

One of the purposes of this study was to describe the baseline OC skills of preschool children who are disadvantaged. The findings from this study showed that children in all three groups had developmental delays in the OC skills. Children performed at 14.14% in the MSFI, 9.56% in the MSFI and 8.92% in the Comparison group on the OC skill performance at pretest. According to IDEA (2004), children who have a low OC percentile score below the 25th percentile were considered developmentally delayed (Figure 4.2). These findings are in agreement with the motor
development literature showing that children in certain populations demonstrated motor development delays as a result of individual and environmental constraints (Goodway & Branta, 2003; Goodway et al., 2003; Godway & Rudisill, 1996; Hamilton et al, 1999; Robinson & Goodway, 2009). For example, Goodway et al. (2003) found that Hispanic children from low income families showed delays in fundamental motor skills below the 25th percentile (around 12%). Goodway and Branta (2003) also reported that disadvantaged African American children had developmental delays at or below the 25th percentile for the fundamental motor skills (around 17%). In addition, Hamilton et al. (1999) found that African American children from a Head Start center had very low scores (below the 20th percentile) on OC skills. Goodway, Robinson and Crowe (2010) also reported developmental delays in OC (below the 20th percentile) among the African American and Hispanic disadvantaged children from two different regions in the USA.

Although this study did not examine why these developmental delays occurred, it might be hypothesized that a variety of individual and environmental factors might lead to the motor developmental delays of these children (Kazdin, 1995; Venetsanou & Kambas, 2010). Dynamical systems theory explains the role of individual (internal) and the environmental (external) constraints on the development of coordination (Newell, 1984). Certain constraints might have an impact on the development of coordination (Newell, 1984). Specifically, low income, single-parent homes and dangerous living conditions might be listed as environmental constraints that might results in children having motor development delays (Hamilton et al., 1999).

In this study, the developmental delays might be explained by a combination of individual or environmental constraints. Children at the pretest showed very low
performance on the OC skill subtest of TGMD-2 which suggests that children did not have any prior experience with the OC skills. One of the possible reasons of this might be limited physical activity opportunities available for these children in their home and outdoor environments. Another possible reason might be explained by their parents’ physical activity level or parent’s encouragement for physical activity participation. Informal interviews with parents and classroom teachers supported that children had limited opportunities to go outside and play with their peers or siblings because of the dangerous neighborhood. In addition, parents indicated that they were not physically active. Many of the children spent much of their day in child care and this environment might be another factor in developmental delays. Factors such as the curriculum, equipment, space and developmentally appropriate practices for their students should be considered in future research. In this study, there was no structured motor skill program included in the curriculum of the Head Start Center. Informal observations showed that children had unstructured physical activity sessions but they did not receive any motor skill instruction by their classroom teachers during these sessions. Furthermore, the Head Start Centers had only one multipurpose room and limited equipment for the physical activity opportunities. It is obvious that a number of individual and environmental constraints exist for this group of children. However, the nature of the effects of the constraints on the developmental delays of children is not clear. More research is warranted to reveal the effects of constraints on developmental delays of children who are from disadvantages circumstances. Children from various populations and geographic regions should be also investigated to determine the motor development differences among diverse populations.
Future research might focus on the possible risk factors of children, home environment, physical activity level of parents, parent perceptions about physical activity or motor development, child care environment or early childhood curriculum to have a deeper understanding of the interaction of factors that might cause delays. Then, early interventions should be designed based on children’s needs to remediate their motor development delays (IDEA, 2004). Early interventions are also necessary for children’s future physical activity participation and motor skill development (Wrotniak, Epstein, Dorn, Jones, & Kondilis, 2007). According to Seefeldt (1980), if children have some degree of fundamental motor skill proficiency, they should be able to apply these FMS to sports and games and be able to participate in more advanced level of activities in their future life. Wrotniak et al. (2007) supported this idea by their study showing a positive relationship between motor skill proficiency and physical activity participation in children 8 to 10 years of children. It might be insightful to do more research on the role of motor skill proficiency on physical activity participation of children in younger age groups. Longitudinal studies might be another strategy to track children’s physical activity participation with regard to its relation to motor skill proficiency.

Gender and Baseline Information

Another research question investigated prior to the interventions was about gender differences in the OC skill performance of children. The results showed no gender differences ($p = .92$) in the OC skill standard scores. However, the raw scores of the OC skill indicated a significant gender difference in favor of the boys ($p = .04$). This result was similar to the previous research showing gender differences in the OC skill performance in favor of boys (Amui, 2006; Robinson, 2007; Garcia & Garcia, 2002;
Lorson, & Goodway, 2007; Thomas & French, 1985; Nelson, Thomas, & Nelson, 1991). The reason for obtaining gender differences in the raw scores was that raw scores showed the mastery of OC skills among children (Goodway & Rudisill, 1997). Specifically, a raw score showed a child’s ability to meet performance criteria of OC skills. TGMD-2 has 6 OC skills (throw, catch, kick, strike, bounce and roll) and children can get a high raw score of 48. However, the standard scores of OC performance were calculated based on children’s age and gender. For this reason, a non significant gender difference was obtained in OC skill standard scores.

Gender differences in the OC skill performance might be attributed to many factors. Biology and environmental differences were analyzed in a meta-analysis done by Thomas and French (1985). They emphasized that biological differences were moderate between girls and boys before puberty and it was suggested that equal expectations, goals and instructional experiences should be set by significant others for both genders to prevent any gender differences in the motor skill development. An interesting study on preschoolers conducted by Garcia (1994) reported that girls were more cooperative engaging in motor skills, on the other hand, boys were more competitive during motor skill instruction. This qualitative study offers that motor skill programs might be organized by considering the social component of teaching and learning environment (Garcia, 1994). So that individual differences help us create more relevant motor skill opportunities for both genders.

_The Effects of Motor Skill Intervention (MSI) on OC Skill Performance_

The effects of two motor skill interventions (MSI & MSFI) on OC skill performance of children were analyzed from pretest to posttest measures. The findings
indicated that children in the MSI group and the MSFI group improved their OC skill performance from pretest to posttest. However, the Comparison group had the same low level of performance in the OC skills. As might be expected both of the intervention groups improved their OC skills, the MSI group changed its standard scores of OC skills from 6.41 to 10.14 (14.14% to 52.14%), the MSFI group changed its score of OC from 5.56 to 9.24 (9.56% to 42.04%). In contrast the Comparison group had similar OC skill scores with 5.62 at the pretest and 5.98 at the posttest (8.92% to 10.92%). The ANOVA with repeated measures revealed a Group X Time interaction from pretest to posttest with a moderate effect size (.42) showing 42% of the variance in OC skill performance was explained by the effects of the interventions. This effect size is smaller than other intervention effect sizes reported in the motor development literature: where large effect sizes in the motor skill interventions were found,.63 (Goodway et al., 2003), .72 (Goodway & Branta, 2003), .82 (Goodway & Robinson, 2009) and .92 (Hamilton et al, 1999). The moderate effect sizes might be explained by the smaller sample size and large standard deviations. The findings of this study also showed that the MSI and the MSFI group were not significantly different from each other. Both groups improved their OC skill performance from pretest to posttest.

Previous motor skill interventions found similar benefits of the motor skill interventions on the OC skill performance of children in disadvantaged circumstances. The children in the studies demonstrated improvement in their OC skill performance as a result of the motor skill interventions (Connor-Kuntz & Dummer, 1996; Hamilton et al., 1999; Goodway & Branta, 2003; Goodway et al, 2003; Robinson & Goodway, 2009). All intervention studies followed similar high quality instructional approaches in their
studies. Those instructional approaches were utilized as guidelines of the interventions of this study as well. Furthermore, Active Start Guidelines for young children (NASPE, 2009), literature reviews in motor development of children (Riethmuller et al., 2009; Venetsanou & Kambas, 2010), physical activity literature (Sluijs et al., 2008; Tucker, 2008), teaching in early childhood area (NAEYC) and effective teaching strategies (Becker & Carnine, 1980; Graham et al., 2007; Graham, 2001; Silverman & Ennis, 1996) were reviewed to create the motor skill interventions for this study.

Two major motor skill interventions (MSI & MSFI) were designed and delivered for children in this study. Both the MSI and the MSFI received the same motor skill intervention that was an effective program to enhance children’s OC skill performance. Major intervention factors that might be associated with the success of the intervention were that lesson plans demonstrated developmentally appropriate practice and high quality pedagogical approaches. A traditional instruction approach was chosen in order to deliver the motor skill instruction to the children in the MSI group. This approach focuses on student learning with low autonomy of children (Becker & Carnine, 1980). Students should follow the directions of instructor in a highly structured teaching-learning environment under the traditional instruction approach. A large number of studies have reported the benefits of traditional instruction (direct instruction) approach on student learning in physical education settings (Ayers et al. 2005; Rikard, Boswell, & Boni 1993; Sweeting & Rink, 1999). Ayers et al. (2005) found that elementary students were successful in jumping performance when direct instruction was provided. Sweeting and Rink (1999) also reported that direct instruction was an effective approach in the preparation phase of jumping. Rikard et al., (1993) indicated that fifth graders increased
their striking ability as a result of direct instruction approach. In addition, preschoolers with development delays showed improvement in their perceived motor competence (Goodway & Rudisill, 1996) and in their FMS with direct instruction approach (Goodway & Branta, 2003; Goodway et al., 2003). Based on the previous research findings, traditional instruction in the MSI was given by a variety of instructional strategies.

The instructional strategies in the MSI involved demonstrations, explanations, cue words, feedback, task modifications, and manipulations of factors (e.g. distance, object and target). For each session in the MSI, the assigned skill for the session were explained with the cue words by the motor development expert, then, the skill was demonstrated (part and whole) in a sequence for children several times. As identified in the literature, correct demonstration is an essential teaching strategy for young children (Graham et al., 2007) who are visual learners and they can copy the demonstrator quickly. Thus, demonstrations were performed for each OC skill and they were effective to teach the skills for children. Cue words were also used in each session of MSI. Landin (1994) and Rink (2006) argued that using cue words during teaching process is one aspect of effective teaching. Masser (1993) supported Rink’s argument by finding that first grade students showed improvement in the handstand and forward roll performance when cue words were provided during instruction. Cue words reflect the critical elements of the skills. For example, in the cue words of “step and kick”, “run and kick” or “step with opposite foot” children might easily understand what they need to do and what the basic elements of kicking are. Cue words for each skill in the MSI were emphasized many
times in each session and children’s understanding were always checked by the motor development expert.

Feedback is another part of the MSI intervention. It is widely known that feedback is an essential element of effective teaching (Lee, Keh, & Magill, 1993). The role of feedback in motor skill learning cannot be ignored (Rink, 1996). Skill related feedback, non-verbal feedback, positive feedback and corrective feedback were given by the motor development expert in this study. However, formal observations or data collection about the frequency or type of feedback were not performed in the sessions. This is one of the weaknesses of this study. The amount of feedback given by the motor development expert for three classes should be examined in this study to show if each class received similar amount and the type of feedback. A recent study completed by Robinson and Goodway (2009) reported the type and the amount of feedback given in their motor skill interventions, which is a strong point of their study. However, other motor skill intervention studies did not give detailed information about their feedback incidents in their studies (Goodway & Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999). Future research should focus on feedback in the motor skill interventions.

Task modifications are another strong part of the MSI. Rink (2006) defined the task modifications as informing, extending, refining and applying of the task. These elements are major components to help children learn the motor skills in physical education (Graham, 2001; Graham et al., 2007). Each skill as a task was extended to make it harder or easier based on children’s success in the MSI. The ideas behind the extension are that if children have a high rate of success for the task, they become motivated to perform the task, they might like the challenges to complete the task and
they might practice more (Graham, 2001; Graham et al., 2007). Informal observations in the MSI sessions shows that children were highly motivated if a task become harder or if they were not successful and the task were arranged in an easy format, they just kept practicing and enjoyed the task. In parallel to the task modifications, task manipulations were also arranged in the MSI. The purpose of the task manipulations were to influence the children’s response dynamics to have desirable performance by practicing the OC skill (Newell, 1984). For this reason, variations in objects, distance, targets, physical prompts and complexity were applied for each skill. Each skill has unique characteristics, thus, task manipulations were unique to the skill (see Appendix A). For example, distance from the targets was manipulated for throwing. Distance from targets was short (5 feet) at the beginning of the instruction, then, it gradually increased (8, 10, 12, 15 feet) to make the task harder and provided challenges for children. Target size was also manipulated from big to small size of the targets (e.g. shapes or pictures). Light objects such as bean bags were utilized, then yarn balls and tennis balls were used. Physical prompts of throwing were scarf tied to leg, foot print, poly spot, line on the floor, sticker on foot/hand using to encourage children to practice critical elements of throwing (e.g. wind up with downward arm/hand or stepping with opposite foot). When children become competent in critical elements, physical prompts were gradually removed during the instruction. The motor development literature supports the role of developmentally appropriate activities and the importance of task manipulations in teaching motor skills (Gallahue & Ozmun, 2006; Haywood & Getchell, 2009; Newell, 1984).

In addition to all effective teaching strategies performed in the MSI, each child was provided with appropriate equipment to achieve maximum participation and decrease
the waiting time in the sessions. It is known that limited equipment is a barrier to reach high number of practices in physical education settings (Hastie & Saunders, 1991). Although developmentally appropriate equipment were recruited for the motor skill interventions, the Head Start Center did not have any appropriate gym for the physical activity opportunities or structured motor skill program. For this reason, an outdoor area was utilized for the MSI if weather is permitted to go outside. During the sessions performed at the outdoor, the classes had to come from their classrooms to reach the outside area. Thus, the cool down or warm up part of these sessions was not always performed because of time limitations. Each session was 30 minutes with 12 minutes instructional time for each of the two OC skills. Thirty minutes was a very limited time and it was hard to apply everything in the session. Forty-five minutes might be a more appropriate time in order to achieve all desired aspects of motor skill instruction (Goodway & Branta, 2003; Goodway & Rudisill, 1996; Valentini & Rudisill, 2004b). Further studies might utilize a 45 minute time frame rather than a 30 minute one.

It should be noted that all teaching strategies in the MSI were controlled by an intervention integrity check list to ensure that the MSI lesson plans were implemented as intended. A motor development expert implemented the lesson plans and delivered the traditional instruction to the children to teach the OC skills in the study. All lesson plans were developed by three motor development experts. These were other strong points of the MSI. Future research should examine whether a trained preschool classroom could bring about the same results. This should be investigated by future research.

In reviewing the MSI findings, it is important to consider a center effect or class effects on the OC skill performance of children. The improvement of children’s object
control skill might be affected by a center effect or class effects. However, the center or class effects were not influential in this study. There were no structured physical activity or motor skill activities provided by the Head Start Center (Center A). The children just participated in the free play sessions as a part of the Head Start Curriculum. The children from the comparison site (Center B) also participated in the same free play activities. They did not improve their OC skills in this study. Future studies should consider center or class effects on children’s OC skill performance.

Overall, the MSI was effective to improve children’s OC skill performance and the MSI contributes to the teaching effectiveness literature by showing the effectiveness of skill demonstrations, cue words, task modifications and task manipulations in the motor skill learning. On the other hand, children in the Comparison group did not improve their OC skill performance and it may be suggested that the unstructured motor skill activities (recess or free play) that is a typical part of a Head Start program resulted in no improvement to OC skill performance. Prior studies had the same result about unstructured activities (Goodway & Branta, 2003; Goodway et al., 2003; Hamilton et al., 1999; Robinson & Goodway, 2009) showing that the curriculum of Head Start centers has failed to support children’s motor development with unstructured motor skill activities. A major implication of this result is that Head Start policy makers need to revisit the Head Start curriculum to structure motor skills in the curriculum. Children with or at risk of developing delays in Head Start centers should be instructed in a developmentally appropriate way which includes structured (planned) motor skill activities, specific skill related feedback, task modifications, individualized learning, appropriate equipment, and enough space to perform the activities.
The Effects of Motor Skill Family Intervention (MSFI) on OC Skill Performance

The second motor skill intervention was the MSFI in this study. The MSFI included the same MSI program with a family component including a series of lesson plans performed at home by parents and their children. Unique reasons to involve parents into the motor skill instruction were that parents are the key people in their children development (Berk, 2009) and children development is affected by their context such as home, school and neighborhood (Bronfenbrenner, 1989; Bronfenbrenner, 2005). Many national agencies, such as the USDHHS (U.S. Department of Human and Health Services), the NASPE, the NAEYC (the National Association for Education of Young Children), the NHSA (the National Head Start Association), the DEC (the Division of Early Childhood) recognize the importance of parental involvement in children’s education and those agencies have their own policies and procedures to increase parental involvement at home and school environment in early years of children. For example, the DEC has a series of recommended practices for early interventions with parental involvement (Sandall et al., 2005) or the Head Start programs offer many programs or organizations to encourage parents to be a part of their children’ education at the centers. Empirical evidence of the positive effects of parental involvement in children’s development also exist in the early childhood education literature (Miedel, & Reynolds, 1999; Shaw et al., 2006; Kagan, 1999). The MSFI program was designed by considering the suggestions of the National organizations and the findings of interventions with parental involvement.

The MSFI program was resulted in improvement of OC skill performance of children from pretest to posttest measures. However, the MSFI was not significantly
different from the MSI group, but was significantly different from the Comparison group which did not receive any motor skill intervention. One study that included parents into a motor skill intervention found similar findings indicating that children in the intervention group improved their OC skill performance from pretest to posttest measures (Hamilton et al., 1999). One big difference between Hamilton et al.’s (1999) study and this study that parents were recruited to the Head Start Center to instruct their children mentored by the motor development experts in their study. In contrast to Hamilton and her colleagues’ study, the parents received a series of lesson plans with appropriate equipment to perform the motor skill activities with their children at home in this study. It should be noted that the MSFI is the first family based motor skill intervention which enhanced parents’ responsibility to improve children’s motor skills and encourage physical activity participation at their home environment. Parents would give “value added” in motor skill development of their children. However, the findings of the study did not support the role of parents in motor skill development. As being the first study to include parents in motor skill development of children, there were many lessons to be learned from this study. Future researchers should continue to examine the role of parents in children’s motor skill development.

As the nature of research in education, the MSFI had methodological strengths and weakness. Basically, the MSFI was organized for an 8 week period with 24 sessions. Parents were supposed to perform three lesson plans in a week based on their available time and space at home. Simple and short motor skill activities were provided in the lesson plans and the lesson plans generally took around 10 to 15 minutes (see Appendix D). The MSFI lesson plans were one of the strong dimensions of the MSFI. The lesson
plans were developed by three motor development experts and two preschool classroom teachers checked the lesson plans whether parents can understand the language of the activities and perform the activities.

A typical MSFI lesson plan included a skill picture showing the critical elements of the skill with explanations underneath of the picture. Then, motor skill activities were explained in a simple way and activity pictures in which an adult and a child demonstrated the motor skill activities. By considering parents’ ethnicities, adults and children in the lesson plans were selected from the same Head Start center, but children were from previous school year. In addition, key words for the activities were written down near the activity pictures for parents to give directions for their children.

Parent’s performance was the key element for the effectiveness of the MSFI. For this reason, the researcher planned carefully the training part of the MSFI. A parent night workshop was arranged for the MSFI. The intention of the workshop was to explain the importance of motor development, physical activity participation and the purpose of the MSFI. A motor development expert was invited to explain the knowledge part of the workshop. However, only 7 parents participated in the workshop, for this reason, another approach was followed by the main researcher. Individual or small group training sessions were arranged based on parents’ schedule. During the training sessions, all information about the study, the lesson plans and the equipment were provided for parents and parents were able to ask questions. It should be noted that their understanding about the study was so important for the effectiveness of the MSFI.

Major methodological difficulties limited the effectiveness of the MSFI. One of the major challenges to in-home parent-child activities is that it is very hard to understand
and document the extent to which parents actually followed the lesson plan protocol, that is, intervention integrity. It was not possible to observe the parents’ performance with their child. The only way to document the parent-child intervention was the self report technique. This is a common technique used in many intervention studies with family involvement (Nader et al., 1996; Ransdell et al., 2003; Ransdell et al., 2004; Teufel et al., 1999). Parents were responsible to fill out the evaluation forms (game sheets) and return them to the classroom teachers in this study. Reminder notes were the main strategy to encourage parents to submit their evaluation forms. A reminder note was put on each classroom’s wall which was near the table with children’s file on it and parents signed or looked thorough the file during pick up times. Reminder notes were also placed in this file for parents. In addition, children were prompted to perform the MSFI activities with their parents at home. Classroom teachers were asked to remind the parents to return their evaluation forms and the main researcher did remind the parents about the MSFI activities and the evaluation forms as well during the intervention period. Incentives (e.g. stickers, pencils, erasers, etc) were provided for children to do the activities. Despite a concerted effort to get parents and children involved in motor activity at home, reminder notes and incentives did not seem to work very well due to the low return rate (16.66%) of evaluation forms. Thus, it would be necessary to use special reward or incentive systems for future family based intervention. Free food and money might be two major incentives to facilitate optimal parent participation for a family-based intervention. Clearly, researchers should consider how to facilitate and maintain parent participation in their studies by giving incentives.
Unfortunately, the incentive system in this study was not effective. The return rate of the evaluation forms was very low. Fourteen parents (total number of children were 25 in the MSFI) returned their evaluation forms with ranged between 3 to 16 (24 game sheets were attached for each child in the equipment bag). For example, while one parent submitted only 3 game sheets, another parent submitted only 12 game sheets. Some parents wrote down some notes on the game sheets which did not include any direction for that. For example, a parent made a note for a rolling activity in which her child did bend the knees with instruction. Two parents wrote down “sometimes” for a yes or no question in a bouncing activity and batting balloons activity. Another parent made a comment about the activity like “he and his brother loved this activity. We pretended like they were baseball players” for batting balloons activity. These notes were good indicators of parent performance in the MSFI. However, a number of parents did not provide extra information about their performance. Others just submitted the evaluation forms which does not prove that parents really did apply the lesson plans with their children. This is one of the weakness of the MSFI.

Home visits might be an effective strategy to observe parents’ and their children while they are performing the activities. Home visits generally have been reported in early interventions for children with disabilities (Rickards, Walstab, Rossi, Simpson, & Reddihough, 2008), early Head Start programs (Korfmacher et al., 2008) and family based interventions (Carpenter, 2007, Heimendinger et al., 2007; Kendrick, Barlow, Hampshire, Stewart-Brown, & Polnay, 2008). In this study, it was hard to perform home visits for the participants because of limited finances and the number of people included in the study. Recent technological advances might be helpful to obtain more reliable data.
on family based interventions. For example, parents might videotape what they did at home in terms of physical activities and download the data into a DVD or CD. They might also send the data via email to researchers. In order to use technological advances in family based interventions, National and local grant opportunities might be possible sources to get financial support for family based interventions. Another strategy to increase parental involvement in interventions might be organized school based (centre-based) interventions. Parents might be invited for parent-child physical or motor activities at the Head Start Centers. The Head Start Act already has a regulation about parental involvement which emphasizes that “Parents must be welcomed as visitors and encouraged to observe children as often as possible and to participate with children in group activities” (Title 45 Public Welfare, CFR 1304.40 (d), Parent involvement-general, USDHHS, 2010). This regulation supports the idea that Head Start Centers should organize diverse activities for children and parents should be encouraged to be a part of these programs. Based on 2009 Fiscal Year, almost 905 thousands of children have been enrolled in Head Start programs (USDHHS, 2010). It is clear that researchers can reach a high number of at the Head Start Centers. If regular structured motor skill activities are provided with parental involvement for children, these activities will have huge contributions for children’s development.

The parents-child part of the MSFI intervention was not satisfactory in this study. During the MSFI, the researcher interacted with the classroom teachers and parents about the evaluation forms. There were no formal interviews conducted to inquire about the parents’ performance with the lesson plans. It would be beneficial to arrange formal interviews with parents about any concerns or problems in family based studies for future
research. For example, parents’ suggestions or expectations might be determined to increase their participation level in the studies. Additionally, common barriers to parental involvement in the studies might be discussed to find solutions for the barriers during the interviews. Some common barriers among the parental involvement in Head Start Centers have been reported as busy schedule, schedule conflict with school program and taking care of a younger child at home in a study by Lamb-Parker, Piotrkowski, Baker, Kessler-Sklar, Clark, and Peay (2001). At this point, it is imperative to include classroom teachers, school administrator or motor development experts in the interviews to provide valuable suggestions for the parents to overcome their barriers. Moreover, children’s reactions to the family based interventions are also needed in future research. The next step of this study should be integrating qualitative research methods (e.g. observation, interview, or case study) into the family based interventions.

In this intervention study, the home environment of participants was investigated to examine the relationships between home environment and children’s motor development. According to Ecological Systems theory, the home environment is the first place in which children begin to interact with their environment that contribute children’s development in different ways (Bronfenbrenner, 1989; Bronfenbrenner, 2005). It is obvious that a high quality of home environment provides a variety of opportunities to stimulate children development. From the motor development standpoint, affordances (opportunities) in the home environment might be available for example materials, toys, spaces or playground area at home (Gabbard et al., 2008). Gabbard et al. (2008) argue that limited data is available about the relationship between opportunities in the home environment and motor development of children in the literature. For this reason, they
developed a questionnaire called AHEMD-SR to examine the role of home environment in children’s motor development (Gabbard et al., 2008). This questionnaire was designed for 18 to 42 months old children and has five main components which are outside space, inside space, variety of stimulation, fine motor toys and gross motor toys (Gabbard et al., 2008). In this study, the researcher piloted the questionnaire to determine whether this instrument was appropriate or not for children who were 48 months old. Analysis showed that parents provided sufficient opportunities for their children. However, this is very limited and subjective data to make any conclusions for the relationships between children’ motor development and their home environment. Better objective tools and measurement techniques are necessary to determine the supports and barriers that the home environment has on motor skill development. Actually, this area of motor development is wide open for future research.

Overall, the findings relative to the MSFI showed that several methodological issues in the MSFI should be solved for future research. The methodological problems in the MSFI might be summarized as a) inability to control the home environment, b) low return rate of game sheets in the lesson plans, c) inability to observe parents’ and children performance at home, d) inability to collect data for the MSFI intervention integrity, e) not cooperative parents, f) ineffective reminder notes and g) ineffective reward system. In conclusion, MSFI was not effective. Possible reasons of ineffectiveness of MSFI might be a) parents did not perform the lesson plans with their children, b) intervention was not effective to develop children’s object control skills and their perceived motor competence, and c) cultural competency of intervention was not suitable for this group of parents (the ethnicity of the main researcher was different from the participants’
ethnicities). Future studies should be undertaken to conduct high quality family based interventions to improve children’s motor skill abilities and increase physical activity participation of children.

Findings of the study also shows that there was a significant Group effect at the posttest of OC skills. Follow up analyses indicated that the MSI and the MSFI groups were not significantly different from each other, but, both groups were significantly different from the Comparison Group in terms of the OC skill performance.

Gender and Intervention Effects

In terms of gender differences from pretest to posttest; there was no gender differences or gender interaction by time in the MSI and the MSFI groups. These results showed that both genders had similar benefits from the interventions. In one study for similar age group, children’s interactions were different in girls and boys during a motor skill program (Garcia, 1994). It is found that while girls preferred to be social, helpful and cooperative, boys were competitive, self-centered and goal oriented (Garcia, 1994). Garcia (1994) argued that differences of social interactions between girls and boys might result in different outcomes of motor skill instruction such as limited practice opportunities for girls which might bring less improvement in FMS for girls. However, the MSI and the MSFI was satisfactory to improve children’s motor skills in both genders. The results of MSI showed that equal practice opportunities were provided for children in the both groups and in both genders. Pedagogical strategies of the MSI were relevant to organize such an environment which served a variety of activities with task manipulations, cue words, appropriate feedback, and individualized learning. In addition, gender was not a factor at the posttest scores of OC skills in the groups.
Retention Effects of Interventions

The posttest to retention test findings revealed a significant Group by Time interaction. When follow up analyses were conducted it was shown that there were no significant differences for the MSI and MSFI groups from post to retention test. This is a positive finding. These findings were important as they show that the MSI and the MSFI groups were be able to maintain performance of their OC skills after the intervention was completed across the period of the 1 month retention test, which shows that the interventions were effective. These findings add to the motor development literature as few studies (Connor-Kuntz & Dummer, 1996; Robinson et al., 2009; Valentini & Rudisill, 2004a) have used a retention test to demonstrate motor learning. It is noteworthy that posttest of the motor skill interventions indicate immediate motor learning (performance) among children and retention tests of motor skill interventions show more permanent results in motor development (learning). Thus, retention test should be conducted in motor skill interventions to determine the quality of motor skill programs. Future research should conduct longitudinal studies to track how OC skill performance of these children in preschool persists as they enter kindergarten and elementary school. A surprising result was that the Comparison group improved their OC performance from post to retention test. It may be that practice effects and familiarity with the test accounted for this finding. However, it is important to note that for the Comparison group their scores were still in the range of developmental delays for OC skills (IDEA, 2004). Overall, these findings support the idea that if children who are at risk in developing delays receive developmentally appropriate motor skill instructions, they can gain significant improvements in their OC skill development (Goodway & Branta, 2003;
Perceived Motor Competence of Children

Baseline Information

Perceived Motor Competence was examined for all children at the beginning of this study. The findings showed that children had relatively high perceived motor competence prior to the intervention indicating that they believed themselves to be “pretty good” at motor skills. This is interesting given that the children had developmental delays in OC skill performance. These findings concur with a similar study reporting that African American preschoolers with developmental delays showed high level of perceived motor competence (Goodway & Rudisill, 1997). In addition, some motor skill intervention studies found similar findings prior to the motor skill interventions (Goodway & Rudisill, 1996; Valentini & Rudisill, 2004b). These findings support the idea that during the early childhood years, children have unrealistic evaluations about their competencies (Harter & Pike, 1984). Given this finding one might think that we should not focus on perceptions of motor competence at such a young age. However, by 7 to 8 years old, children typically begin to realize their capacities and make realistic judgments on their abilities as a result of cognitive development (Rudisill et al., 1993). When children begin to perform realistic evaluations about their abilities and if they have developmental delays, they might easily give up doing the activities because of unsuccessful experiences in physical activities (Barnett et al., 2008).

The current finding on perceived motor competence is in conflict with some prior research that suggest young children do not always have high level of perceived motor
competence. Work by Robinson et al. (2009) reported that African American preschoolers with developmental delays had low perceived motor competence (around 2.50). Another study conducted by Jambunathan and Burts (2003) reported that Hispanic children from different socioeconomic status had low perceived motor competence (around 2.40). From a developmental viewpoint, it is important to track perceptions of competence and how they tie to actual motor competence as perceived competence is a key variable in supporting physical activity behaviors (Stodden et al., 2008). Maintaining high perceptions of competence are key as children with high perceived motor competence will tend to be more persistent in engaging in physical activities (Harter, 1978; Harter & Pike, 1984; Rudisill, 1989). Future research needs to address the relationship between perceived motor competence, actual motor competence and physical activity across the childhood years. Potential gender differences were also examined for the perceived motor competence of children. No gender differences were observed prior to the interventions consistent with findings in the literature for similar aged children (Goodway & Rudisill, 1997; Jambunathan & Hurlbut, 2000).

*The Effects of Motor Skill Interventions (MSI & MSFI) on Perceived Motor Competence*

The second part of this study was to investigate the effects of two motor skill interventions (MSI & MSFI) on children’s perceived motor competence. The results for perceived motor competence were surprising. The MSI and the Comparison group did not significantly change their scores from pretest to posttest. However, the MSFI group significantly improved their perceived motor competence from pretest to posttest. This is the first study revealing positive effects of motor skill intervention on perceived motor competence of children in the context of families. Similar findings were found by a
recent study but not in context of families examining the influence of motor skill interventions on perceived motor competence of preschoolers (Robinson et al. 2009). The researchers revealed that children in the comparison group and the low autonomy group did not improve their perceived motor competence score at the end of the intervention. The instructional approaches followed in the Robinson et al.’s (2009) low autonomy group were quite similar to the MSI group in this study. The traditional instruction approach in both the current study and the Robinson et al.’s (2009) study did not seem to promote perceptions of competence. Goodway and Rudisill (1996) conducted a similar study involving traditional instruction approach in a motor skill intervention. However, the researchers found different findings indicating that children who were at risk in developing delays enhanced their perceived motor competence as a result of a 12-week motor skill intervention with traditional instruction approach (Goodway & Rudisill, 1996).

It is not clear why the MSFI participants improved their perceived motor competence. It may be that the activities performed with their parent/s resulted in the types of feedback and positive reinforcement that positively impacted perceptions of competence. Or that the pretest scores for this group were slightly lower than the other two groups. It should be noted that there is no study involving parents into a motor skill intervention to examine children’s perceived motor competence in this age group. This study is the first study to examine the effects of parent involvement on the perceived motor competence of children in motor skill interventions. Therefore, this study might be seen as a stepping stone in perceived motor competence studies. It is obvious that a limited number of studies investigated young children’ perceived motor competence
resulting from motor intervention (Goodway & Rudisill, 1996; Valentini & Rudisill, 2004a; Robinson et al., 2009). The number of studies should be increased and an examination of different instructional approaches on perceived motor competence of children should be investigated.

Posttest and Retention Effects of the Interventions on Perceived Motor Competence

The intervention effects on perceived motor competence were also examined at posttest and retention test. Posttest measures revealed that the MSI group was not significantly different from the MSFI and the Comparison group. However, the MSFI was significantly different from the Comparison group regarding perceived motor competence. One possible explanation for the posttest results of perceived motor competence could be that while the MSFI group had the lowest perceived motor competence score at the beginning of the study (3.15), it had the highest score (3.72) at the end of the interventions. The Comparison group almost had the same scores for the perceived motor competence from pretest (3.37) to posttest (3.35). These findings need replication as the number of children in the groups was limited.

Posttest to retention test changes were another part of the current study. The results indicated that the MSI and the Comparison group did not significantly change their scores from posttest to retention test. But, interestingly, the MSFI group significantly decreased its perceived motor competence from posttest (3.72) to retention test (3.43). It is unknown why their score decreased from posttest to retention test. It should be noted that the analysis were only conducted for children who had posttest and retention test data so the N was small. Subjects were lost in the retention test which included 15 children in the MSI group and 19 children in the MSFI group. Subject loss
might be one of the reasons to find this result. The time period between posttest to retention test was one month in which the primary researcher did not collect any data about what happened in this period. It might be speculated that physical activity level of children was low because of the winter season and children might be less engaged in motor skill activities. This might cause a decline in the perceived motor competence of children. Another possible explanation might be that the interventions were over and children did not have any opportunity to be reinforced positively in performing motor skill activities. Still, it unknown why their scores declined or why the MSI group had almost the same score at the posttest. The results of perceived motor competence of children suggest that time period between posttest to retention test should be analyzed by the researchers in terms of activity pattern of children in the MSI and the MSFI groups. School activities should be also examined between two tests in order to reveal any occurrence of motor skill activities at the school site.

The Harter and Pike (1984) pictorial scale used in the current study has 4 subscales to it, one of which is perceived motor (physical) competence. However, one of the other subscales in the instrument is maternal acceptance of children. It might also be valuable to examine maternal acceptance in the family based intervention group (MSFI) to see if the parent-child activities increases maternal acceptance by the children. Future studies need to analyze the role of maternal acceptance of children in the family based interventions.

Perceived motor competence was included in this study due to the fact that it has been considered as an underlying factor to facilitate motor skill proficiency (Barnett et al., 2008; Goodway & Rudisill, 1996; Goodway & Rudisill, 1997; Rudisill et al., 1993;
Southall et al., 2004; Stodden et al., 2008; Ulrich, 1987; Valentini & Rudisill, 2004a, 2004b). The role of perceived motor competence in actual motor competence has been discussed in a recent article focusing on “the role of motor skill competence in physical activity” (Stodden et al. 2008). A conceptual model was proposed as a framework explaining dynamical and reciprocal associations among actual and perceived motor competence in physical activity participation (Stodden et al., 2008). The model argues that physical activity engagement might be tied to motor skill proficiency of children. Specifically, the model suggests that having some degree of motor skill proficiency might bring more physical activity opportunities for children, which probably result in development of health related fitness for them. In addition, perceived motor competence is seen as a key factor for motivation to engage in motor skill activities. However, these associations have been argued for middle and late childhood period. From this model, it might be suggested that a) children should be encouraged to acquire motor skill proficiency as early as possible because of the potential relation to physical activity participation and b) the role of perceived motor competence should be taken into consideration in motor skill proficiency. This conceptual model provides a variety of implications for school based interventions.

In this study, this conceptual model was one of the major theoretical framework to develop two motor skill interventions (MSI & MSFI). In addition, this study tied to the National physical activity plan for children recently discussed by Siedentop (2009). In his paper, Siedentop (2009) reviewed the research on PreK to 12 school based physical activity opportunities for children. The conclusions from this review were that a) limited data was available on physical activity level of early childhood period, b) physical
activity interventions were effective if developmentally appropriate opportunities were provided for children in a certain amount of time, and c) school characteristics had powerful effect on physical activity level of children in early childhood period. Basically, high quality school physical activity interventions are suggested for future research and federal legislation should be arranged for financial support of physical activity interventions (Siedentop, 2009). This current study was in line with Siedentop’s conclusions.

The following section provides a series of implications in early childhood education and future recommendations for the researchers.

Theoretical and Conceptual Implications of the Study

Dynamical systems theory was one of the theoretical frameworks in this study. Three dimensions of the Dynamical systems (organism, environment and task) were considered while designing the MSI and MSFI. In this study, children had many characteristics which might that may have affected their growth and development. However, these characteristics or variables were not known. One important variable that was revealed at the pretest was that children showed developmental delays in the OC skill performance. Thus, this study attempted to change the Head Start environment to promote motor skill development of the children. In this environment, task manipulations were arranged to provide developmentally appropriate activities for the children and the tasks were developed around the range of developmental levels of the children. The goal of these tasks were to perturb the children’s systems to cause phase shifts from less efficient to more efficient attractors.
Ecological systems theory was the other theoretical framework of this study. This theory explains the role of different systems (e.g. family, child care center or health agencies) in children overall development. From this point, families were included in the MSFI, but, there were no variables manipulated in the MSFI. Thus, future research should focus on manipulations of variables in family components such as family environment.

Implications

This study has important implications for early childhood programs (e.g. Head Start), policy makers, school administrators, physical education teacher education (PETE) programs, classroom teachers, and parents.

Implications for Early Childhood Programs (e.g. Head Start), Policy Makers and School Administrators and Coordinators

1. School administrators and coordinators should monitor their students’ motor development on a regular basis to identify any developmental delays that might exist.

2. Early childhood programs need to provide developmentally appropriate and structured motor skill programs for children at risk in developing delays to support children’s motor development and remediate their developmental delays.

3. Policy makers in early childhood education should arrange their curriculum to include both structured and unstructured physical and motor skill activities to meet the NASPE physical activity guidelines for children ages 0 to 5 (NASPE, 2009). Adequate time, space and specific equipment are necessary to develop children’s motor skills and to achieve the NASPE guidelines.
4. Parents should be involved in their children’ motor skill development, thus, early childhood programs should recruit parents through training into their motor skill programs.

5. Preschool classroom teachers should be trained through workshops or courses to be able to instruct their students for the motor skill development.

**Implications for Physical Education Teacher Education (PETE) Programs**

1. PETE programs should increase the number of classes related to child development, motor development and motor learning. If students in PETE major have adequate knowledge about motor behavior of children, they can design effective curriculum and use developmentally appropriate instructional approaches.

2. Cooperation with other departments (e.g. Early Childhood departments) might be helpful to educate PETE majors in the motor development area.

3. PETE programs should provide field based experiences for PETE majors about the motor skill programs at the different childcare centers, such as Head Start Centers, elementary school sites or Church based centers.

4. PETE programs should teach a variety of instructional approaches in the motor development instruction for PETE majors.

**Implications for Preschool Classroom Teachers and Parents**

1. Preschool classroom teachers should be aware of the importance of motor skill development. They should use the activity time period effectively to encourage children to be active and get involved in motor skill activities.
2. Preschool classroom teachers should coordinate with parents with regard to their children’ motor development and inform parents about their children development on a regular basis.

3. Preschool classroom teachers should take the responsibility to increase their students’ physical activity level and provide developmentally appropriate instruction for their motor skill development.

4. Parents should recognize the benefits of physical activity participation and the importance of motor skill development for their children in early years. They should be proactive to get involved in their children’s education.

Suggestions for Future Research

Suggestions for Motor Skill Interventions and Family Based Interventions

Future research on motor skill interventions should:

1. Increase the number of motor skill interventions with parental involvement and the number of participants in the intervention studies. Different populations from various regions should be also investigated.

2. Increase the number of intervention studies with retention tests to examine any retention effects on motor development of children.

3. Examine the time period between posttest to retention test to describe what parents and children do at that time in family based motor skill interventions. This is very important to do to correct interpretations from retention test results.

4. Examine parents’ performance during family based interventions. They should be interviewed to identify what they really do or not do in the study.
5. Information about parents’ home environment and physical activity patterns should be gathered to make meaningful connections among their children’s motor development and related variables.

6. Include recent technological advances to obtain more reliable data from family based interventions. For instance, parents might videotape their performance with their children at home and send the researcher via email or they might download their data from videotape to DVDs or CDs. Video cameras, cell phones with cameras or other devices with cameras might be used by parents.

7. Try more effective reward systems for parents to gather adequate data from them in family based interventions. Money, free food, toys for children might be taken into consideration as the most effective rewards for low income families.

8. Investigate the motor skill development of children from different populations (e.g. Hispanic, Latino, or Asian), background (e.g. low SES or middle SES) and regions of USA (e.g. South, West or East ).

9. Examine the different instructional approaches (e.g. traditional instruction, mastery motivational climate or parental involvement) in motor development to find effective approaches.

10. Examine the effects of trained preschool classroom teachers on children’ motor development.

11. Examine the instructional feedback on motor learning during the motor skill interventions.
REFERENCES


National Association for the Education of Young Children (2004). *Developmentally appropriate practice in early childhood program serving children from birth through age 8: A position statement of the National Association for the Education of Young Children*. Washington, D.C.


Sweeting, T., & Rink, J.E. (1999) Effects of direct instruction and environmentally designed instruction on the process and product characteristics of a


APPENDIX A

CONVENTIONS FOR OBJECT CONTROL SKILLS
THE OBJECT CONTROL SKILLS

Skill: THROW

Critical Elements:
6. Wind-up with downward arm/hand
7. Throwing arm straight back behind body before throwing
8. Trunk rotation from lower body to upper body
9. Shift weight forward with opposite foot
10. Follow through after releasing ball

Key Words for Instruction:
Throw hard, step forward and throw, step with opposite leg, swing arm back and over, reach behind, swing arm and throw, follow through, transfer body weight

Factors we manipulated

1. Distance: 5, 8, 10, 12, 15, 20 feet
2. Object: bean bag, yarn ball, tennis ball
3. Target: large (e.g. wall), medium (e.g. hoops on wall, picture sheets), small (e.g. shapes, numbers, letters on paper)
4. Physical Prompts: scarf tied to leg, foot print, sticker on foot and hand, poly spot, hula-hoop, lines on floor, no prompt
5. Complexity: Individual practice, partner activity, game like activity

Convention (simple to complex):
In the beginning we manipulated and focused on distance and the object. We used physical prompts to assist the child. As children became proficient we removed physical prompts, increased the distance and introduced targets. We also added complexity in the lessons.
Skill: CATCH

Critical Elements:
1. Hands in front of the body
2. Reaching ball with extended arms
3. Catching ball with hands only
4. Taking one or two steps if necessary
5. Absorb force of the toss with arms bending and arms into body

Key Words for Instruction:
Hands ready, eyes on ball, reach with hands, reach for the ball, and catch with hands, bend arms as you catch (absorb)

Factors we manipulated

1. Distance and Arc: small tosses, big tosses, 5, 8, 10, 12, 15 feet – flat arc and rainbow toss
2. Object Texture: bean bag, fleece ball, bump ball, playground ball, tennis ball
3. Complexity: Individual practice, partner activity, game like activity
4. Movement of Person: no movement, forward, dominant side, non-dominant side, non-dominant side, backward, unpredictable

Convention (simple to complex):
In the beginning we manipulated and focused on distance and object texture. In addition, we added complexity of the lesson plans. Movement of children in the activities was manipulated from easy (e.g. no movement) to complex (e.g. unpredictable)
Skill: KICK

Critical Elements:
1. Rapid approach to ball
2. A long last step or leap before kicking ball
3. Non-kicking foot at the back of ball
4. Kicking with instep of dominant foot
5. Follow through beyond the ball – arm-leg opposition

Key Words for Instruction:
Step and kick into ball, kick hard, swing leg from hip, run and kick, eyes on ball, step and kick, follow through, hop after kicking ball

Factors we manipulated
1. Movement of Person: stationary, 1 step, several steps, run
2. Distance and Target: short distance (e.g. 5 feet) to big target (e.g. wall), short distance to smaller targets (e.g. cones), longer distance to big target, longer distance to small target
3. Movement of Ball: no movement, kicking from front, kicking from side
4. Object: balloon, milk jug, play ground ball, soccer ball
5. Physical Prompts: scarf tied to leg, foot print, sticker on foot, poly spot, lines on floor, no prompt
6. Complexity: Individual practice, partner activity, game like activity

Convention (simple to complex):
In the beginning we manipulated and focused on movement of the person from stationary to one step. We used a variety of physical prompts to assist the child. As children became proficient we increased the number of steps, removed physical prompts, increased the distance and introduced targets. A variety of objects was used and movement of ball was changed.
Skill: STRIKE

Critical Elements:
1. Gripping bat with dominant hand above non-dominant hand
2. Non-dominant side to target
3. Striking with stepping opposite foot
4. Trunk rotation from lower body to upper body
5. Ball contact with bat
6. Follow through with a wrist roll

Key Words for Instruction:
strong swing, swing bat, swing long-all the way through, stand
sideways, step and swing, “squish the bug” (step), swing to the ball,
swing through, swing long, twist your trunk

Factors we manipulated

1. Bat: hand, paddle, shorter fat bat, regular bat
2. Movement of ball: on tee, hanging from string, tossed
3. Ball size and type: beach ball, balloon, 6 inch foam ball, 4 inch foam ball, plastic softball/whiffleball
4. Physical Prompts: scarf tied to leg, foot print, sticker on foot and hand, poly spot, hula-hoop, lines on floor, no prompt

Convention (simple to complex):
In the beginning we manipulated and focused on bat and movement of ball. We used a variety of physical prompts to assist the child. As children became proficient we removed physical prompts and changed movement of ball, ball size and ball type.
Skill: **ROLL**

**Critical Elements:**
1. Dominant hand swing down and back behind the body
2. Taking step with opposite foot to arm
3. Bending knees
4. Ball releasing close to the floor
5. Follow through after releasing ball

**Key Words for Instruction:** Step and roll, roll hard, bend knees, release ball close to the floor, fingers to the floor, follow through

**Factors we manipulated**

1. **Distance and Target:** short distance (e.g. 5 feet) to big target (e.g. wall), short distance to smaller targets (e.g. cones), longer distance to big target, longer distance to smaller target

2. **Physical Prompts:** scarf tied to leg, foot print, sticker on foot and hand, poly spot, hula-hoops, lines on floor, no prompt

3. **Ball Size and Type:** yarn ball, tennis ball

4. **Complexity:** Individual practice, partner activity, game like activity

**Convention (simple to complex):**

In the beginning we manipulated and focused on distance and target. In addition, we used a variety of physical prompts to assist the child. As children became proficient we removed physical prompts, increased the distance and introduced targets. We added complexity to the lesson plans.
Skill: **STATIONARY Dribble**

Critical Elements:
1. Contact ball with one hand at about waist level
2. Push ball with fingertips
3. Ball control at least 4 consecutive bounces in front of foot
4. Ball bounces to hip height and to the outside
5. No moving the feet

Key Words for Instruction: Drop and catch, push with fingertips, relax arm, bounce ball at hip height,
push ball hard, keep ball to same side of body as hand

Factors we manipulated

1. Movement of Person: knees, stationary, walk, jog
2. Complexity: no direction, around cones, avoiding other people and changing direction
3. Number of Repetitions: 1 X, 3 X, 5 X, 10 X, unlimited

Convention (simple to complex):

In the beginning, we manipulated and focused on movement of person. We added complexity in the lesson plans. As children became proficient, we increased the number of repetitions during dribbling.
APPENDIX B

LESSON PLANS OF MOTOR SKILL INTERVENTION
Session: 1.2
Date: 
Group: Motor Skill Intervention
Time: 
Skills: Strike and Catch
Allocated Time: 30 min

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Organization</th>
<th>Instruction/Key Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3 min</td>
<td><strong>Warm up</strong></td>
<td>Children stand in their personal space</td>
<td>Encourage children participation for warm up and perform locomotor skills</td>
</tr>
<tr>
<td></td>
<td>Jumping game in hula-hoops or Body parts game</td>
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<td></td>
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<tr>
<td>12 min</td>
<td><strong>Striking</strong></td>
<td>Children on their own space and work individually</td>
<td>Focus on stepping with the non dominant foot</td>
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<tr>
<td></td>
<td>Strike balloon/beach ball with hand</td>
<td>Toss balloons/beach balls to children</td>
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<tr>
<td></td>
<td>Strike balloon with paddle</td>
<td>Make a line on the floor for “step and swing” (use stickers)</td>
<td></td>
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<tr>
<td></td>
<td>Strike balloons with paddles in pairs (peer or teacher)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 min</td>
<td><strong>Catching</strong></td>
<td>Children stand on poly spots in a line. Work individually</td>
<td>Key words:</td>
</tr>
<tr>
<td></td>
<td>Toss bean bag in air and catch (small toss and bigger toss)</td>
<td>Teacher increase the height or distance of the toss to increase difficulty</td>
<td>Hands ready, Eyes on ball, Reach with hands, Reach for the ball, Catch with hands, Pull ball to the chest</td>
</tr>
<tr>
<td></td>
<td>Toss an 8 inch ball in air and catch (small toss and bigger toss)</td>
<td>Teacher increase the distance for rainbow tosses (8, 10, 12, feet)</td>
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<td></td>
<td>Toss an 8 inch ball to the child.</td>
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<td></td>
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<tr>
<td>2-3 min</td>
<td><strong>Closure</strong></td>
<td>Children stand in their personal space.</td>
<td>Encourage children participation for activities</td>
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<tr>
<td></td>
<td>Balance activities or stretching</td>
<td></td>
<td>Ask questions for critical elements of catching and striking</td>
</tr>
<tr>
<td></td>
<td>Emphasizing critical elements of catching and striking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Equipment: CD player, poly spots, balloons, beach balls, beanbags, yarn balls, 8 inch balls, paddles, masking tape
### Session: 7.1  
**Group:** Motor Skill Intervention  
**Skills:** Throw and catch  
**Allocated Time:** 30 min  

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Organization</th>
<th>Instruction/Key Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3 min</td>
<td>Warm up</td>
<td>Children stand in their personal space and teacher leads the warm up activities</td>
<td>Encourage children participation for warm up and emphasize locomotor skills: leap, skip, gallop, jump, slide</td>
</tr>
</tbody>
</table>
| 12 min | Throwing       | Teacher demonstrates how to throw a ball. Focus on sideways stance. Children stand behind a line on the floor and work individually (use stickers). Teacher increase the distance of targets (4, 6, 8 feet) | **Key words:** Arm back and throw hard  
Step forward and throw  
**Swing arm back and over Reach behind, swing arm and throw** |
| 12 min | Catching       | Teacher demonstrates how to catch a ball. Children stand on poly spots in a line. Teacher increases the height or distance of the toss to increase difficulty. Teacher tosses the ball to the sides (right, left). Teacher increase the distance for rainbow tosses (8, 10, 12, feet) | **Key words:** Hands ready, Eyes on ball  
Reach with hands  
Reach for the ball  
Catch with hands only  
Bend arms as you catch (absorb) |
| 2-3 min| Closure        | Children stand in their personal space.                                      | Encourage children participation for activities  
Ask questions for critical elements of throwing and catching |

**Equipment:** CD player, yarn balls, foam balls, targets, cones, masking tape, stickers, spots
APPENDIX C

CHECK LIST FOR THE LESSON PLANS IN MOTOR SKILL INTERVENTION
Checklist of MSI Intervention

√ : performed  
× : not performed

<table>
<thead>
<tr>
<th>Session</th>
<th>Skills</th>
<th>3.2</th>
<th>4.2</th>
<th>5.2</th>
<th>6.1</th>
<th>7.1</th>
<th>8.1</th>
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<tr>
<td></td>
<td>Warm –up activities, music songs</td>
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<td>Task Manipulations</td>
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<td>Physical Prompts</td>
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<td>Key words for the skills</td>
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<td>Equipment availability for each children</td>
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<td>Closing Activities</td>
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</tbody>
</table>
APPENDIX D

LESSON PLANS OF MOTOR SKILL FAMILY INTERVENTION
Lesson 1: BATTING BALLOONS

You need:  
Game Sheet 1  
Balloon – blown up  
Rolled up newspaper

Activities:  
1. Adult tosses balloon to child. Child hits balloon back with hand. Repeat 10 times!  

Tell your child  
* Hit with 1 hand  
* Eyes on balloon  
* Good job

2. Adult hits balloon to child – child hits back with hand- adult hits the balloon back to child with hand- Can you hit the balloon 20 times in a row? Try again 2 more times.

Tell your child  
* Hit with 1 hand  
* Swing your arm  
* Nice work
3. Stand your child sideways like a baseball player, toss the balloon to the child and have them hit the balloon with their hand. **Do it 5 times.**

**Tell your child**

* Swing your arm
* Good job

4. Stand your child sideways like a baseball player with newspaper in hand. Toss the balloon to the child-child hits balloon back to adult. **Do it 10 times.**

**Tell your child**

* Hit with bat
* Swing your arm
* Nice job
Child name:
Class # :

GAME SHEET for BATTING BALLOONS

When your child hit the ball with newspaper, did your child:

- stand sideways □ Yes □ No □
- swing the arm □ Yes □ No □
- hit the balloon with newspaper □ Yes □ No □

Really Fun  Pretty Fun  OK  Not Fun

How long did this activity take? -----------------------------

Signature -----------------------------
Lesson 3: JUMPING OVER BUBBLES

You need: Game Sheet 3
Plastic bubble wrap
Masking tape
Tape measure

Jumping is from 2 feet to 2 feet.

Good jumpers:
• Jump off 2 feet and land on 2 feet
• Start with knees bent and arms behind body
• Swing arms forward quickly on take off
• Land on 2 feet with arms down
**Activities:**

1. Child holds parents hands- facing each other. Jump straight up and down on 2 feet. **Repeat 5 times.**

   **Tell your child**
   * Jump high
   * Good job

2. Child stands on the “launch pad” (X) or paper spot. Child gets into the start position (legs bent & arms behind body). Child swings arms forward and back but, DOES NOT JUMP! **Repeat 10 times.**

   **Tell your child**
   * Swing your arms forward and back
   * Good job
3. Child stands on X. Child swing arms forward and backward twice (while counting 1 and 2) and on 3rd swing do a short forward jump off 2 feet and land on 2 feet. **Repeat 5 times. Now do it 3 more times and fill out the game sheet.**

**Tell your child**
* Jump 2 feet to 2 feet
* Swing your arms forward quickly
* Good job

4. Child stands on launch pad (X), bends knees with arms behind body. Then child jumps as far as he/she can go and land on 2 feet. **Repeat 7 times. Then do it 3 more times and measure jumping distance.**

**Tell your child**
* Jump 2 feet to 2 feet
* Swing your arms forward quickly
* Good job

After jumping for distance like a standing broad jump, allow child to jump and pop all the bubbles in the bubble wrap. They will love the sound and the challenge.
Child name:
Class #: 

GAME SHEET 3 for JUMPING

Activity 3

Did your child bend knees at the start? Yes ☐ No ☐

Did your child jump 2 feet to 2 feet? Yes ☐ No ☐

Did your child swing their arms forward? Yes ☐ No ☐

How far did your child jump? -----------------------------

Did your child have fun? Circle below

Really Fun  Pretty Fun  OK  Not Fun

How long did this activity take? -----------------------------

Signature -----------------------------
Lesson 9: THROW THROW THROW

You need:  
Game Sheet 9  
Kitty  
Paper Spot

This picture is throwing.

Good throwers:

- Start sideways
- Reach arm with ball behind their body
- Step with opposite foot to arm
- Throwing arm swings across body after ball is released
Activities:
1. Child stands on a paper spot and adult asks the child to throw “a pretend ball” to the wall. **Repeat 10 times.**

   **Tell your child**
   * Step with opposite foot
   * Throw hard
   * Good job

2. Child stands on a paper spot and adult asks the child to throw the kitty to the wall. **Repeat 10 times. Rest and repeat 10 more times.**

   **Tell your child**
   * Step with opposite foot
   * Throw hard
   * Good job
Child name:
Class #:

GAME SHEET 9 for THROWING

Activity 2
Did your child take step when throwing a bean bag?  Yes ☐ No ☐
Did your child throw bean bag harder?  Yes ☐ No ☐
Did child rotate hip when throwing a bean bag?  Yes ☐ No ☐
Did your child do follow through?  Yes ☐ No ☐

Did your child have fun? Circle below

Really Fun  Pretty Fun  OK  Not Fun

How long did this activity take? ---------------------------------  

Signature ----------------------------------
APPENDIX E

IRB APPROVAL FORM
September 14, 2009

Protocol Number: 2002B0224
Protocol Title: BUILDING AN ACTIVE FUTURE: THE INFLUENCE OF PROJECT SKILL ON THE MOTOR SKILLS AND PHYSICAL ACTIVITY OF YOUNG CHILDREN; Jacqueline Goodway, Antoinette Miranda, Shannon Rankin, Shannon Titus, Sport and Exercise Science
Type of Review: Continuing Review & Appendices O & T Amendments - Expedited
Approval Date: September 8, 2009
IRB Staff Contact: Jacob R. Stoddard
Phone: 614-292-0526
Email: stoddard.13@osu.edu

Dear Dr. Goodway,

The Behavioral and Social Sciences IRB APPROVED the Continuing Review of the above referenced research.

Date of IRB Approval: September 8, 2009
Date of IRB Approval Expiration: September 8, 2010
 Expedited Review Category: 7

In addition, the protocol has been reapproved for the inclusion of children (permission of one parent sufficient).

In addition, the IRB APPROVED the amendment request to amend the protocol dated 08/28/09—Add Laura Mowad as key personnel; revise parental permission form and add the Movement ABC instrument.

If applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

This approval is valid for one year from the date of IRB review when approval is granted or modifications are required. The approval will no longer be in effect on the date listed above as the IRB expiration date. A Continuing Review application must be approved within this interval to avoid expiration of IRB approval and cessation of all research activities. A final report must be provided to the IRB and all records relating to the research (including signed consent forms) must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University's OHRP Federally Assured #00005578. All forms and procedures can be found on the OREP website—www.or ep.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Shari R. Speer, PhD, Chair
Behavioral and Social Sciences Institutional Review Board