Coaching Teachers to SKIP: A feasibility trial to examine the influence of the T-SKIP package on the object control skills of Head Start preschoolers

DISSERTATION

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Abstract

The purpose of this study was to determine the influence of providing on-going coaching and support to early childhood teachers delivering a motor skill intervention called Teacher-Led Successful Kinesthetic Instruction for Preschoolers (T-SKIP) on the object control (OC) skills of their Head Start preschool students who were disadvantaged. Early childhood teachers (n=10) were recruited from Head Start centers located in a large Midwestern city (n=25). Random assignment of T-SKIP (n=5) and Comparison classes (n=5) occurred at the site level (n=5). The experimental teachers were provided with a six-hour initial workshop on T-SKIP. The teachers were assessed throughout the initial workshop to determine the effectiveness of the workshop on teachers’ knowledge. After the initial workshop, teachers implemented T-SKIP to their students. Students (n=122) were nested into either T-SKIP (n=5) or Comparison classes (n=5). All students were pretested and posttested on the Test of Gross Motor Development-2 (TGMD-2; Ulrich, 2000) OC subscale to determine object control skill gains. The T-SKIP students received 15, 30 minute T-SKIP sessions over eight weeks while Comparison students received Head Start’s everyday curriculum of well-equipped free play. Eighty-one percent of all students scored below the 30th percentile on the OC subscale of the TGMD-2 at the pretest. The T-SKIP students’ (n=63) pretest mean was the 21st percentile while the Comparison students’ pretest mean was at the 16th percentile. There were no significant
between-group differences for OC percentile rank scores at the pretest ($p=.236$). The teachers ($n=5$) implemented T-SKIP for eight weeks with an overall fidelity mean of 47%, Level-1 fidelity mean of 59%, and Level-2 fidelity mean of 34%. Comparison teachers ($n=5$) continued to provide their students with Head Start’s everyday curriculum of well-equipped free play. At the posttest, T-SKIP students increased their OC percentile rank to 54% while Comparison students’ lowered their OC percentile rank to 13%. In addition, a two-level hierarchical linear model (HLM) was conducted to examine the extent to which T-SKIP predicted OC standard score means at the posttest. The HLM revealed that when pretest scores equaled zero, Comparison students had a predicted posttest OC standard score mean of 5.66 ($SD=.48$). In contrast, T-SKIP students with pretest scores of zero had a predicted posttest OC standard score mean of 10.36 ($SD=.67$). The T-SKIP coefficient from the HLM was statistically significant ($p<.001$). Two additional HLM analyses were conducted, to address the extent to which fidelity predicted posttest OC standard scores and to analyze the differential effects of T-SKIP by gender. The results of the HLM for fidelity indicated that for every 1% increase in fidelity, posttest OC standard scores increase by .12 points. Despite the positive, linear relationship predicted from the HLM for fidelity, the actual HLM was not statistically significant ($p=.201$). Additionally, no differential effects for gender within T-SKIP found from the HLM on gender ($p=.285$). The results show that T-SKIP is a valid curriculum to promote OC competence in Head Start preschool children who are disadvantaged regardless of gender.
Dedication

Dedicated to my sister, Lauren Elizabeth Brian
Acknowledgments

To my mother and father, I am grateful for the support, guidance, love, and encouragement you always provide. I never would have made it this far without you. To my sister Lauren, you taught me to appreciate every second of every day and how to place the challenges of life into real perspective. You were and always will be my best friend. May she rest in peace knowing that she influenced me to never, ever, give up no matter what! To all my Aunts, Uncles, and Cousins, thank you for your unwavering support no matter what. Especially to Uncle Rick Quinn for always checking in on me and making sure I’m ok. I promise I will never leave the country again without letting you know! Finally, to my Uncle Rick Brian and my Grandparents I know that you are looking down on me and smiling, I hope I made you proud.

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Chapter 1: Introduction

Fundamental motor skills (FMS) are considered the building blocks to more advanced movement patterns like sport-skills and moderate-to-vigorous physical activity, and are as critical to movement as the “ABC’s” are to writing (Gallahue, Ozmun, & Goodway, 2012). Typically divided into three categories, FMS include object control skills (OC), locomotor skills (LOC), and stability skills. Object control skills, also known as manipulation skills, involve the reception, propulsion, and manipulation of an object with either the hand or the foot (Gallahue et al., 2012). Throwing, kicking, catching, striking, rolling a ball, and dribbling are examples of OC skills. Moving the body from one place to another requires LOC skills such as galloping, jumping, leaping, hopping, running, and sliding. Stability skills, such as bending and twisting, occur when the body moves while remaining in the same general place in space (Hayward & Getchell, 2008).

It is often a misconception that FMS competence occurs as a result of maturation and developmental time (Gallahue et al., 2012; Hayward & Getchell, 2008). However, current research demonstrates that this is not the case (Goodway & Branta, 2003; Robinson, 2011; Robinson & Goodway, 2009; Valentini & Rudisill, 2004). In fact, in order to obtain FMS competence, young children need to receive structured motor skill instruction focusing on FMS development in a developmentally appropriate manner (Stodden et al., 2008). In addition, young children need to experience opportunities to be
successful in practicing FMS in order to develop competence (Robinson & Goodway, 2009; Robinson, 2011).

Several models of motor development agree that the early years (ages 3-7) are the ideal time to develop FMS competence (Gallahue et al., 2012). According to Seefeldt (1980) a hypothetical “proficiency barrier” exists between FMS and advanced movement patterns. He claims that if young children do not develop FMS competence before the ages of 7-9 years that they will be less likely to do so afterwards, and thus will be unlikely to participate in more complex movement patterns into adolescence. In accordance with Seefeldt, Clark and Metcalfe (2002) referred to FMS as the “base camp” from which one’s journey up the mountain of motor development begins. Thus, FMS are the precursor to context specific skills (sports, games, and lifetime activities) and ultimately skillfulness in a specific activity.

Object control skills are particularly important as a vast majority of sports and games involve the manipulation of objects. Motor development theorists (e.g. Gallahue et al., 2012; Hayward & Getchell, 2008) suggest that OC skills develop in a more ontogenetic manner and need additional practice and time to be taught. Additionally, the development of OC skills in the early years is vital to the overall development of young children as they transition into adolescence (Barnett et al., 2009; Gallahue et al., 2012). Without competency in these OC skills, young children will not progress through the “proficiency barrier” (Seefeldt, 1980) and will be less likely to choose to participate in physical activity later on in life. Moreover, Barnett et al. (2009) found that OC competence in childhood was related with physical activity outcomes in adolescence. Thus, developing OC competence in the early childhood years is an important task for
teachers to promote healthy motor development into adolescence and to encourage participation in physical activity into young adulthood.

In recognition of the importance of developing FMS in the early years, the National Association of Sport and Physical Education (NASPE, 2009) developed its “Active Start” guidelines for children ages birth through five years old. The Active Start guidelines for physical activity were developed for three age groups: infants (0-1 years), toddlers (1-2 years) and preschoolers (3-5 years). According to NASPE (2009), “All children from birth to age 5 should engage daily in physical activity that promotes movement skillfulness and foundations of health-related fitness” (p. 5). There are five guidelines for preschoolers:

• Preschoolers should accumulate at least 60 minutes of structured physical activity each day.

• Preschoolers should engage in at least 60 minutes and up to several hours of unstructured physical activity per day and should not be sedentary for more than 60 minutes at a time except when sleeping.

• Preschoolers should develop competence in fundamental motor skills that will serve as the building blocks for future motor skillfulness and physical activity.

• Preschoolers should have indoor and outdoor areas that meet or exceed recommended safety standards for performing large muscle activities.

• Individuals in charge of the health and well-being of preschoolers have a responsibility to understand the importance of physical activity and promote movement skills by providing opportunities for structured and unstructured physical activity.
The Society for Health and Physical Educators (SHAPE, 2014) physical education guidelines for school-aged students also highlights the importance of developing fundamental motor skills. These guidelines identify that young children need to demonstrate competence in FMS in order to be physically literate (SHAPE, 2014).

It is clear from the scientific literature within motor development and physical education that young children need to develop their FMS early in life. However, there are broader implications to developing FMS in addition to participating in sports, games and physical activity (Stodden et al., 2008). Stodden and colleagues developed a hypothesized model that situates the relationship between FMS, physical activity, and body weight status across developmental time. At the heart of the model is the relationship between FMS competence and physical activity. In the early years, participating in physical activity drives FMS competence. However, during middle childhood and late childhood, FMS competence is believed to drive whether or not a child engages in physical activity. Stodden and colleagues hypothesize that possessing lower FMS competence in middle to late childhood results in lower physical activity levels, which in turn, provides little opportunities to practice and improve motor competence. The interaction between lower motor competence and lower physical activity levels sends the child into a negative spiral of disengagement with physical activity and ultimately increases their risk of the child becoming overweight and/or obese (Stodden et al., 2008). The dynamic process within the negative spiral of disengagement with physical activity continues and strengthens across developmental time providing a divide between motor competent and active children who are in a positive spiral of engagement, and their peers who lack motor competence and physical activity. More
recent empirical evidence provides cross-sectional (Barnett et al., 2009; D’Hondt, Deforche, de Bourdieudhui, & Lenoir, 2009) and longitudinal (D’Hondt et al., 2011; Lopes, Rodriguez, Maia, & Molina, 2010) evidence for the developmental trajectory model developed by Stodden and colleagues, and highlights the importance of developing FMS competence during the early childhood years to facilitate a positive spiral of engagement in physical activity.

For young children from socioeconomically disadvantaged settings, the potential for having low motor competence is exacerbated by the context in which they are growing up (Centers for Disease Control [CDC], 2013; Goodway & Branta, 2003; Goodway & Smith, 2005). Lower motor competence can manifest into developmental motor skill delays. Developmental delays may be due to inadequacies in the environment to support timely motor development, placing these young children more “at-risk” for motor skill delay (Goodway & Smith, 2005). Supporting this claim, the literature shows that upwards of 86% of young children who are disadvantaged are developmentally delayed in their FMS (Goodway & Branta, 2003; Goodway, Crowe, & Ward, 2003; Goodway, Robinson, & Crowe, 2010; Hamilton, Goodway, & Haubenstriker, 1999; Robinson & Goodway, 2009; Robinson, 2011; Valentini & Rudisill, 2004). Although the evidence as to why these disparities occur is inconclusive, it is postulated that children from socioeconomically disadvantaged settings may not have access to safe places such as parks and playgrounds in which to play (Goodway & Smith, 2005). Additionally, many children from disadvantaged environments do not have safe back yards, or physical activity resources in their neighborhoods (Goodway & Smith, 2005). As a result of the overabundance of motor delays present in young children from disadvantaged
environments, there has been a call to provide opportunities for these young children to develop their motor competence and be physically active (CDC, 2013; Goodway, Robinson, & Crowe, 2010; Robinson, 2011).

A significant body of literature in motor development has begun to address the issue of motor delays in young children who are disadvantaged (Amui, 2006; Connor-Kurtz & Dummer, 1996; Goodway & Branta, 2003; Goodway, Robinson, & Crowe, 2010; Humeric, 2010; Robinson, 2011; Robinson & Goodway, 2009; Robinson, Rudisill, & Goodway, 2009; Valentini & Rudisill, 2004). The authors of these studies developed motor skill intervention (MSI) curricula to remediate motor delays. The research in MSIs has consistently demonstrated success in remediating the motor skill delays of young children who are disadvantaged (Amui, 2006, Humeric, 2010; Goodway & Branta, 2003; Goodway & Rudisill, 1996; Robinson & Goodway, 2009; Robinson, Rudisill, & Goodway, 2009; Valentini & Rudisill, 2004). One such curriculum, the Successful Kinesthetic Instruction for Preschoolers (SKIP) curriculum has been validated over the past 20 years to successfully remediate the delays of young children who are disadvantaged in multiple states and across gender and ethnicity (Goodway & Branta, 2003; Goodway & Rudisill, 1996; Robinson & Goodway, 2009; Robinson, Goodway & Rudisill, 2009). The focus of the SKIP curriculum is development of FMS with the dose of the intervention ranging in length from 9-12 weeks, for 30-45 minutes two times per week. The SKIP curriculum is an evidence-based program focusing on the array of skill development, developmental task analyses of progressions, individualized and differentiated instruction, cycles of increased and decreased task complexity all with the goal of developing motor competence (Robinson & Goodway, 2009). The content of
SKIP focuses on FMS development instructed either via high autonomy environments (Robinson & Goodway, 2009; Robinson, Goodway, & Rudisill, 2009; Valentini & Rudisill, 2004) or direct instruction (Goodway & Branta, 2003; Robinson & Goodway, 2009). The research on the SKIP program has clearly shown that children who receive the SKIP curriculum remEDIATE their motor skill delays (Goodway & Branta, 2003; Goodway, Crowe, & Ward, 2003; Robinson & Goodway, 2009).

The results of the SKIP studies and the MSI literature are promising. However, there are some limitations to their methodology (Kirk & Rhodes, 2011; Logan, Robinson, Wilson, & Lucas, 2011). A number of studies did not explicitly describe the details of the intervention making replication difficult (e.g. Deli, Bakle, & Zachopolou, 2004; Venetsanou & Kambas, 2004). Other studies did not report fidelity measures or bias reduction for coding of experimental data (e.g., Wang, 2004; Zachopolou, Tsapikidou, & Derri, 2004). Without fidelity measures and bias reduction explicitly described, it is unclear if the intervention occurred as described and that error in data coding was reduced making it difficult to rule out validity threats (Ary, Jacobs, Ravezieh, & Sorenson, 2009). Thus, Morgan et al. (in press) recommend that future intervention research needs to explicitly describe the intervention, provide fidelity measures and ensure bias reduction with data coding by using methods such as double blind coding.

In addition to the critique identified above, the MSI studies in the USA can also be criticized for a lack of translational power impacting the ecological validity of these studies (Kirk & Rhodes, 2011; Logan et al., 2011). Most MSI studies were conducted by motor development experts but few early childhood centers employ a motor development or physical education expert with the knowledge necessary to deliver a curriculum like
SKIP (McWilliams et al., 2009). Lack of funding for equipment and no physical activity policy, or an inappropriate physical activity policy also limits the ecological relevance of the studies in the literature (McWilliams et al., 2009).

Based upon the recommendations above it may be suggested that early childhood teachers (ECTs) need to teach FMS as part of their regular preschool curricula (Logan et al., 2011). However, there are significant challenges to meeting this suggestion. The majority of ECTs lack preparation and exposure to motor development and/or physical education; thus, they may lack the requisite knowledge and skills to deliver MSI to their children. Additionally, ECTs are often unaware of physical activity recommendations and the types of physical activity materials and curricula available to them to teach FMS (Gagen & Getchell, 2006; McWilliams et al., 2009). As such, the majority of time children spend in physical activity in an early childhood center is often unstructured free play that may or may not be well equipped (Bower et al., 2008; Lubans, Morgan, Cliff, Barnett, & Okely, 2010; McWilliams et al., 2009; Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004). It is no wonder that research has demonstrated a positive correlation between the amount of preparation ECTs possessed in motor development and physical education and the amount of time children spend in overall physical activity (Dowda et al., 2009) and structured physical activity that is geared towards FMS competency (Parish, Rudisill, & St Onge, 2007). Thus, we need to examine the extent to which ECTs can be coached to deliver a MSI, like SKIP, and its effects on the motor competence of their students who are disadvantaged (Logan et al., 2011).

To date there is little or no evidence to examine the extent to which ECTs can deliver MSIs such as SKIP to their children and bring about changes in motor
competence. In the early childhood sector, few MSI studies feature a classroom teacher who specifically received professional development to solely target FMS development (Adams, Zask, & Dietrich, 2009; Hardy, King, Kelly, Farrell, & Howlett, 2010; Iivonen, Saasklahti, & Nissinen, 2011; Zask et al., 2012). Children with average motor skill development from non-disadvantaged environments located outside of the United States showed growth in FMS after their teachers, who received professional development, implemented interventions (Adams et al., 2009; Hardy et al., 2010; Iivonen et al., 2011; Zask et al., 2012). However, the focus of many of these interventions was broad and included both nutrition and health education with motor skill development comprising of a small portion of the intervention (Adams et al., 2009; Hardy et al., 2010; Iivonen et al., 2011; Zask et al., 2012). Students who were taught by their ECTs achieved significant (p<.001) pretest to posttest gains in a variety of LOC and OC skills associated with the TGMD (Adams et al., 2009; Hardy et al., 2010; Zask et al., 2012). Despite significant gains in skills across the intervention, many of the studies did not report effect sizes (e.g. Hardy et al., 2010; Zask et al., 2012). Fidelity measures were also not reported so it is not clear what exactly occurred during the interventions. Based on this critique, it is clear that there is a need to conduct research on MSIs taught by ECTs involving high quality methods (Logan et al., 2011). Additionally, this research addresses a gap within the motor development literature regarding the efficacy of coaching ECTs to deliver a MSI to young children from disadvantaged settings who are at risk for motor delay.

There is no current prescription as to what is the most effective manner to provide coaching and professional development for ECTs to deliver curricula targeting FMS competency. Thus, we must look to the professional development literature in physical
education and classroom education to guide our decision-making. Overall the professional development literature in physical education (Armour, Makopoulou, & Chambers, 2012; Armour & Yelling, 2004; Deglau & O’Sullivan, 2006; Ko, Wallhead, & Ward, 2006; Patton & Parker, 2012; Sinelnikov, 2009) and classroom teaching (Birman, Desimone, Porter & Garet, 2000; Borko, 2004; Guskey, 1985; 2002; National Partnership for Excellence in Education and Accountability in Teaching [NPEAT], 1999; Shelton & Jones, 1996) suggest the following principles should guide professional development for teachers: active learning not passive listening; teachers have a sense of ownership and voice over what they are learning; repeated engagement not a one-shot workshop; peer-to-peer coaching to enhance learning outcomes for teachers; demonstration of lessons and engagement of teaching lessons to help teachers learn new lesson content; evidenced-based practice showing theory to practice in real environments; and getting teacher buy-in by showing how the new knowledge impacts student learning. These evidenced-based principles will increase the likelihood that teachers will learn and be able to apply their new knowledge base.

In summary, it is salient that young children from disadvantaged settings are highly at risk for developmental delays in FMS. Providing expert-led MSI results with preschool children who are disadvantaged remediating their developmental delays. Motor development experts rarely exist in preschool centers leaving the burden to provide motor instruction on ECTs. The limited number of studies conducted within the early childhood literature utilizing trained ECTs delivering MSIs showed that the ECTs were capable of achieving FMS gains with their students (e.g. Hardy et al., 2010; Zask et al., 2012). However, these studies had methodological weaknesses including not
explicitly reporting methods and fidelity for the structure as to what is the most effective avenue for teaching ECTs to deliver FMS interventions. This study addresses a gap in the literature by examining whether young children who are disadvantaged can achieve gains in their FMS after receiving a MSI taught by their ECTs who receive coaching from motor development experts.

**Significance of Study**

In the United States, over 950,000 preschool children attend Head Start preschool programs (UDHHS, 2012). There is a need for evidence-based curriculum that provides resources and coaching to ECTs to meet national physical activity and physical education guidelines that addresses the methodological limitations within the literature (Morgan et al., 2014). Early childhood teachers are responsible for providing their students with structured physical activity that promotes FMS competence but are not adequately trained to do so (McWilliams et al., 2009). Therefore, future research is needed to determine how best to provide ECTs with coaching, knowledge, and tools to implement MSIs such as SKIP that can result in FMS competence.

**Purpose of the Study**

The purpose of this study was to determine the influence of a MSI implemented by trained ECTs on the OC skills of their preschool students who are disadvantaged as compared to the current standard of practice in Head Start. There were three phases to this study. Phase I was the development of coaching materials and the modification of the SKIP program to the T-SKIP package or Teacher-Led SKIP. Phase II addressed the professional development of the ECTs and sought to answer if the ECTs received coaching, would they learn motor development content and early childhood physical...
education pedagogy? During Phase III, the ECTs implemented the T-SKIP package. This phase addressed whether ECTs who receive on-going coaching and support, could deliver T-SKIP with fidelity and if so, would preschool children who are disadvantaged show gains in OC skill outcomes from pretest to posttest.

**Research Questions (RQ) and Hypotheses (H)**

RQ 1: To what extent can ECTs demonstrate motor development and physical education knowledge and skills by the end of a six-hour initial workshop led by a motor development expert?

RQ 2: To what extent can ECTs implement the T-SKIP lesson plans with fidelity across an eight-week MSI?

RQ 3: What are the effects of the eight-week T-SKIP package on the OC skills of preschool children who are disadvantaged?

   H3a: The students will score below the 30th percentile on the TGMD-2 at the pretest demonstrating developmental delays with OC skills.

   H3b: The T-SKIP group will significantly improve their OC skills from pretest to posttest as compared to the Comparison group.

RQ 4: To what extent does gender influence the effects of the T-SKIP package on the OC skills of preschool children who are disadvantaged?

   H4a: There will be no differential treatment effects for gender in the T-SKIP package.

RQ 5: To what extent does the fidelity of the T-SKIP teachers predict posttest OC scores?
Delimitations of the Study

This study was delimited to the following:

1. Boys and girls aged 3-5 years enrolled in intact classes in Head Start preschools located in a large, Midwestern city in the United States.

2. Typically developing boys and girls without cognitive or physical disabilities beyond motor skill developmental delay. Motor skill developmental delay is operationalized as scoring below the 30th percentile on the Test of Gross Motor Development-2.

3. An eight-week MSI meeting two times per week for 30 minutes per session with on site coaching by a motor development expert.

4. The implementers were the lead teacher and his/her assistant teacher for each of the five classes currently employed at Head Start. The teacher’s years of experience ranged from 1-20.

Limitations of Study

The limitations of this study were the following:

1. The weather during the T-SKIP intervention resulted in school closure, shorter time allowance than initially planned for the intervention, and broken patterns of delivery. The intervention was planned for nine weeks. However, three days of school closure from severe weather resulted in an eight-week intervention being delivered.

2. It was impossible to determine the nature of free play interactions between the ECTs and students during the period of the MSI other than the three random observations of free play that occurred. It was intended to observe free play four
times over the course of the study but school closure from severe weather reduced the number of observations to three.

3. We were unable to determine whether children had additional skill practice outside of school at home. However, verbal interactions with the children, and teacher report of parent discussions suggested that children had little or no opportunity to be active at home.

4. There were space constraints in one site where T-SKIP was implemented within that site’s classroom and not in a large muscle room.

5. When the lead teacher was absent, the assistant teacher had to implement T-SKIP. The assistant teacher implemented T-SKIP two times for three lead teachers, one time for one lead teacher and never for the fifth lead teacher.

6. The results for fidelity may limit the internal validity for T-SKIP.

Definitions of Terms

**Motor Competence (MC):** an individual’s ability to perform motor skills proficiently (Stodden et al., 2008).

**Constraints:** factors within a system that either promote or impede developmental change. Constraints can be positive or negative. Positive constraints are referred to as affordances; negative constraints are defined as rate limiters. Affordances and rate limiters are subdivided into the following categories:

-Environmental: Conditions outside the body of the learner within the learning environment including equipment modifications and opportunities to practice skills and be instructed on them by teacher within the environment

-Organismic: Conditions within the body of the learner that influences development
- Task: Conditions, goals, complexity, rules and strategies with an outcome desired of producing a motoric action (Gallahue et al., 2012).

**Disadvantaged:** Children raised in a socioeconomic environment in which their families’ income falls below the poverty guideline for the United States of America (USDHHS, 2013).

**Dynamic Systems Theory (DST):** An epistemological framework that motor development theorists utilize as a theoretical underpinning to explain movement. DST posits that development of movement is non-linear, continuous-discontinuous, and is the result of perturbations both internal and external to the learner, promoting change. Stable patterns are perturbed. Human subsystems self-organize based upon the transactional and synergistic interactions amongst constraints. After stable reoccurring patterns of performance, called attractor states, receive a perturbation, the body becomes variable and then self-organizes to become stable again. The act of moving from one attractor state to another attractor state is referred to as a phase shift. Affordances promote a phase shift to an efficient attractor state, while rate limiters inhibit motor development. Dynamic systems theorists believe that development is age related and not age dependent thus is considered in opposition to maturational theories (Gallahue et al., 2012).

**Fundamental Motor Skills (FMS):** Basic patterns of movement that can be seen by the eye. Also known as fundamental movement skills, these patterns are subdivided into locomotor, object control, and stability skills (Gallahue et al., 2012).

**Locomotor Skills (LOC):** Subset of FMS, locomotor skills are any basic patterns in which an individual uses to move his/her body from one point to another. Examples of
locomotor skills are running, jumping, leaping, galloping, and skipping (Gallahue et al., 2012).

**Object control (OC) Skills:** Subset of FMS, OC skills include manipulating an object with either hand or foot. Examples of OC skills include throwing, catching, kicking, rolling, and striking (Gallahue, et al., 2012).
Chapter 2: Literature Review

The purpose of this chapter is to present the literature, theoretical underpinnings and evidence base that guided this study. This chapter includes a basic overview of motor development, a discussion of Dynamic Systems Theory and Newell’s Constraints Theory, and a review of the motor skill intervention (MSI) literature. This chapter concludes with a presentation of the professional development literature both in the classroom and physical education as well as an overall summary.

**Motor Development**

According to Clark and Whitall (1989), motor development is defined as “changes in motor behavior over the lifespan and the processes which underlie these changes” (p. 194). Motor development is a process that begins in utero, continues throughout the lifespan, and concludes with death. Gross motor movements, which involve large muscle groups and substantive movements, are the focus of this study.

A subset of gross motor movement is fundamental motor skills. A motor skill is a “learned, goal-oriented, voluntary movement task of one or more body parts” (Gallahue, Ozmun, & Goodway, 2012, p.14). It is important to note that a motor skill is a learned action and motor skill competency is not derived from genetics or maturation (Newell, 1986) but through opportunities to practice motor skills in a developmentally appropriate environment where the learner experiences success early and often (Gagen & Getchell,
Fundamental motor skills (FMS) are observable patterns of motor behavior classified into object control skills, locomotor skills (LOC), and stability skills (Gallahue et al., 2012). Object control skills (OC) involve receiving, propelling and manipulating an object with either the hand or the foot and consist of skills such as throwing, catching, kicking, punting, hand dribbling, foot dribbling, striking and rolling (Ulrich, 2000). Locomotor skills are any pattern that moves the body from one point in space to another and include hopping, running, leaping, sliding, skipping, galloping, and jumping (Gallahue et al., 2012). Stability skills involve the balancing of the body such as twisting or bending and can occur when the individual is in motion (skiing) or while stationary (twisting; Hayward & Getchell, 2008).

Fundamental Motor Skills are considered the building blocks to more complex movement patterns and begin to develop in the early childhood years when a child is capable of ambulating on his/her own (Clark & Metcalfe, 2002; Hayward & Getchell, 2008; Seefeldt, 1980). With developmentally appropriate environmental exposure and opportunities to practice children are capable of developing efficient FMS patterns (Gagan & Getchell, 2006). Without a focus on FMS development in the early years, young children may become at risk for motor skill delay, which has the potential to affect various outcomes such as physical activity levels, body composition, and perceptions of motor competence (Stodden et al., 2008).

**Theoretical Framework**

Historically, developmental theorists who subscribed to maturational and stage theories believed that FMS developed as a result of maturation and time (Bayley, 1935; Gesell, 1954; McGraw, 1935; Shirley, 1931). As such, these beliefs alluded to the notion
that as children aged and matured their movement processes would naturally improve regardless of the environment in which children existed. Furthermore, maturational and stage theorists believed that all children develop FMS in the same sequence. The sequence was thought to be a linear and unidirectional progression from an immature pattern of movement, through a non-proficient pattern of movement to a mature pattern. However, in the recent past, evidence emerged to refute the maturational perspective by describing how the development of children’s motor skills, motor control and motor behavior were not linear or unidirectional, but was highly variable and unique to the individual learner (Ehl, Langendorfer, & Roberton, 2005; Langendorfer & Roberton, 2002; Halverson & Roberton, 1979; Southard, 2002; Thelen & Ulrich, 1991). As a result, Dynamic Systems Theory emerged as a process-oriented approach to provide a rationale for the variability found within the child data and from the child-to-child data that was counter-intuitive to the theories of maturationalists (Clark & Whitall, 1989; Thelen & Ulrich, 1991).

**Dynamic Systems Theory**

Dynamic Systems Theory (DST), sometimes referred to as Dynamical Systems Theory, is rooted in Chaos Theory (Thelen & Ulrich, 1991) and derived from Newtonian Mathematics (Alligood, Sauer, & Yorke, 2000). Dynamic Systems Theory portrays the complex phenomena of human growth and development in a manner that attempts to organize chaos metaphorically. Organizing chaos from a motor development perspective is a metaphorical description of the degrees of freedom problem (Gallahue et al., 2012), which Bernstein (1967) posited as how muscle choices occurred and what role the brain and central nervous system (CNS) had in this choice. Essentially, there are many
possible movement configurations within the body to perform a motor skill, posing a
degrees of freedom problem (Bernstein, 1967). The degrees of freedom problem asks
how does the brain and CNS funnel the multiple movement configurations present within
the body to elicit the most efficient motor pattern? Dynamic Systems Theory offers a
metaphorical hypothesis to answer the degrees of freedom problem (Clark & Whitall,
1989).

According to DST, humans are ever changing, transactional systems that co-exist
within the larger environmental system. Within the human system is a process in which
patterns of movement emerge from numerous interactions among human subsystems (e.g.
multi-limb coordination, perceptual, and cognitive) and the lowest components (e.g.
blood cells, nerves, metabolic enzymes etc.) of the system. These interactions occur to
self-organize the chaotic human system, which is a result of interacting with the
environmental and task systems external to the human system (Newell, 1986).

Although there are many possible movement patterns to perform a task, DST
suggests that humans demonstrate common patterns of movement within a specific task.
Common patterns of movement appear to replicate across learners; the common patterns
may be the most efficient manner to perform a motor task. The most commonly
demonstrated patterns of movement are called dynamic attractors or attractor states

Attractor states are highly repeatable, fixed-action patterns (Lewis, 2005). For
example within throwing, there are typically five fixed-action patterns/attractor states in
which children most often present. Fixed-action patterns/attractor states are sometimes
referred to as developmental sequences or stages of the skill (Langendorfer & Roberton,
2002). From a DST perspective, not every child will experience each stage of the throw and they may not develop their throwing skill in a staged, sequential order (Langendorfer & Roberton, 2002). Overall, if a large enough cross-sectional sample of children are observed throwing at different times over a year, the five stages of throwing will occur across the entire sample and will likely occur across children in an order that one might perceive as sequential (Halverson & Roberton, 1979). However, if one follows the developmental trajectory for each child individually and longitudinally, one will see the individual child does not necessarily develop the throw in a stable, sequential manner (Langendorfer & Roberton, 2002). In fact, any child could present a proficient stage or a non-proficient stage within one observation and vary amongst stages. Additionally, the patterns of development for one child may not repeat for a different child. The inter-child and intra-child variation with the development of motor skills is a result of control parameters rather than maturation and time (Langendorfer & Roberton, 2002).

Control parameters are factors within the human system and within the external environmental system that provide a condition for a pattern of change. Control parameters prompt the self-organization and rearranging of the biomechanical degrees of freedom within the performance of a movement task through an individual gaining motor control and coordination. Motor control and coordination develops as control parameters constrain the numbers of degrees of freedom present (Gallahue et al., 2012).

Control parameters are subdivided into positive and negative factors. A positive control parameter is also known as an affordance while a negative control parameter is recognized as a rate limiter. Affordances and rate limiters in a catching task would be the speed, angle and height of the toss and the size, shape and weight of the object. For
example, if a blue beach ball is slowly tossed no higher than one foot above the catcher’s head, with an arched angle directed at the chest, then the catcher will be more likely to catch the ball. The color of the ball contrasting against a white background enables the catcher to better see the ball. The speed, angle and height of the toss enable the catcher to more easily track the back with his/her eyes. The size, shape and weight of the beach ball helps to remove the fear of being hit by the ball and also enables a child to more easily squeeze the ball with his/her hands while attempting to catch. The scenario described above depicts examples of affordances within a catching task that is a developmentally appropriate task for a young child. For the same child in the above scenario, rate limiters might present if an 11-inch plastic white softball ball was tossed quickly to the non-dominant side of the child in a straight line from a white background. The child might struggle to track the ball with his/her eyes (white ball against a white background), may be slower to react to the speed, angle and direction of the toss, and might be fearful of catching a hard plastic ball. That fear may increase the likelihood of the child turning his/her head away from the ball and not being able to catch the ball.

The use of affordances in the design of a task may help to elicit a phase shift from a less proficient attractor state (pattern of movement or developmental sequence) to a more proficient attractor state/movement pattern (Gallahue et al., 2012). During a phase shift, less proficient patterns, which are stable in their frequency, need to be disrupted or perturbed in order to phase shift to a more proficient pattern. During the time in which a phase shift occurs, variability in skill presentation will emerge until the more proficient pattern stabilizes. The stabilization of the more proficient pattern/developmental
sequence/stage/attractor state is an indication that motor skill learning occurred (Southard, 1998; 2002).

Affordances and rate limiters can also be operationalized as constraints (Gallahue et al., 2012). In an attempt to theoretically infuse the dynamic, transactional role between the human (e.g. genetics, heredity, biological factors), the environment (e.g. built environment, recreational opportunities, experience etc.) and the movement task systems, Newell (1986) developed his Constraints Theory.

**Newell’s Constraints Theory.** According to Newell (1986), the movement task transacts with the human (sometimes referred to as an organism or learner) and the environment. Not only do the constraints within the task, environment, and organism interact but they can also be modified (Gallahue et al., 2012). Specifically, the modification of the constraints within the task, environment and organism may help to produce a phase shift from a non-proficient pattern of performance to a proficient pattern of performance (Newell, 1984; 1986; Thelen & Ulrich, 1991).
Tasks are operationalized as any specific activity in which a learner (organism) performs in order to obtain an outcome (Gallahue et al., 2012). Constraints for a task may include but are not limited to task type and the outcomes desired.

**Task type.** Object control skills, as stated earlier, are typically categorized as being a reception skill, propulsion skill, or both. Catching is a reception skill, dribbling, rolling, kicking and throwing are propulsion skills, and striking is both (Gallahue et al., 2012). Propulsion skills are posited to be simpler to learn and perform than reception skills, as the learner is in control when the object is propelled, but reception skills require the ability to react, track and utilize multi-limb coordination. Striking may be the most difficult skill to learn, as it is both a reception and a propulsion skill and contains the challenges included in both skill types (Gallahue et al., 2012).

**Outcomes measures of the task.** The desired outcomes of a task and the manner in which the outcomes are measured can be manipulated and are considered task constraints. A task can be designed to produce either speed or accuracy results.
Examples of either speed or accuracy results include the number of throws a child performs regardless of hitting a target versus the number of times a child successfully hits a target with the throw. In order to elicit a higher number of throws children need to have multiple objects to throw and be told to throw as hard as he or she can, without much concern for size of target and distance from target. In contrast, to incur more accurate throws, a child needs a large target and be close in proximity to the target. As such, it is more developmentally appropriate to focus on throwing the ball as hard as he/she can and focus on numbers of correct practice trials than to worry about accuracy for young children. If a child attempts to elicit accuracy, he/she may change the pattern of throwing to a less proficient pattern (i.e. throw without stepping / stage one chop throw) with fewer degrees of freedom in order to hit the target. In order to throw as hard as one can, a target that is further away and use of a slightly heavier object such as a beanbag may elicit a more proficient pattern of movement (i.e. long step with opposition, long arm swing and trunk rotation / stage five segmented rotational throw). As the most proficient patterns of movement are the outcomes desired in this study, a focus on numbers of correct trials was chosen over accuracy.

**Environment.** Often times in the DST/Constraints Theory literature, the distinction between environmental and task constraints may be blurred. For the purpose of this study, environmental constraints involve any control parameter that are outside of the learner’s body and are not specifically defined by the instructor requiring an outcome. The socioeconomically disadvantaged environment in which young children in this study serves as a rate limiter. In addition, the teachers to the students who are situated within
the socioeconomically and the equipment in which the teachers modify within the disadvantaged environment serve as environmental constraints.

**Equipment used.** The type of equipment used within an environment modifies the difficulty of the action. Catching a large blue beach ball propelled from a person standing in front of a white background is markedly easier than receiving a white table-tennis ball propelled from a person standing in front of a white background. In addition to color of the background from which an object is propelled, modifications to the size, shape, color, texture, and weight of equipment can also serve as constraints within the environment. A young child catching a beach ball is less intimidated than a young child catching a hard plastic softball, as they would be less fearful of the ball hitting them.

Other examples of environmental constraints are temperature, weather, and time of day. It is very difficult to modify environmental constraints with the exceptions of controlling indoor temperature, providing cover outdoors from the sun, rain or wind, and choosing the time of day to execute the task. It is important to note that differences between environmental and task constraints can often blur. Therefore, task constraints are set within an environment in which a teacher is providing a MSI that includes modifications to equipment for young children.

**Organism.** Organismic constraints are defined as conditions within the body that influence development. For the organism, also referred to as learner or student, it is not possible to manipulate certain organismic constraints quickly such as speed, static/dynamic balance, anthropometrics, strength, and flexibility. Constraints that are unable to be manipulated quickly are either affordances or rate limiters leading to the success or detriment of the execution of the task. In order to adjust for organismic
constraints that can only be manipulated slowly, task and environmental constraints must be induced such as those listed above.

Motivational constraints, however, are examples of student-level organismic constraints that can be manipulated quickly. To heighten one’s motivation to participate within the activities, task constraints can be manipulated. Examples of motivational task constraints include providing a “fun” target like a bowling pin to roll at, using a theme to the lesson such as an ocean theme, and providing opportunities for young children to be successful at the task early, and often. Ensuring success early and often can occur by manipulating task constraints such as placing the student in close proximity to a large target. Having success early and often also manipulates motivation. The above example also illustrates how task, environment and organismic constraints are all related and transactional.

In summary, there are three main points from DST and Newell’s Constraints Theory that influenced and underpinned this study.

• movement is not coded a priori, hard wired or prescriptive, but rather it is softly assembled, self-organizing and highly variable
• movement is the product of many subsystems both within the body (organismic) and external to the body (task and environment
• environmental (equipment and task set up) and instructional prompts and engaging developmentally appropriate tasks can perturb the system (child) to move from inefficient patterns of movement to more efficient patterns of movement
Being a dynamic system, human development is not linear; it is not hierarchical and does not necessarily end with a state of motor skill competence. From a DST perspective, children need to be taught FMS in a developmentally appropriate manner and experience success early and often in order to learn FMS and achieve motor patterns appropriate for the individual learner (Hayward & Getchell, 2008). In the following section, four models of motor development (Clark & Metcalfe, 2002; Gallahue et al., 2012; Seefeldt, 1980; Stodden et al., 2008) are discussed to provide rationale for FMS being developed early and proficiently.

**Models of Motor Development**

There are four prominent models of motor development that demonstrate the importance of FMS (Clark & Metcalfe, 2002; Gallahue et al., 2012; Seefeldt, 1980; Stodden et al., 2008). The four models of motor development are the “Sequential Model of Motor Development” (Seefeldt, 1980), the “Mountain of Motor Development” (Clark & Metcalfe, 2002), the “Hour Glass” model (Gallahue et al., 2012), and the “Developmental Trajectories of Motor Development” model (Stodden et al., 2008). Each model situates the importance of FMS but also provides intricate differences that are valuable.

In the Sequential Model of Motor Development, Seefeldt (1980) describes motor skill acquisition in relationship to developmental time. The model begins within the reflexive stage describing infant reflexes and responses up until the early childhood years. Next, Seefeldt suggests FMS must be developed during the early childhood years. Fundamental motor skills are positioned below a hypothetical “proficiency barrier”. According to Seefeldt, children need to acquire FMS competence in order to breach this
proficiency barrier and move into the transitional skill phase. Transitional skills are lead up skills to more specialized movements which can be sport-specific such as tennis, volleyball, or non-sport specific, such as dance. Without the ability to break through the proficiency barrier, it is unlikely that those with lower FMS competency will be active later on in life. Thus, FMS acquisition should occur in the early childhood years.

Clark and Metcalfe (2002) developed a similar model to Seefeldt’s (1980), using a metaphor called the “Mountain of Motor Development.” Clark and Metcalfe situate motor skills in developmental time consisting of six phases: reflexive, pre-adaptive, fundamental motor patterns, context-specific, and skillful. Fundamental motor skills are considered the “base camp” from which all individuals start their journey toward the performance of context specific skills and skillful movement. The mountain of motor development model is unique in that it considers both intra-individual (within one person) and inter-individual (between individuals) differences in regard to FMS. The intra-individual variation depicts a person’s level of competency for many different types of skills. For example, a gymnast would have a high level of competency at balance activities, such as walking on a beam (high mountain peak) but may not be very proficient at hitting a golf ball (low mountain peak). These divergent skill capabilities are depicted within the model as different “peaks” of the mountain. Not only does an individual have varying peaks, but also each person’s mountain looks different, accounting for inter-person variance. A gymnast’s mountain would look very different than a golfer’s mountain, but the paths to climb up their mountains all start with FMS.

Gallahue developed his Triangulated Hourglass Model (Gallahue, 1995; Gallahue & Ozmun, 2006; Gallahue et al., 2012) to depict the process and product of motor
development. Gallahue’s model has similarities with Seefeldt (1980) and Clark and Metcalfe’s models (2002). The hourglass model is unique in that it combines the phases seen in Seefeldt’s model, within individual factors (similar to Clark & Metcalfe) but also includes task and environmental constraints as factors affording or limiting motor skill development. There are four phases within Gallahue’s hourglass model: reflexive movements, rudimentary movements, FMS, and specialized movements. Children progress through these phases of movement at different rates based upon the influence of genetics and environment, with motor control and movement competence being the hopeful outcomes (Gallahue et al., 2012). In the hourglass model, FMS are situated between rudimentary movements and a specialized movement phase. According to Gallahue, one must first develop FMS mastery in order to be capable of achieving specialized movements, which leads to motor control and movement competence.

The first three models explicitly describe the hypothesized relationship between FMS and sport-specific, and non-sport specific movement skills. However, none of the first three models speak directly to the relationship between FMS and lifetime physical activity. A recent model by Stodden et al. (2008) highlights the relationship between FMS and physical activity by developing a conceptual framework with motor competence and physical activity at the heart of the model, and perceived motor competence (PMC) and health-related fitness as mediators. Stodden and colleagues posit that the nature of the relationship between FMS (or motor competence) and physical activity changes across developmental time; specifically it is different in early childhood, middle childhood, later childhood and adolescence. For young children, according to Stodden and colleagues, physical activity leads to motor competence but for adolescents,
motor competence leads to physical activity participation mediated by PMC and health related fitness levels. Thus, it is critical that children obtain FMS competency in the early years in order to remain physically active into adolescence.

All four models of motor development situate FMS competence as a determinant of more complex and specialized movement patterns (e.g. participation in games, sports and recreation). The model proposed by Seefeldt (1980) is unique in that it was the first to envision the age-related proficiency barrier between FMS competence and complex, sport-specific and non-sport specific movement patterns. Clark and Metcalfe (2002) expanded upon Seefeldt’s model to include within-person and person-to-person variances highlighting that each individual’s mountains are different but all require FMS competence to start a journey towards motor competence. Gallahue et al., (2012) developed upon each model by including the influence of environment and heredity as constraints upon motor competence. Finally, Stodden and colleagues (2008) situated the development trajectory for the relationship between FMS and physical activity noting the dynamic and synergistic relationship between the variables as they change across developmental time. What is clear is that motor competence may not necessarily cause an individual to participate in games, sports, recreation and physical activity, but a lack of motor competence, in particular FMS competence, may be prohibitive towards games, sports, recreation and physical activity participation.

Motor development theorists argue that FMS need to be taught, children need opportunities to be successful, and that motor success comes often in the early years. In recognition of the importance of FMS development in the early years, the National Association of Sport and Physical Education (NASPE, 2009) developed their Active Start
guidelines for children from birth through age five. The overall “Active Start” guideline for all ages is that, “All children from birth to age 5 should engage daily in physical activity that promotes movement skillfulness and foundations of health-related fitness,” (NASPE, 2009, p. 5). However, there are five specific guidelines for preschoolers:

• Preschoolers should accumulate at least 60 minutes of structured physical activity each day.

• Preschoolers should engage in at least 60 minutes and up to several hours of unstructured physical activity per day and should not be sedentary for more than 60 minutes at a time except when sleeping.

• Preschoolers should develop competence in fundamental motor skills that will serve as the building blocks for future motor skillfulness and physical activity.

• Preschoolers should have indoor and outdoor areas that meet or exceed recommended safety standards for performing large muscle activities.

• Individuals in charge of the health and well being of preschoolers have a responsibility to understand the importance of physical activity and promote movement skills by providing opportunities for structured and unstructured physical activity.

As preschoolers move into elementary school, The Society for Health and Physical Educators (SHAPE, 2014) recognizes the continued importance of FMS through its physical education guidelines for school-aged students. Standard one states that the, “physically literate individual demonstrates competency in a variety of motor skills and movement patterns” (SHAPE, 2014, p. 1). Unfortunately, for children who are socio-economically disadvantaged environments, there are disparities in the opportunities to
receive “structured” physical activity focusing on FMS competence in accordance with NASPE and SHAPE.

**Children who are Disadvantaged and FMS**

According to the United States Department of Health and Human Services (USDHHS, 2013), a poverty guideline is calculated based upon the numbers of individuals within a household. Within the USDHHS guidelines for a family of two, the poverty guideline is an annual household salary of $15,730.00. Many United States government sponsored services calculate eligibility for their programming based upon a percentage of the poverty guidelines ranging from 130-300% below the poverty guideline (USDHHS, 2013). According to the Annie E. Casey Foundation (ACF, 2014), 40% of all children within the United States are from low-income families of which 8% are raised in extreme poverty (less than $1.25/day; World Bank, 2014) and 32% live with a single parent (AECF, 2014).

**The Child At-Risk for Developmental Delay**

Children raised in socio-economically disadvantaged circumstances may be exposed to risk factors that could negatively affect development (Kazdin, 1995). These risk factors include child, family and school factors. Child factors include temperament, psychomotor skills, cognition, prematurity and low birth weight, as well as chronic illness during childhood (Kazdin, 1995). Family factors include genetics, alcohol and drug abuse, parental interactions, family situations (such as marital status, size and birth order), financial status, and parental level of involvement/supervision (Kazdin, 1995).
The increased risk factors a child is exposed to may increase the likelihood for developmental delay (Kazdin, 1995). The definition of developmental delay per the Individuals with Disabilities Education Improvement Act (IDEIA, 2004) as,

“Children aged three through nine (or any subset of that age range, including ages three through five), may include a child who is experiencing developmental delays as defined by the State and as measured by appropriate diagnostic instruments and procedures in one or more of the following areas: Physical development, cognitive development, communication development, social or emotional development, or adaptive development; and who, by reason thereof, needs special education and related services “ [34 CFR §300.8(b)].

There is no evidence-based explanation as to why socio-economic status and ACF (2014) risk factors place young children from disadvantaged environments highly at risk for developmental delay (Goodway & Smith, 2005). However, it is posited that one cause of increased risk for developmental delay may be due to lack of opportunities to play outside because the neighborhoods are unsafe, increased screen time, lack of structured physical activity in school, and lack of structured play with parents due to work hours (Goodway & Smith, 2005).

Despite the lack of evidence for “why” developmental delay is prevalent amongst young children who are disadvantaged, a substantial amount of evidence exists that reinforces the notion that a high incidence of developmental delay occurs in young children who are disadvantaged (Goodway & Branta, 2003; Goodway, Robinson, & Crowe, 2010; Robinson & Goodway, 2009; Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004). Over the past decade, several studies have been conducted that investigated the motor competence of young children who are disadvantaged (e.g.,
Goodway & Branta, 2003; Goodway, Crowe, & Robinson, 2010; Robinson & Goodway, 2009; Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004). In all of the studies, the Test of Gross Motor Development (TGMD; Ulrich, 1985; 2000) was the instrument that was used to calculate motor competence. The TGMD is a norm-referenced and validated test based upon census data, to accurately depict motor data of children ages 3-10 years, 11 months (Cools, De Martelaer, Samaey, & Andries, 2008). Scoring at or below the 30th percentile on the TGMD is how IDEIA classifies developmental delay. A percentile rank of 30 means that 70% of the validated sample achieved a higher score than the subject who scored at or below the 30th percentile (Ulrich, 2000). According to Goodway et al. (2010), 86% of their sample demonstrated developmental delays scoring at or below the 25th percentile on the TGMD-2. In addition, all groups tested within the MSI literature conducted in various regions across the USA, regardless of gender produced a mean score at or below the 30th percentile on the TGMD-1/2 (Hamilton, Goodway, & Haubenstricker, 1999; Goodway & Branta, 2003; Goodway et al., 2010; Robinson & Goodway, 2009; Martin et al., 2009; Valentini & Rudisill, 2004). These findings of developmental delay amongst preschool children who are disadvantaged in the USA have been consistently reported over the past twenty years (Hamilton et al., 1999; Goodway & Branta, 2003; Martin et al., 2009; Robinson & Goodway, 2009; Valentini & Rudisill, 2004).

The role of Gender and FMS. In addition to socioeconomic disadvantage being a constraint on FMS development, the motor development literature also depicts a gender effect on FMS (Garcia, 1994; Garcia & Garcia, 2002; Lorson & Goodway, 2008; Thomas & French, 1985). In particular, young girls within these studies tend to exhibit lower
FMS than boys during the initial testing (Branta, Haubenstricker, & Seefeldt, 1984; Garcia & Garcia, 2002; Lorson, & Goodway, 2008; Thomas & French, 1985). The gender gap for FMS becomes more exacerbated throughout adolescence (Goodway, Robinson, & Crowe, 2010) if not addressed in a developmentally appropriate manner.

One possible explanation for FMS gender differences may be the social environment (Garcia, 1994). According to Garcia, boys tended to be more egocentric and competitive while girls are more caring and interested in sharing. A competitive orientation led to more time engaged with the task for the boys as compared to the girls (Garcia, 1994; Williams, Haywood, & Painter, 1996). In accordance with the findings from Garcia, it is hypothesized that teachers, coaches and parents provide boys with feedback focusing on competency while encouraging only effort to participate, regardless of competency, for young girls (Lorson & Goodway, 2008).

Overall, gender differences exist for FMS competence for all children but especially young girls who are disadvantaged. These gender differences are hypothesized to be from environmental factors. Garcia and Garcia (2002) purport that instruction focusing on competency development that is encouraging and using proper models was effective for girls. Social factors such as how children interact during FMS lessons (Garcia, 1994) or divergent expectancies from children based upon gender might factor into the gender differences present for young children (Lorson & Goodway, 2008). Fortunately, when provided with structured MSIs that focus on FMS in a developmentally appropriate manner, young girls are able to catch up to the boys in regard to FMS (Goodway, Robinson, & Crowe, 2010). Therefore, it is critical that change occurs in the manner in which young girls are provided with exposure to FMS.
Young girls need the same focus on motor competence that young boys receive and need to participate in structured FMS programs early and often (Robinson & Goodway, 2009).

In summary, it is clear from the MSI literature that young children who are disadvantaged have a high incidence of developmental delay with their motor skills and need intervention. In addition, young girls, especially those from a disadvantaged setting are more delayed than boys and specifically need intervention that is structured. Although not the focus of this study, other work has suggested that the environments in which these children are being raised are not supportive to timely development including motor development (Goodway & Smith, 2005). In recognition of these challenges within the USA, Head Start programs were developed in the 1960s to address the disparities in educational achievement of children between poor, middle and high socio-economic status families.

**Head Start and Motor Skills**

In 1965, the United States Government initiated a program called Head Start to provide children from disadvantaged settings comprehensive educational opportunities (USDHHS, 2013). The purpose of Head Start programs is to provide early childhood education, health, and family support programs to children of families earning 130-300% below the poverty line (USDHHS, 2013). In addition, children who are in foster care or families who are experiencing homelessness may also qualify for Head Start (USDHHS, 2013). According to the USDHHS (2013), 904,153 children are currently enrolled in Head Start programs across the country with over 25 million participating since 1965. In the location of this study, over 35,000 children participated in Head Start in 2013.
Head Start Early Childhood Teachers (ECTs)

In order to become a teacher within Head Start, one must meet one of the following guidelines:

1. a state-awarded certificate that meets or exceeds the (CDA),
2. an associates, bachelors or advanced degree in early childhood education,
3. an associates degree related to early childhood education with experience teaching preschool,
4. a baccalaureate or advanced degree in any field and coursework equivalent to a major relating to early childhood education with experience teaching preschool-age children or;
5. a baccalaureate degree in any field and has been admitted into the Teach For America program, passed a rigorous early childhood content exam, such as the Praxis II, participated in a Teach For America summer training institute that includes teaching preschool children, and is receiving ongoing professional development and support from Teach For America’s professional staff.

Within an Associate’s Degree of Early Childhood program, little to no coursework exists on motor development and/or physical education (Derscheid, Umoren, Kim, Henry, & Zittel, 2010; Dunn et al., 2006; Larson, Ward, Neelon, & Story, 2011; Robinson, Webster, Logan, Lucas, & Barber, 2012).

Once teachers are hired to work at Head Start they are required to maintain professional development credits as well as continuing education. It is not specified that any of these credits be in motor development or physical education. Early childhood teachers (ECTs) are the only agents responsible for providing their students with motor
development; it is possible they never receive any professional development or education in this area.

Current policy and constraints within Head Start preschool centers make implementing the Active Start guidelines (NASPE, 2009) and providing structured motor skill instruction difficult (Copeland et al., 2012; Dowda et al., 2009). Although there is no policy or law requiring physical education or motor development specialists in preschool, Head Start does place gross motor skill development as one of its targeted outcomes (USDHHS, 2013). In fact, the Head Start website within the USDHHS website (2014) lists FMS and stages of physical growth and development within the domain of Quality Teaching and Learning. To meet the desired gross motor skill outcomes, Head Start provides young children with 30-60 minutes of well equipped free play daily. Well equipped free-play can occur inside or outside and includes playground equipment like slides and climbing bars, physical education equipment like playground balls, soccer balls, shorter basketball baskets, jump ropes, scooters and tricycles.

Despite the desired focus on gross motor outcomes in Head Start and prevalence for well-equipped free play, the evidence-based reality shows young children within Head Start are highly at risk for developmental delay (Goodway et al., 2010). The increased risk for developmental delay within children who are disadvantaged may be due to policy constraints within Head Start. Policy constraints include a lack of motor development specialists, lack of funding for equipment, small spaces, and lack of experience and professional development for ECTs (Copeland et al., 2012; Dowda, et al., 2009). The policy constraints listed above may provide a rationale for why early childhood facilities do not provide the recommended structured FMS activity that focuses
on FMS competence (Bower et al., 2008; Dowda et al., 2009; Pate, Pfeiffer, Trost, Ziegler, & Dowda, 2004).

**The Influence of Motor Skill Interventions**

From the motor development literature (e.g. Hamilton et al., 1999; Goodway et al., 2010; Valentini & Rudisill, 2004), it is clear that young children from disadvantaged settings are highly at risk for motor skill delays. According to Stodden et al. (2008), motor competence developed in the early years is an underlying mechanism driving physical activity levels into adolescence, which may predict whether or not children have overweight or obese body compositions. Therefore, a motor skill intervention (MSI) infused into Head Start targeted to remediate motor skill delay may help to break down the effects of risk factors on many young children who are disadvantaged. Motor skill interventions in Head Start would also answer the call placed by the Centers for Disease Control (CDC) to combat sedentary lifestyles and childhood obesity (CDC, 2013) by developing motor skill competence in the early years.

**Reviews and Meta Analysis**

Within the MSI literature, there are currently two literature reviews (Kirk & Rhodes, 2011; Riethmuller, Jones, & Okely, 2009) and one meta-analysis (Logan et al., 2011) published to date. The meta-analysis/literature reviews were examined to present an amalgamation of the findings of MSI studies across type, location, and purpose. In 2009, Riethmuller and colleagues conducted a review of the literature to determine the efficacy of motor development interventions on young children. During their review, Riethmuller and colleagues found 17 articles that fit their inclusion criteria and determined 60% of those studies showed statistically significant improvement during the
posttest. Unfortunately, only three of the studies met Riethmuller and colleagues’ standards for high methodological quality explained below. Overall, Riethmuller and colleagues recommends that studies need to incorporate the teacher either with or without assistance from the researcher. Studies should also be based upon a sound theoretical underpinning, sample size needs to be calculated a priori to ensure power and that all procedures be sound methodologically.

In 2011, Kirk and Rhodes conducted a similar review to Riethmuller et al. (2009) but focused solely on children who were diagnosed with developmental delay. In their review, eleven studies met inclusion criteria and 82% showed statistically significant improvement at the posttest. Similar to Riethmuller et al., Kirk and Rhodes recommend that future researchers include robust methodological designs, a theoretical framework, and involvement of teachers in the delivery of the intervention.

In 2011, Logan et al. conducted a meta-analysis to determine the significance of MSI on the FMS of young children. Logan et al. had inclusion criteria that required the reporting of means and standard deviation in order to calculate a Cohen’s $d$ effect size. Overall, 22 studies were included in the meta-analysis and 90% showed statistically significant improvement from pretest to posttest. Intervention lengths ranged from 6-35 weeks with a non-significant, negative correlation present between intervention length and intervention efficacy ($r=-.18, p=.296$). Effect sizes ranged ($d=.41-.45, p<.0001$) for OC, LOC and overall FMS improvements. The effect size for control group improvement was not significant ($d=.06, p=.33$). Logan et al. (2011) recommended that early childhood centers should incorporate structured physical activity as a part of their everyday curriculum. However, future studies are needed to determine best practices for
implementation of curricula, policy and curriculum development.

With an overwhelming majority of the studies indicating positive results of MSI intervention, Logan et al. (2011) cautioned the reader about the validity of these claims as the majority of the studies within their review had small sample sizes and did not report effect sizes. In addition, Riethmuller et al. (2009) claimed that less than 1/3rd of the studies conducted in their review met their complete standards for quality and that a theoretical basis needs to inform curricular decisions. In addition Kirk and Rhodes (2011) suggest that theoretical and statistical rigor are gaps within the MSI literature. It is clear that there is a need for future research to be conducted with statistical rigor.

In summary, between 60% (Riethmuller et al., 2009) and 90% (Logan et al., 2011) of the MSI studies showed statistical improvement as a result of a MSI focusing on FMS. The majority of the studies conducted within the reviews/meta-analysis, utilized a researcher, trained physical education teacher, or parents to provide the MSI. Therefore, to improve ecological validity, Riethmuller et al. (2009) recommended that future interventions needs to include the teacher with or without the assistance of the researcher.

**MSI Studies**

A review of the MSI literature from 1979 to present was conducted to provide an evidence-base and guiding principles for this study. The following section provides a synthesis of the findings from over 25 studies located in various regions of the USA, Europe, Greece, Taiwan, and South Africa. The review was delimited to only include children with typical development or developmental delay, aged 3-6 with a form of motor competence as a dependent variable, and a MSI as the independent variable. The findings were broken down by region.
MSI Outside the USA. Motor skill intervention studies throughout the world have used MSI either as the sole focus of the intervention or as a part of a larger, holistic curriculum seeking to provide total change (e.g., FMS, health classes, nutrition). When the MSI was the sole focus of the study, dependent variables ranged from LOC skills to stability stills to OC skills with equally varying methods of assessment. The MSI studies from outside the USA utilized physical education teachers, coaches or the researcher as the implementer.

In Greece, dance/movement education/rhythmic interventions were the curricula that focused on improving LOC skills (Derri, Bakle, & Zachopoulou, 2001), stability skills (Zachopoulou, Tsapakidou, & Derri, 2004) and FMS (Karabourniotis, Evaggelinou, Tzetzis, & Kourtesis, 2002). Karabourniotis et al. (2002) studied self-testing infused into a standard physical education curriculum that included games, dance and FMS skills. The results showed that the self-testing group (students assessing themselves) significantly improved over the control group for both OC ($p<.001$) and LOC ($p<.001$) as tested by the TGMD-1. Karabourniotis and colleagues did not report effect sizes, nor did they conduct any statistical adjustments for post hoc analysis. Deli et al. (2006) also saw statistical differences after their movement intervention (running ($F[1,24]=7.77, p<0.05, \eta^2=0.24$), hopping ($F[1,24]=9.42, p<0.01, \eta^2=0.43$), leaping ($F[1,24]=18.24, p<0.001, \eta^2=0.21$), horizontal jump ($F[1,24]=6.61, p<0.05, \eta^2=0.50$), and skipping ($F[1,24]=23.95, p<0.001, \eta^2=0.44$). The movement only intervention was in contrast with movement plus music in LOC skills (running ($F[1,24]=19.20, p<0.001, \eta^2=0.43$), hopping ($F[1,24]=6.75, p<0.05, \eta^2=0.45$), leaping ($F[1,24]=19.82, p<0.001, \eta^2=0.45$), horizontal jump ($F[1,24]=21.30, p<0.001, \eta^2=0.48$), and skipping ($F[1,24]=23.45,$
\( p<0.001, \eta^2 = 0.43 \). Deli and colleagues conducted one of the few studies to compare multiple curricula in the same setting against a control of free play (Robinson & Goodway, 2009 compared direct instruction and mastery motivational climate). As Deli and colleagues did report effect sizes it is interesting to note that they are considered high effect sizes (Lomax & Hahs-Vaughn, 2012) however, they are considerably lower than Goodway and Branta (2003; \( \eta^2 = .70 \)) and Apache (2005; \( \eta^2 = .85 \)) reported. Furthermore, the movement only group (\( \eta^2 = .36 \)) was not as statistically powerful as the movement plus music group (\( \eta^2 = .45 \)). Both curricular groups showed considerably higher growth than the control group, which did not show statistically significant growth (\( p = .254 \)). The results of the studies conducted in Greece infer that MSI using movement education significantly improved LOC skills for children Greece.

Throughout Finland, Germany, Taiwan, and South Africa several large-scale studies (\( n=6 \)) occurred in which one is still in progress (Roth et al., 2010). The large-scale (\( n=5 \)) studies aimed at reshaping a larger, holistic curriculum of which FMS acquisition was a central focus either directly in schools (e.g. Graf et al., 2004; 2008; Roth et al., 2010) or as a part of the community (Draper, Achmat, Forbes, & Lambert, 2012). All of the studies had control groups that utilized normal curriculum for the culture/setting. All studies found statistically significant gains in some form of FMS but not necessarily for all FMS skills. For example, Iivonen, Sääkslahti, and Nissinen (2011) showed no significant improvement for dynamic balance (\( p = .596-.944 \)). However, the boys within the study showed linear gains in running (\( p = .02 \)) but the girls did not (\( p = .248 \)). No other skills (standing broad jump, manipulative skills) showed significant differences at the posttest (\( p = .220-.904 \)). Graf et al. (2004; 2008) conducted a large-scale
set of studies that aimed to instill a holistic curriculum throughout Germany. This holistic curriculum that included health education and physical activity showed positive results in FMS ($p<.001$) after four years. Graf et al. found that children would benefit from an increase in organized physical education in preschools and from better physical education skills of preschool teachers.

In Taiwan however, Wang (2004), was one of the few researchers to report that LOC increased as a result of their musical and movement-based intervention ($p=.042$) but that OC did not increase ($p=.26$) when compared to the control group. Wang conducted a movement-based intervention somewhat similar to that of the studies conducted in Greece. From that standpoint, it is not surprising that their OC did not improve, as it was not the focus of the intervention.

All control groups in the studies located outside of the USA did not report statistically significant changes from pretest to posttest ($p=.06-.345$) as compared to the experimental group ($p<.001-.049$). Thus, the MSI studies conducted outside of the USA were successful with improving the FMS of the children within the studies. However, not all types of FMS improved, particularly OC skills as many of the studies featured dance/movement or music MSI geared towards LOC skills.

*Weaknesses and Recommendations.* The studies, conducted in Europe, Taiwan, and South Africa, are not generalizable outside of their particular areas because they are the only ones of their kinds in their settings and very specific to their culture (e.g. Draper et al., 2010; Wang, 2004). Replication is needed across time, region and cultures to allow for generalizability. In addition, methodological rigor was missing from the above-mentioned studies as the MSI was not explicitly described (e.g. Draper et al., 2010;
Wang, 2004), effect sizes were not always reported (e.g. Karabourniotis et al., 2002), and quality controls for reducing coding bias did not occur in any of the studies (e.g. Graf et al., 2004; Roth et al., 2010). Future research is needed to replicate all findings and to determine if the findings are consistent across culture.

**Strengths and Recommendations.** A major strength of the studies conducted outside the USA is that the some of the studies contained a large sample size and prolonged engagement (e.g., Graf et al., 2004; Roth et al., 2010). In addition, the studies outside of the USA featured subjects who were not disadvantaged or developmentally delayed and were successfully able to improve the FMS of the subjects. Seeing MSI improve the FMS of children who are not developmentally delayed further supports the hypothesis that FMS do not develop naturally but rather are ontogenetic. Even children who do not display FMS delays need continuing instruction and as a result will demonstrate improvements in FMS. To improve the FMS of young children located outside the USA, many MSI featured musical based interventions. The musical based interventions assisted LOC but showed no significance for OC when implemented by physical education teachers, coaches or the researcher. Similarly to MSI in the USA, ECTs outside the USA are charged with implementing motor skill programming for young children. As such, the translational power from these studies is limited and future research is needed to determine if musical-based interventions are as effective when implemented by an ECT.

**MSI within the USA**

Within the USA, the vast majority of the MSI literature was conducted either in the Midwest ($n=7$) or the South/Southeast ($n=5$). In the USA, the major outcomes
sought within the MSI literature FMS competence (OC, LOC or both) as defined by the TGMD-1 or 2 (Ulrich, 1985; 2000). For LOC, OC and FMS results in the USA, twelve studies were conducted that focused on those skills. Within these studies, eight focused on FMS, four focused on OC and none focused on LOC only (which is in contrast to the Greek studies and Wang, 2004). All of the studies in the USA showed statistically significant gains from pretest to posttest (e.g. Robinson, 2011; F([1,39]=106.39, p<.001) in terms of OC and for FMS overall (e.g. Goodway & Branta, 2003; LOC F([1,57]=134.23, p<.001; OC F([1,57]=161.55, p<.001). The results vary in magnitude such as Goodway and Branta (2003) showing effect sizes of $\eta^2=.70$ for LOC and $\eta^2=.74$ for OC, to Apache (2005) displaying effect sizes of $\eta^2=.85$ for both LOC and OC. The effect sizes reported can be interpreted as strong (Lomax & Hahs-Vaughn, 2012). The variance explained by the interventions report that between 70-85% of the difference between pretest and posttest could be attributed to intervention. Typically, in social science research an effect size of .3 is considered moderate (Lomax & Hahs-Vaughn, 2012). Therefore, to yield effect sizes of over .3 is very powerful.

Typically, in the USA MSI studies, a highly qualified expert researcher conducted the MSI focusing on FMS (n=10). The findings from those studies mentioned earlier have been replicated several times and are considered to be valid and reliable. Not only have they been replicated, but also they were set against control groups, which showed little to no gain in FMS. These gains were also shown in two distinct regions of the USA (Midwest and South/Southeast), in both an urban (n=8) and rural setting (n=4), with only African-American children (n=7), African-American and Hispanic children (n=2) and a diverse sample of children (n=3).
Studies in the USA within Disadvantaged Settings

Naturalistic Physical Education. Two studies set within a natural kindergarten elementary physical education program were conducted to determine the efficacy of a MSI on the FMS of young children from disadvantaged settings (Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004). Within these studies, the schools physical education teacher performed the intervention with assistance from the lead researcher. Mean scores within these studies showed that the children were socioeconomically disadvantaged and were delayed in their FMS with scores ranging between the 1st and 30th percentiles on the TGMD 1/2. After a six-week (Martin et al., 2009) or a twelve-week (Valentini & Rudisill, 2004) intervention, mean scores of subjects showed a remediation of FMS delays. The studies set in Kindergarten serve to reinforce the notion that if young children do not learn their FMS early that these skills will not naturally emerge as a result of maturation and time as the mean age of these studies were 6.5 years. If FMS developed naturally, it would follow that the Kindergarten students would perform higher than the students in the early childhood studies but this was clearly not the case. In addition, the Kindergarten studies show that with support of a motor development expert, physical education teachers can successfully implement a MSI.

Project SKIP. Along with the studies set in a naturalistic physical education setting for Kindergarten, several studies in Head Start preschools occurred to develop a curriculum designed to remediate the motor skill delays of young children from disadvantaged settings. The Project SKIP studies or the Successful Kinesthetic Instruction for Preschoolers studies featured similar results to that of the Kindergarten studies. Goodway and Branta (2003), and Savage (2002), found that young children
who were developmentally delayed and from disadvantaged settings were able to remEDIATE OC delays (F[1, 75] =14.44, p < .001, η² = .16; Savage, 2002), and both OC (F[1,57]=161.55, p<.001, η²=.70) and LOC delays (F[1,57]=134.23, p<.001, η²=.74; Goodway & Branta, 2003) in an intervention lasting between eight (Savage, 2002) to twelve weeks (Goodway & Branta, 2003).

Goodway and Branta (2003), and Savage (2002) both featured motor development experts as the intervener. In contrast, Humric (2010) and Hamilton et al. (1999) utilized a parent-led MSI. Humric found that children improved their OC skills in eight weeks after the parent-led MSI in contrast with the control group who received the early childhood center’s everyday curriculum (p=.017). Similarly, Hamilton and colleagues found that students within a parent-led MSI improved their OC skills in contrast to the control groups (p=.002). Hamilton and colleagues reported a Cohen’s d effect size of 1.85 for 3 Group x 2 Test interaction. A Cohen’s d effect size of 1.85 is considered high as that indicates a 1.85 standard deviation improvement (Lomax & Hahs-Vaughn, 2012). It is important to note that a Cohen’s d effect size is not interpreted in the same manner as the Eta squared effect sizes reported in Apache (2005), Goodway and Branta (2003) and Robinson and Goodway (2009). A Cohen’s d refers to a standard deviation shift between groups whereas an Eta squared is the amount of variance explained in the dependent variable attributed to the independent variable (Lomax & Hahs-Vaughn, 2012).

Robinson and Goodway (2009), and Amui (2006) both extended this SKIP research line to determine the impact of a particular pedagogical approach on student learning. Both studies contrasted direct instruction and high autonomy pedagogical
approaches and reported that students improved their OC skills in both the direct instruction and high autonomy groups. Two positive features of Robinson and Goodway were the use of random assignment of students to class and the use of a retention test. First, random assignment was used at the student level, which helped to rule out threats to validity (Ary, Jacobs, Razavieh, & Sorenson, 2009). Second, a retention test occurred nine weeks after the intervention occurred. This is a positive attribute as a retention test helps to show how much student learning “retained” after the intervention concluded. In Robinson and Goodway, experimental groups almost completely retained (dropping approximately 5 points, 38-33 out of a possible 48, from post to retention) their improvements nine weeks after the posttest. A highlight of both studies was that both the use of direct instruction and high autonomy climates improved students’ FMS showing that the SKIP curriculum is successful in a variety of pedagogical approaches.

The studies conducted within the USA consistently demonstrated statistically significant gains in the FMS of young children after an MSI. The effect sizes within these studies varied but in general were all considered strong. All of the studies included a control group that were statistically the same as the MSI group at pretest, that did not statistically change from pretest to posttest, and were significantly different from the MSI group at the posttest. The SKIP studies were able to validate the SKIP curriculum as a means to remediate developmental delay when implemented by a motor development expert in disadvantaged environments. The SKIP curriculum is effective in either a high autonomy or a direct instruction environment and its effects retain for at least nine weeks after the last dose of SKIP. A main gap within the studies conducted in the USA is the
lack of ecological validity as all studies in the USA featured the researcher, a motor
development expert, a physical education teacher or parents as implementers.

The SKIP studies lack ecological validity because they contain little to no “real
world” translational power. Few early childhood centers have physical education/motor
development specialist and ECTs receive little coursework during their pre-service
experience in motor development or physical education, it may be difficult to conduct
SKIP in an ecologically valid manner.

Clearly, ECTs need professional development in motor development and physical
education in order to implement a MSI like SKIP. Thus, a major gap in the literature is to
determine whether after receiving professional development, on-going coaching and
support, can ECTs implement SKIP? In order to provide evidence-based coaching
methodologies, the professional development literature was examined to determine how
best to coach teachers to deliver programs such as SKIP. Providing professional
development, on-going coaching and support to ECTs is the start to addressing the
ecological validity gap within the MSI literature.

**Professional Development Literature in Physical Education and the Classroom**

There is no validated structure present in the early childhood education or motor
development literature as to what is the most effective manner in which to provide
professional development for ECTs to deliver a MSI, like SKIP targeting FMS learning.
Therefore, the professional development literature in physical education and classroom
education guided the decision-making process in this study. Overall, the professional
development literature in physical education (Armour, Makopoulou, & Chambers, 2012;
Armour & Yelling, 2004; Deglau & O’Sullivan, 2006; Ko, Wallhead, & Ward, 2006;
Patton & Parker, 2012; Sinelnikov, 2009; Ward & Doutis, 1999) and classroom teaching (Birman, Desimone, Porter, & Garet, 2000; Borko, 2004; Guskey, 1985; 2002; National Partnership for Excellence in Education and Accountability in Teaching [NPEAT], 1999; Shelton & Jones, 1996) provides several guidelines to help increase the likelihood for retention of learning and transfer into practice for teachers:

• deriving methods from a theoretical evidence-base
• getting teacher buy-in by showing how the new knowledge impacts student learning
• active learning not passive listening
• teachers have a sense of ownership and voice over what they are learning
• peer-to-peer coaching to enhance learning outcomes for teachers
• repeated engagement not a one shot workshop

The guidelines that emerged from the professional development literature serve to provide an evidence-based rationale for effective coaching/professional development. In the following section, the guidelines extracted from the professional development literature are expanded and developed.

**Deriving Methods from a Theoretical Evidence-base**

In order to provide quality coaching and professional development one must incorporate an evidence-base that supports praxis. Praxis is defined as bringing theory to practice in real environments (Friere, 1970). The main theory within the classroom professional development literature underpinning the on-going coaching and support within this study is the Model of Teacher Change (Guskey, 1985; 2002).
The Model of Teacher Change. Professional development in education and across content areas has been deemed important for teacher growth, yet produces consistently ineffective results (Guskey, 1985). Guskey (2002) suggests two main reasons that professional development fails are 1) due to a lack of understanding of teacher motivation to engage in professional development and 2) a failure to recognize the process by which teacher change most likely develops. Most teachers, according to Guskey (2002), want their students to learn and view student learning as a reflection of teacher effectiveness. In order to motivate teachers to attend professional development they need to see concrete, pragmatic and successful strategies to improve student learning that are realistic for their actual classroom (Guskey, 2002). The second reason that professional development fails is that those implementing the professional development at the beginning of the session focus on teacher dispositions (attitudes, values and beliefs) and not on the process of change (Guskey, 2002).

![Figure 2.2. Guskey (2002)’s Model of Teacher Change](image)

Alternatively, instead of focusing on changing one’s attitude about a concept, Guskey (2002) states that behavioral change in the classroom will impact student learning. Seeing a change in student learning will then impact the attitudes, values and beliefs of teachers.
beliefs of the teachers, which may then lead to an increased likelihood that teacher change is sustained (Guskey, 1985; 2002, see Figure 2.2).

**Show How New Knowledge Impacts Student Learning Early and Often**

If teachers see students learning, it is hypothesized that they will be more likely to “buy-in” or accepts the professional development session as valuable (Guskey, 2002; NPEAT, 1999). Part of cultivating value is presenting material that is relevant and applicable to the actual classroom (Armour & Yelling, 2004). If teachers view professional development as valuable, relevant and applicable, and, if they can see student learning early and often, they will be more likely to continue to implement the content learning after the professional development ceases (NPEAT, 1999; Shelton & Jones, 1996).

**Active Learning, not Passive Listening**

Along with demonstrating student learning early and often and using theory in a manner that translates into practice, actively involving the teachers into the professional development session is also important (Armour & Yelling, 2004; Ko, Wallhead, & Ward, 2006; Deglau & O’Sullivan, 2006). In most educational settings, passive listening does not yield student learning or enjoyment of content in a manner that is as strong as active engagement within the content (Bonwell & Eison, 1991; Michel, Cater, & Varela, 2009). The increase of learning from active engagement in a classroom for pre-service teachers also translates to professional development sessions for in-service teachers outside of the classroom (Armour & Yelling, 2004). In a professional development context in-service teachers who are actively engaged with the learning process are more likely to transfer learning into the classroom (Shelton & Jones, 1996). Moreover, active learning in a
professional development context is enhanced when active learning occurs with a peer (Shelton & Jones, 1996).

**Peer-to-peer Coaching to Enhance Learning Outcomes for Teachers**

As stated above, active engagement within a task, especially when working cooperatively with a peer, helps to translate the content from professional development into the classroom (Armour & Yelling, 2006; Bechtel & O’Sullivan, 2006; NPEAT, 1999; Patton & Parker, 2012; Shelton & Jones, 1996). Working with peers in a coaching capacity helps to create a “learning by doing” atmosphere, but also cultivates the creation of a critical friend. Critical friends and associating with peers outside the classroom exacerbates the sustainability and effectiveness of professional development (Armour & Yelling, 2004; Patton & Parker, 2012; Sinelnikov, 2009). Having a peer with whom one worked during the initial workshop and developing critical friends helps to cultivate ideas, provide positive reinforcement of implementing the content of the workshop, and also can provide encouragement to continue the content of the workshop when new content becomes challenging (Armour & Yelling, 2004).

**Teachers have a Sense of Ownership and Voice**

In order to fully engage the teachers during a professional development workshop it is important to provide teachers with a “voice” in what they learn and a sense of ownership in the process of “their” professional development (Deglau & O’Sullivan, 2006; Patton & Parker, 2012; NPEAT, 1999; Shelton & Jones, 1996). Having teachers “drive” their learning also helps to cultivate the “buy in” that was addressed earlier through ownership of the process (Armour & Yelling, 2004; Patton & Parker, 2012; Shelton & Jones, 1996). Having an ownership within the process of “their” professional
development may lead to the teachers perceiving being valued by the facilitator and may also promote transfer into the classroom (Armour & Yelling, 2004; Patton & Parker, 2012; Sinelnikov, 2009).

**Repeated Engagement, not a One-shot Workshop**

The guidelines mentioned to this point all focus around the outcomes of providing professional development that is most likely to transfer into the classroom and sustain for a prolonged duration. One central component to ensuring transfer and prolonged engagement is not providing a “one-shot” dose of professional development (Bechtel & O’Sullivan, 2006; NPEAT, 1999; Patton & Parker, 2012; Shelton & Jones, 1996; Ward & Doutis, 1999). A “one-shot” dose of professional development would be to provide a professional development session one time and then cease further professional development with the teachers involved. In contrast, it is recommended that professional development occur continuously for a prolonged duration (Armour & Yelling, 2004). Continuous professional development can include, multiple professional development sessions, communities of practice as well as coaching and support from peers and experts (Armour & Yelling, 2004). Translating professional development into continuous professional development is more advantageous than a “one-shot” dose as teachers are more likely to “buy-in”, learning is more likely to be retained, questions can be answered lessening frustration from perceived failure, and teachers are more likely to feel valued by the facilitator (NPEAT, 1999; Shelton & Jones, 1996). When facilitating professional development based on these recommendations, it is more likely to lead to the transfer of learning into the classroom and sustained engagement with the content (NPEAT, 1999; Shelton & Jones, 1996).
In summary, according to Guskey (1985; 2002) teachers’ professional development promotes changes in the classroom when the professional development sessions follow several guidelines. If teachers are actively engaged in professional development with peer coaching and have a voice in the process, they are more likely to transfer the content learned in the professional development session into the classroom. In addition, if teachers see student learning early and often, they are more likely to buy into the content from the workshop. Impacting attitudes, values and beliefs (dispositions) as a result of implementing change that fosters student learning is theorized to be more impactful than attempting to change dispositions at the beginning of professional development (Guskey, 2002). Therefore, it is important to follow the recommended in the professional development literature and the concepts from Guskey’s Model of Teacher Change (2002) in order to provide meaningful professional development to teachers.

**Overall Summary**

From a dynamic systems theory perspective, motor skill acquisition does not naturally emerge through time and maturation, but rather is soft-wired and not prescriptive. Motor skill acquisition is embedded within the constraints of the learner and emerges as the result of the interaction of task, environment and learner constraints. Without developmentally appropriate, carefully planned motor experiences that occur early and often, young children may become developmentally delayed in their motor skills. Young children from socioeconomically disadvantaged environments are highly at-risk for developmental delay as their environment may serve as a constraint to participating in structured physical activity in their neighborhood or at home. As such,
young children from disadvantaged settings often present motor skill delays and are very much in need for early intervention with their motor skills.

Motor skill interventions implemented in the early years have historically been successful in remediating the delays of young children who are disadvantaged. Although the success of the MSI literature is clear, its ecological power is limited. A motor development expert has implemented the vast majority of all studies conducted within the MSI literature. In fact, no studies to date within the USA have implemented a MSI with an ECT as its facilitator. Few ECTs possess the background necessary to implement a MSI. Thus, the translational power of the MSIs conducted by an expert in an early childhood center is limited. Therefore, it is necessary to provide coaching to ECTs in order to implement the MSIs that young children from disadvantaged settings so desperately need.

Providing coaching to ECTs that is theory-based and features the guiding principles derived from the professional development literature may lead to a successful transfer of content learned to the classroom. Designing professional development for ECTs that is evidence-based, features teacher’s voice in the process, involves peer coaching and demonstrates student learning early and often is more likely to result in teacher buy-in and prolonged engagement with the content. Designing a professional development protocol that includes continuous coaching and support, as opposed to a “one-shot” dose is critical to the transfer of learning from professional development to the classroom, as well as prolonged engagement with the content. As shown within the professional development literature, when not following the recommended guidelines, many professional development sessions are deemed unsuccessful (Shelton & Jones,
1996; Ko, Wallhead, & Ward, 2006). Thus, it is important to incorporate as many of the recommended guidelines located within the professional development literature to increase the likelihood of success within teachers’ professional development that transfers to student learning both in the classroom and the gymnasium.
Chapter 3: Methods

The purpose of this study was to determine the influence of providing on-going coaching and support to early childhood teachers (ECTs) delivering a motor skill intervention called Teacher-Led Successful Kinesthetic Instruction for Preschoolers (T-SKIP) on the object control (OC) skills of their preschool students who were disadvantaged. There were three phases to this study: 1) creation of materials, 2) the workshop for ECTs and 3) T-SKIP intervention. Research questions were tied to phases II-III (see Figure 3.1).
Figure 3.1. Research questions tied to phases of this study

Phase 1: Development of Coaching and Intervention Materials

- **RQ1**: To what extent can ECTs demonstrate motor development and physical education knowledge and skills by the end of a six-hour initial workshop led by a motor development expert?

Phase 2: Initial workshop for ECTs

- **RQ2**: To what extent can ECTs implement the T-SKIP lesson plans with fidelity across an eight-week MSI?
- **RQ 3**: What are the effects of the eight-week T-SKIP package on the OC skills of preschool boys and girls who are disadvantaged?
- **RQ 4**: To what extent does gender influence the effects of the T-SKIP package on the OC skills of preschool children who are disadvantaged?
- **RQ 5**: To what extent does the fidelity of the T-SKIP teachers predict posttest OC scores?

Phase 3: Implementation of T-SKIP
This chapter describes the theoretical framework of the study, structure and results of the pilot study; setting, research design, participant information, instrumentation, intervention procedures, and rationale for statistical analyses for the main study.

**Theoretical Framework**

This study was rooted within a Dynamic Systems Theory and Newell’s Constraints Theory perspective. According to a dynamic systems approach, motor skill acquisition (in this study fundamental motor skills), is the result of the ever changing and transactional interactions between three types of constraints: task, environmental and organismic (Newell, 1984; 1986). Organismic constraints operationalize within the students participating in this study. The organismic constraints of the students were age, gender, anthropometrics, and present level of performance. As organismic constraints, such as strength, balance and flexibility, cannot be quickly manipulated this study focused on manipulating the motivation and experience of the students through task and environmental constraints (see Figure 3.2). Therefore, the intent of this study was to manipulate environmental and task constraints to perturb the system (student) to more efficient patterns of OC skills.

The environmental constraints within this study consist of the location of the Head Start center, the neighborhood where the child lived, the teacher who provided instruction on OC skills and the manipulation of the equipment within the classroom (gymnasium and outdoor play area). All students in this study attended Head Start centers. Head Start centers serve to provide educational opportunities for young children who are disadvantaged (USDHHS, 2013; see Chapter 2 for more detail). The actual home environment of each student was unknown but each student in this study qualified
for Head Start assistance, requiring a household family income between 130%-300% below the poverty guideline (USDHHS, 2013). Therefore, it was assumed that each student came from a socioeconomically disadvantaged home. In addition, each student within this study had an opportunity to receive instruction on OC skills that included the manipulation of equipment (e.g. ball size) inside the gymnasium, classroom or on the playground outside the Head Start center. From a conceptual standpoint, the teacher’s instruction of OC skills was viewed as an environmental constraint on the child’s OC skill development (see Figure 3.2).

The actual tasks that each student performed within the T-SKIP package served as task constraints within this study. There were a variety of tasks tied to OC skills and featured throughout the T-SKIP package. The tasks originated within the SKIP program, which was a previously validated (e.g. Goodway & Branta, 2003; Robinson & Goodway, 2009), reliable and evidence-based program shown to produce significant OC growth from pretest to posttest over the past twenty years. The lead researcher modified the OC tasks within SKIP so ECTs could meet the developmental needs of the students and motivate students to perform and participate within each task (see Figure 3.2).
Figure 3.2 student constraints operating within this study.

Before the current study began, all procedures, methods and materials were piloted with a smaller sample in the Spring, 2013. Many adjustments and modifications occurred as a result of the pilot including the modification of SKIP to T-SKIP. An overview of the pilot study occurred in the following section.

**Pilot Study**

In Spring 2013, a pilot study was conducted to test several items pertaining to the main study. The goals of the pilot study were to:

- develop SKIP coaching materials for teachers
- pilot the coaching of teachers

...
• observe the teacher’s implementation of the SKIP program
• examine the extent to which the teachers could bring about improvement in child outcomes on LOC and OC development
• get feedback from the teachers on the coaching process and teaching of the lesson plans

**Coaching of Pilot Teachers**

Participants consisted of two ECTs who served as the pilot teachers, along with their 30 students and two assistant teachers. An additional 30 students from six other classrooms served as comparison participants to the student-level data. The first phase of the study consisted of the coaching for the pilot teachers. Time constraints and financial restrictions made the coaching for the teachers for this pilot study limited. Despite a request for more time, only 30 minutes of one-on-one initial coaching occurred with each teacher by the researcher. During this 30-minute session, the researcher discussed each lesson plan and the motor development content to be covered during the study. The lesson plans used for the pilot were identical to the lesson plans used in previous SKIP studies (Goodway & Branta, 2003; Robinson & Goodway, 2009).

To support the one-on-one coaching, an Apple iBook containing all coaching materials and videos was provided to each teacher. The coaching materials included critical elements and cues of 12 FMS, videos of each stage of the 12 FMS, motor development principles, physical education pedagogy and all lesson plans. The researcher provided an overview of the iBook and discussed the videos with the teachers during the 30-minute initial coaching session. The teachers were instructed to read the iBook, watch each video and read through the lesson plans. When it was time to
Implement each lesson, teachers were instructed to refresh their knowledge by re-reading the pertinent section of the iBook and reviewing each of the videos.

The amount of time available for the initial coaching during the pilot study was seen as a limitation to the study. The researchers knew ahead of time that the teacher’s time was limited and thus the decision to develop an iPad with more autonomous coaching was conceptualized. One thirty minute, initial coaching session was not enough time to coach teachers and because teachers did not use the autonomous coaching materials on the iPad, the researchers needed to provide on-going coaching and support throughout the study.

**Implementation of Pilot SKIP Program**

Prior to the implementation of the SKIP program, all children were pretested on their FMS through the Test of Gross Motor Development (TGMD-2; Ulrich, 2000). The 12 skills within the TGMD-2 battery are divided into two subscales, LOC skills and OC skills. Pretesting procedures followed the TGMD-2 manual standard protocols (Ulrich, 2000). After all pretests were complete, the SKIP pilot program began.

The SKIP program was implemented over six weeks with two, 30-minute SKIP sessions occurring each week. The SKIP program lasted for a total of 360 minutes of which 288 were dedicated to FMS. The lead researcher was present at all sessions, video recorded each session and audio recorded the lead classroom teacher with a wireless microphone that fed into the video camera. Each lesson plan consisted of a three-minute warm up, twenty minutes of skill instruction and a three-minute cool down. Four minutes were allotted for transition, lesson overview and demonstrations. The lead teacher taught two ten-minute segments for the students of one OC skill. The assistant teacher
concurrently taught two ten-minute segments for the students of a different OC skill. The assistant teachers did not wear microphones and did not receive any coaching from the lead researcher. The assistant teachers were briefed and trained by the lead teachers who provided them with access to the iBook and lesson plans. A decision was made not to collect data on the assistant teacher because time constraints did not allow for their coaching with the lead researcher and in a typical environment the assistant teacher is under the direction of the lead teacher.

All lessons were taught in a large muscle room with adequate space, approximately 60 feet long by 20 feet wide that contained benches, cabinets, hallway entrances and glass exit doors leading outside. Appropriate safety measures occurred to minimize the likelihood of an injury to a child. Lesson plans were videotaped and data was collected on lesson plan fidelity, feedback, number of practice trials and number of successful practice trials for each session.

For the first session, the teachers were instructed to set up their lesson and implement the lesson using the iBook and lesson plans as a guide. The first session was unsuccessful for both teachers as tasks were set up incorrectly, feedback was incorrect, demonstrations were incorrect and practice trials were low both in opportunity and success rate. After witnessing the first session, the lead researcher set up the equipment for all subsequent lessons. It was hoped that providing assistance with the set up of equipment would improve the number of trials a child received in a lesson and lesson fidelity. During the second lesson, improper feedback and incorrect demonstrations from the teachers occurred resulting in low success rates for the students. After the second session, it was determined that each Friday prior to the lessons of the following week,
(Friday of week one for sessions three and four etc.) the lead researcher would go over
the lessons with the SKIP teachers, provide demonstrations and answer questions.
Lesson fidelity, feedback and demonstrations improved but numbers of successful trials
remained low.

For weeks three and four, the lead researcher set up all equipment, met with the
teachers on the Friday prior to the lesson, and provided on-going support and coaching
throughout the lessons. During week five, the Friday preparation meetings ceased as the
content of the lessons repeated but on-going support/coaching continued during the
teacher’s lesson delivery. Coaching support included but was not limited to providing
teachers feedback during the lessons, adjusting lesson setups, inserting visual prompts
and informing the teachers when they incorrectly demonstrated a skill. For the final
week, the lead researcher was present but provided little coaching/support during the
lessons but did set up and take down all equipment. Following the pilot SKIP program,
all children were posttested on the TGMD-2 following the same standardized procedures
as the pretest.

**Learning Outcomes of the Pilot Students**

To determine between-group differences at the pretest, an independent samples *t*-test occurred. To measure FMS gains from pretest to posttest for the children, a
MANOVA with repeated-measures was run on the OC and LOC raw scores for each
group. Dependent samples *t*-tests were used for post hoc analyses to determine within-
group differences by time. Additional independent samples *t*-tests were conducted post
hoc to determine between-group differences. Bonferroni adjustments of the alpha level
occurred to account for inflated error by running multiple post hoc analyses (Lomax & Hahs-Vaughn, 2012).

**Baseline results.** At the pretest, there was no significant differences between groups for both OC skills $F(-.839, 55)=.011, p=.405$ and LOC skills $F(-.527, 55)=.115, p=.499$. Thus, both groups were statistically similar at the pretest in OC and LOC skills. Table 3.1 shows the raw scores and percentile ranks of each group.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Loc</th>
<th>OC</th>
<th>Loc Percentile</th>
<th>OC Percentile</th>
<th>Loc Standard Score</th>
<th>OC Standard Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>26</td>
<td>23</td>
<td>16</td>
<td>26</td>
<td>15</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Comparison</td>
<td>31</td>
<td>24</td>
<td>18</td>
<td>29</td>
<td>18</td>
<td>8</td>
<td>7</td>
</tr>
</tbody>
</table>

Table 3.1. Raw scores and percentile ranks for each group during the pretest.

**Posttest results.** A 2 group x 2 time repeated-measures MANOVA was conducted on LOC and OC raw scores. There was a significant multivariate main effect for Time $F=67.864, p<.001, \eta^2_p=.723$ as well as a Group X Time interaction of $F=44.241, p<.001, \eta^2_p=.630$.

**Locomotor skills.** The repeated measures MANOVA resulted in a significant Group X Time interaction for locomotor skills $F(1, 55)=10.828, p=.002$ and an effect size of $\eta^2_p=.170$. Paired samples $t$-tests showed that for the comparison group, locomotor skills were not significantly different from pre to posttest ($p=.060$) but were significantly different from pre to posttest for the experimental group ($p<.001$).
**Object control skills.** The repeated-measures MANOVA resulted in a significant Group X Time interaction for OC skills $F(1, 55)=82.222$, $p<.001$ and an effect size of $\eta^2_p=.608$. Paired samples $t$-tests showed that OC skills for the comparison group were not different from pre to posttest ($p=.354$) but were different from pre to posttest for the experimental group ($p<.001$). Table 3.2 depicts pretest to posttest changes by group.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>16</td>
<td>32</td>
<td>23</td>
<td>34</td>
<td>6</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>15TH</td>
<td>72ND</td>
<td>26TH</td>
<td>68TH</td>
<td></td>
</tr>
<tr>
<td>Comparison</td>
<td>18</td>
<td>19</td>
<td>24</td>
<td>28</td>
<td>7</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>18TH</td>
<td>22ND</td>
<td>29TH</td>
<td>45TH</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.2. Results of the pilot study by group

In summary, the pilot showed that with on-going coaching and support, master ECTs were able to implement SKIP with fidelity. After ECTs delivered six weeks of SKIP, their students were able to remediate the motor delays that were present. Specifically, experimental SKIP students in this study achieved OC skill gains from the 15th to the 72nd percentile. These gains were significantly different than the comparison group who saw little change from pretest to posttest for OC skills. For LOC skills, experimental SKIP students improve from the 26th to the 68th percentile in six weeks. The comparison group also improved their LOC skills from the 29th to the 45th percentile. This finding may be due to a bleed over effect that could have occurred as a result of both the experimental and comparison groups being situated within the same site.
Lessons Learned from the Pilot

The pilot study helped inform all phases of the current study. The initial 30-min coaching sessions were not adequate and thus the teachers needed on-going coaching and support. Over the pilot intervention coaching support faded as the teachers became more independent and effective. The lead teacher and the assistant teacher taught two skills simultaneously. The assistant teachers struggled with delivering their portion of intervention. Below is the list of recommendations based upon the findings of the pilot and the feedback of the teachers who participated:

- hard copies of coaching materials – not an iBook
- more time for coaching and include hard copy visual aids
- on-going support and coaching throughout the intervention
- lead teacher teaches all content with the assistant teacher providing support
- lesson content to only include OC skills
- placing the experimental and comparison groups in different sites in order to rule out bleed over

The T-SKIP Package

This study took place in a Midwestern coalition of Head Start centers. Head Start programs in the coalition varied from half-day childcare providers to full day preschool centers. All sites in the Head Start coalition used the same holistic curriculum focusing on learning outcomes to prepare children for elementary school readiness, as well as providing ancillary services such as meals and any other social services for which the child might qualify. The curriculum at the Head Start centers on creative learning within
several domains: cognitive, social/emotional, fine/gross motor skills and language, math and literacy. In the motor area, Head Start provides an “I am moving, I am learning” special program as well as “desires to measure gross motor outcomes” that include balancing skills, movement skills and manipulation skills. In order to provide gross motor outcomes, children are allotted 30-60 minutes of free play daily.

The facilities within Head Start operate with a 1:10 teacher to student ratio, which is lower than State’s (where this study is located) minimums of 1:14 (daycare.com, 2013). Lead teachers are assigned to a classroom and, in order to keep to the ratio, they are assigned assistant teachers so that one teacher is present for every ten students. In 2011, the Head Start coalition in the state serviced 3,618 children of whom 2,436 were eligible and received subsidized for tuition and those children served as the pool from which the student level participants for this study were selected.

As of 2011, 254 individuals in the State were employed as teachers or assistants. These individuals, stratified by site, served as the pool from which teacher-level subjects were selected. Teachers who were employed as full time employees all used the same teaching schedule guidelines. A typical day for a full-day Head Start classroom is located in Table 3.3.
<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 – 7:30 AM</td>
<td>Preschoolers arrive to the center.</td>
</tr>
<tr>
<td>7:30 – 7:45 AM</td>
<td>Read aloud</td>
</tr>
<tr>
<td>7:45 – 8:00 AM</td>
<td>Washing hands and setting the table.</td>
</tr>
<tr>
<td>8:00 – 8:45 AM</td>
<td>Breakfast</td>
</tr>
<tr>
<td>8:45 – 9:00 AM</td>
<td>Toothbrush and Restrooms</td>
</tr>
<tr>
<td>9:00 – 10:00 AM</td>
<td>Group Time Language and Literary</td>
</tr>
<tr>
<td>10:00 – 11:00 AM</td>
<td>Group Time Mathematics and Technology</td>
</tr>
<tr>
<td>11:00 – 12:00 PM</td>
<td>Science and Discovery</td>
</tr>
<tr>
<td>12:00 – 12:15 PM</td>
<td>Washing hands and setting table</td>
</tr>
<tr>
<td>12:15 – 1:00 PM</td>
<td>Lunch, toothbrush, and restroom</td>
</tr>
<tr>
<td>1:00 – 1:30 PM</td>
<td>Free-play</td>
</tr>
<tr>
<td>1:30 – 3:30 PM</td>
<td>Nap Time</td>
</tr>
<tr>
<td>3:30 – 3:45 PM</td>
<td>Restroom and washing hands</td>
</tr>
<tr>
<td>3:45 – 4:00 PM</td>
<td>Snack Time</td>
</tr>
<tr>
<td>4:00 – 5:00 PM</td>
<td>Mathematics and Technology or Arts and Crafts</td>
</tr>
<tr>
<td>5:00 – 5:15 PM</td>
<td>Read Aloud</td>
</tr>
<tr>
<td>5:15 – 5:45 PM</td>
<td>Free Play</td>
</tr>
<tr>
<td>5:45 – 6:00 PM</td>
<td>Clean Up Time</td>
</tr>
<tr>
<td>6:00 – 7:00 PM</td>
<td>Drawing and Departure</td>
</tr>
</tbody>
</table>

Table 3.3. A typical day for full day Head Start

Three of the five sites recruited for this study were half-day Head Start preschool centers.

Schedules for those sites was the following:

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 – 8:30 AM</td>
<td>Preschoolers arrive to the center and eat breakfast</td>
</tr>
<tr>
<td>8:30 – 8:45 AM</td>
<td>Toothbrush and Restrooms</td>
</tr>
<tr>
<td>8:45 – 9:00 AM</td>
<td>Read Aloud.</td>
</tr>
<tr>
<td>9:00 – 9:30 AM</td>
<td>Free play</td>
</tr>
<tr>
<td>9:30 – 10:00 AM</td>
<td>Group Time Language and Literary</td>
</tr>
<tr>
<td>10:00 – 10:30 AM</td>
<td>Group Time Mathematics and Technology</td>
</tr>
<tr>
<td>10:30 – 10:45 AM</td>
<td>Washing hands and setting table</td>
</tr>
<tr>
<td>10:45 – 11:00 AM</td>
<td>Lunch, toothbrush, and restroom</td>
</tr>
<tr>
<td>11:00 – 11:30 AM</td>
<td>Drawing and Departure</td>
</tr>
</tbody>
</table>

Table 3.4. A typical day for half-day Head Start
Research Team

The research team was comprised of the lead researcher and two undergraduate Kinesiology majors conducting an internship with the lead researcher and the lead researcher’s advisors. The duties of the research team were allocated as follows:

- video recording of T-SKIP lessons
- assistance with set up and clean up of lessons
- assisting the lead researcher with all collection and coding of the pretest and posttest
- assisting the lead research with observing the Comparison sites during recess

In order to perform each of the duties allocated, all research team members were trained by the lead researcher. Training included:

- attending 7, 1-2 hour sessions with the lead researcher where the TGMD-2 testing protocols, stages & critical elements of OC skills, and lesson plan setup/progressions were taught
- attending 3, 2-hour coaching sessions that mimicked the coaching protocols that the T-SKIP teachers received
- practice coding the OC subscale of the TGMD-2 and matching the lead researcher at a minimum of 95 percent
- observing the lead researcher take field notes of a Comparison site during recess

Only the lead researcher led the teacher coaching sessions and provided coaching to the T-SKIP teachers in regards to pedagogy and content.
Participants

There were two levels of participants for this project: ECTs and their students. All T-SKIP teachers were employed at a Head Start preschool center and licensed in early childhood teacher education by the State. The T-SKIP teachers ($n=5$) had varying years of experience (1-15 years) and included four females and one male. The self-identified ethnicity of T-SKIP teachers included one African-American, three Caucasian and one Hispanic. The T-SKIP teacher’s previous experience with sport, physical or motor development varied (see Table 3.6).

Comparison teachers ($n=5$) were also employed by Head Start centers and required all the same prerequisites as T-SKIP teachers. Comparison teachers had varying years of experience (5-20 years) and consisted of five females. The self-identified ethnic profile of the comparison teachers included three African-American, one Caucasian and one Asian with varying ages and sporting background (see Table 3.6).

Assistant teachers ($n=10$) were also included in this study, as the Head Start early child care centers in this study require a 1:10 teacher to student ratio. There was one assistant teacher for every lead teacher included with this study. Consent was obtained from the assistant teachers to be included in this study but no data was captured.

Students. The students comprised of boys and girls from various ethnic backgrounds who were disadvantaged. For students to be eligible to participate in the current study they were enrolled in a Head Start preschool center. In order to be enrolled in a Head Start preschool center the parents of the child must meet one of the following criteria according to the USDHHS (2013):

- family income falling at 130% or below of federal poverty guidelines
• receiving public assistance
• the child is in foster care

In order to participate in this study, students must be between the ages of 3-5 and of typical cognitive development (with the exception of motor skill delay). Students included all gender and any race, culture and ethnicity. All students participated in the current standard of practice, regular Head Start curriculum.

One hundred and forty-two participants began this study with 72 in the experimental group and 70 in the comparison group. By the posttest, one hundred-twenty two students completed this study with 63 in the experimental group and 59 in the comparison group. Students were dropped from the study if they did not complete both the pretest and posttest. Many students had to be removed due to relocation to a different school. No student voluntarily withdrew from this study.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-SKIP Teachers</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>T-SKIP Asst Teachers</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total T-SKIP Teachers</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Comparison Teachers</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Comparison Asst Teachers</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total Comparison Teachers</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Total Teachers</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>T-SKIP Students</td>
<td>72</td>
<td>63</td>
</tr>
<tr>
<td>Comparison Students</td>
<td>70</td>
<td>59</td>
</tr>
<tr>
<td>Total Students</td>
<td>142</td>
<td>122</td>
</tr>
</tbody>
</table>

Table 3.5. Number of participants from pretest to posttest

Students in the experimental group \((n=63)\) resided within the intact classes of consenting ECTs. The mean age of the students was 4.7 months +/-2.4. The ethnic/racial breakdown for the students was African American \((n=31; 49\%)\), Caucasian \((n=9; 14\%)\),
Hispanic (n=21; 34%), Asian (n=2; 3%) and other (n=0; 0%); 23 (37%) of the students were boys and 40 (63%) were girls.

Comparison students (n = 59) were students enrolled in classes taught by teachers who were randomly assigned to not receive T-SKIP coaching. These students continued to receive the standard Head Start curriculum. The comparison students’ demographic breakdown was African American (n=26; 44%), Caucasian (n=4; 7%; 10%), Hispanic (n=6) and Asian (n=0; 0%) and other (n=23; 39%) with 32 boys (54%) and 27 girls (46%). The mean age for the control groups was 4.8 months +/-1.9. Figure 3.3 outlines participant information stratified by condition, site and class.

Experimental Condition: Students (n=63)

<table>
<thead>
<tr>
<th>Age</th>
<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7</td>
<td>2.4</td>
<td>40</td>
<td>23</td>
<td>35</td>
<td>9</td>
<td>24</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Class 101 (n=15)

<table>
<thead>
<tr>
<th>Age</th>
<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4</td>
<td>2.2</td>
<td>9</td>
<td>6</td>
<td>14</td>
<td>1</td>
<td>0</td>
<td>0</td>
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</tbody>
</table>

Class 102 Students (n=13)

<table>
<thead>
<tr>
<th>Age</th>
<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5</td>
<td>1.8</td>
<td>8</td>
<td>5</td>
<td>7</td>
<td>2</td>
<td>3</td>
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</table>

Class 103 Students (n=10)

<table>
<thead>
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<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
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<tbody>
<tr>
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<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
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</tr>
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</table>

Figure 3.3. Student-level participant demographic information stratified by condition, site and class
Figure 3.3 continued

Class 104 Students \((n=13)\)

<table>
<thead>
<tr>
<th>Age</th>
<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7</td>
<td>2</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>0</td>
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</table>

Class 105 Students \((n=12)\)

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<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
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<td>2</td>
<td>3</td>
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<td>8</td>
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</table>

Comparison Condition Students \((n=59)\)

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<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
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<th>Other</th>
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<td>4.8</td>
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<td>3</td>
<td>6</td>
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<td>24</td>
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Class 202 Students \((n=12)\)

<table>
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<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
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<th>Other</th>
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<td>12</td>
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<td>0</td>
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<td>0</td>
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</table>

Class 203 (Students \(n=5)\)

<table>
<thead>
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<th>Age</th>
<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1.3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
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</table>

Class 204 (Students \(n=15)\)

<table>
<thead>
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<th>Age</th>
<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
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<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>10</td>
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Class 205 (Students \(n=16)\)

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<thead>
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<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>1</td>
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<td>5</td>
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</table>

Class 206 Students \((n=11)\)

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<th>SD</th>
<th>Girls</th>
<th>Boys</th>
<th>AA</th>
<th>C</th>
<th>H</th>
<th>A</th>
<th>Other</th>
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<tbody>
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<td>4.6</td>
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<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 3.4 lists the demographic information for all teacher-level subjects seen below.
### Teachers ($N=10$)

<table>
<thead>
<tr>
<th>T-SKIP</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Years teaching</th>
<th>Sporting Experience</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>T101</td>
<td>25-30</td>
<td>M</td>
<td>Caucasian</td>
<td>1-5</td>
<td>high school sports, college soccer player, recreational sports, very physically active in recreation and sports</td>
<td>none</td>
</tr>
<tr>
<td>T102</td>
<td>25-30</td>
<td>F</td>
<td>Caucasian</td>
<td>5-10</td>
<td>high school sports, light physical activity less than one time per week</td>
<td>One motor development course</td>
</tr>
<tr>
<td>T103</td>
<td>25-30</td>
<td>F</td>
<td>African American</td>
<td>1</td>
<td>little to none, sedentary lifestyle</td>
<td>One physical education course</td>
</tr>
<tr>
<td>T104</td>
<td>30-35</td>
<td>F</td>
<td>Caucasian</td>
<td>5-10</td>
<td>none, physically active with walking, yoga, canoeing on occasion</td>
<td>none</td>
</tr>
<tr>
<td>T105</td>
<td>40-45</td>
<td>F</td>
<td>Hispanic</td>
<td>10-15</td>
<td>played middle school volleyball but otherwise none. Is moderately physically active due to daily walking</td>
<td>none</td>
</tr>
<tr>
<td>T202</td>
<td>45-50</td>
<td>F</td>
<td>African American</td>
<td>10-15</td>
<td>none, sedentary</td>
<td>none</td>
</tr>
<tr>
<td>T203</td>
<td>25-30</td>
<td>F</td>
<td>Caucasian</td>
<td>5-10</td>
<td>little to none, light physical activity in occasional aerobics, walking or yoga</td>
<td>none</td>
</tr>
<tr>
<td>T204</td>
<td>45-50</td>
<td>F</td>
<td>African American</td>
<td>10-15</td>
<td>none, sedentary</td>
<td>none</td>
</tr>
<tr>
<td>T205</td>
<td>40-45</td>
<td>F</td>
<td>Asian</td>
<td>10-15</td>
<td>little to none, light physical activity participation in occasional walking</td>
<td>One motor development course</td>
</tr>
<tr>
<td>T206</td>
<td>50-55</td>
<td>F</td>
<td>African American</td>
<td>15-20</td>
<td>none, sedentary</td>
<td>none</td>
</tr>
</tbody>
</table>

Figure 3.4. Teacher-level participant demographic information.
In summary, there were ten lead teacher-level participants and 122 students across both the experimental \((n=3)\) and comparison \((n=2)\) classes. All participants varied in terms of ethnicity, gender, age, experience and present level of performance.

**Research Design**

This study was a feasibility trial and sought to determine that if under ideal circumstances changes occur from pretest to posttest in the OC of young children who are disadvantaged. The study featured an experimental, pretest-posttest test comparison group design (Ary, Jacobs, Ravezieh, & Sorenson, 2009). This study was experimental in that the sites were randomly assigned to the T-SKIP experimental condition or a comparison condition. Within five Head Start sites, teachers \((n=10)\) and their students \((n=122)\) were recruited. Three sites were randomly assigned to the experimental T-SKIP condition. Five teachers and their 63 students served as experimental T-SKIP subjects. Five teachers and their 59 students within the remaining two sites served as the comparison group. A positive attribute of this design was that the random assignment of treatment to site helped to rule out many internal validity threats such as history and selection.
Recruitment Procedures

Permission was obtained prior to recruitment from the lead researcher’s University Institutional Review Board. Consent via written letter was also obtained from the Head Start center as well as from the director of each individual site. Once site permission was obtained, a recruitment letter was delivered to the teachers within each site through the site’s director. The letter outlined the purpose of the study, the time commitment involved in participating in the study, incentives for and the benefits of participation. If any questions arose the teachers were directed to contact the lead researcher to discuss their questions. Interested teachers signed consent forms and returned them to the lead researcher. Overall twelve teachers were recruited and ten
agreed. The lead researcher obtained parental consent. At the same time, the lead researcher also obtained child assent. Overall, 180 student subjects were recruited, 142 agreed and 122 completed the entire study.

**Instrumentation**

There was instrumentation with respect to the teacher’s and instrumentation relative to the students.

**Teacher Instrumentation**

The sections below describe the variables collected on all consenting teachers as well as variables collected on only experimental teachers.

**Teacher demographics.** All teachers completed a demographic questionnaire prior to the start of the study. The demographic information included years of teaching, previous experience teaching and learning physical education, motor development and structured physical activity, years at Head Start, age-range category, gender, ethnicity, experience in recreational sport, school-level sport, club sports and personal levels of physical activity. The demographic data serves to describe the population for the purpose of inference and replication.

**Teachers’ motor development and physical education knowledge.** All teachers completed a formative assessment as a process measure of their motor development/physical education knowledge during the initial workshop. This assessment was a video test that included stages and critical elements of six OC skills. Teachers were shown a clip of a skill and then were asked to identify what stage was presented, what was the focal element of that stage and what cues were appropriate. Teachers completed this exam for each skill as they learned the skill during the initial workshop. This exam
occurred six times for five minutes each for a total of 30 minutes. The exam occurred immediately after all content was dispersed and all demonstrations occurred for each individual skill. The purpose of the exam was to determine teachers’ level of competency with the content in order to decide whether continual instruction needed to occur or if teachers were ready to progress to the next skill. If teachers were able to answer video exam questions with 85% accuracy it was determined they were ready to learn a new skill.

**Lesson Plan Fidelity**

In order to address research question two and determine if teachers could implement T-SKIP lesson plans as described, lesson plan fidelity was calculated via a check sheet from the video recordings. Each lesson was video recorded and each teacher wore a wireless microphone. Each lesson was broken down into warm up and introduction, lesson plan progressions, LOC breaks and closure.

There were two levels of fidelity (Level-1, core element; Level-2, highly desired) within the check sheet. To receive a check mark for Level-1 or core element components of the spreadsheet, teachers needed to perform the portion of the lesson plan at 85% accuracy. The components were deemed Level-1 because they were core element and considered vital to the execution of the lesson plan. The 85% accuracy calculation occurred for:

- pacing of the lesson (calculated with running time from the video tape verses allotment from the lesson plan)
• providing the critical elements of each skill during the demonstration (comparing against the critical elements on the TGMD-2 if applicable or comparing against the task of the progression)
• using verbal prompts that followed the task analysis sheet and were aligned with the task (note: this check mark was allowed whether the teacher gave one instance of feedback or several instances of feedback)
• implementing each progression so that they followed the lesson plan

The remaining points of the fidelity sheet were deemed Level-2 components or highly desired. As such, they did not require an 85% correct prerequisite. Level-2 components were awarded fidelity if the teacher attempted to implement them or not. The exception to this rule included modifications to lesson plans. Modifications to lesson plans for the individual student and for the entire class had to be 100% accurate with the task analysis. Modifications for individual students or the entire class had to match the task analysis or they would not be appropriate. Thus, modifications for the individual student or the entire class were awarded Level-2 fidelity points on a yes or no basis if implemented at 100% alignment with the task analysis sheet. Level-2 components are considered Level-2 components because they are appropriate to the function of the lesson and highly desired, but skill practice still occurred without their presence. Examples of Level-2 components are:
• a musical warm up that included LOC skills
• a LOC break in between the first half of skill practice and the second half of skill practice during lessons 1-10

84
• a verbal introduction to the lesson that spoke to the skill, theme and nature of the lesson
• a verbal closure of the lesson that included a review, checking for understanding and a preview of the next lesson
• checking for understanding after each demonstration
• making modifications to the lesson for the skill level of an individual learner that followed a task analysis sheet
• making modifications to the lesson for the entire class based upon the skill level of the class that followed a task analysis sheet

Depending on the nature of the lesson, number of skills taught and number of progressions taught, the amount of checkmarks each teacher could receive per lesson varied. To standardize this variability, fidelity was reported by total numbers of check marks per lesson and as a percentage. Here is an example of how a teacher would receive fidelity checkmarks (Figure 3.6):
### Progression 1:

<table>
<thead>
<tr>
<th>Demonstration contained all correct critical elements (it is possible that this could be n/a);</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch</td>
</tr>
<tr>
<td>Critical element (CE): 1</td>
</tr>
<tr>
<td>Toss the scarf with two hands to head height</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>Catch the scarf with two hands at chest height</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Keep feet on the polyspot</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>n/a</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>n/a</td>
</tr>
</tbody>
</table>

- Checked for understanding after demonstration “How many hands do we catch with? How high do we toss the scarf? x
- Demonstrated from multiple angles Demonstrated from front view and then from side view x

**Set up appropriately including:**

- **Correct equipment** Teachers used scarves to catch x
- **Individual (e.g. stickers or scarves)** n/a
- **Entire class (e.g. polyspots and targets)** Each child had a polyspot x

**Correct pacing/timing (85% of planned time or better)**

Progression 1 was 85% of the time allotted in the lesson plan (+/- 52 seconds of the 5 minutes allotted) x

**Modifications correct according to the task analysis chart for the entire class**

no-the teacher did not modify for individual learners

**Modifications correct for individual student needs while keeping the rest of the class in the same progression**

no-the teacher did not change the lesson plan

**Used verbal prompting, cues and feedback that were appropriate to the task analysis sheet and aligned with the progression**

“Good job of using two hands Billy!” x

---

Figure 3.6. Examples of fidelity
This process continued for each of the progressions within the lesson plan. The teachers used the lesson plan as their “playbook” to implement the lessons. Fidelity coding was based upon the teachers following their lesson plan and implementing the lesson accordingly.

**Head Start Common Standard of Practice: Well-Equipped Free Play**

In order to determine what occurred during the teacher-monitored free play for the Comparison group at the Comparison sites, each Comparison site was observed three times for 30 minutes each by a member of the research team at randomly selected dates and times. Field notes were taken during the observations. It was understood that the Comparison group might have changed their implementation of free play on the days that the lead researcher did not observe them. However, using random selection of days, not alerting the comparison teachers as to when observations would occur and letting the comparison teachers know at the start of free play that observation would occur, helped to minimize the likelihood that the everyday curriculum would be intentionally changed due to researcher presence.

**Student Instrumentation**

**Object control skills: TGMD-2 OC subscale.** The OC subscale of the Test of Gross Motor Development-2 (TGMD-2; Ulrich, 2000) was used to measure OC skills at the pretest and posttest. The TGMD-2 is norm and criterion referenced and validated for children ages 3-11 based upon census data (Ulrich, 2000). The OC skill subscale measures six OC skills: throwing (8), catching (6), kicking (8), striking (10), dribbling (8) and rolling (8). The number in the parentheses indicates the possible raw skill score for each. Each skill has 3-5 critical elements, which are scored by trained raters. Each
subject performs two trials of each skill. If critical elements are present, the subject receive a “1” per element. If critical elements are not present, the subject receives a “0”. Both trials are summed and each child receives a score for the skill and the subscale. The total raw score for OC skills is 48. The raw score serves as the criterion reference portion of the test. Raw scores can be converted into standard scores and percentile ranks based upon age and gender (Ulrich, 2000) providing a norm reference. Raw scores were used in the analysis. The TGMD-2 is a valid (GFI =.9-.96) and reliable test (ICC=.82-.91; Cools, De Martelaer, Samaey, & Andries, 2008; Ulrich, 2000).

Despite its wide use in the motor development literature, there are several criticisms to using the TGMD-2. Although the TGMD-2 is validated for 3-11 year old boys and girls, it does contain floor and ceiling effects in discriminating between low performing and higher performing children (Goodway, Brian, Chang, & Park, in press). Additionally, the TGMD-2 is only validated with subjects from the USA. Finally, some experts in motor development may not consider the mature forms of each motor skill a developmentally appropriate gauge for proficiency in young children (Goodway et al., in press).

**Procedures**

In the following sections, the procedures for each phase of this study are delineated. Phase I included the development of all T-SKIP coaching materials and the modification of SKIP to T-SKIP. Phase II incorporated the workshop for the T-SKIP teachers and pretesting of students. Phase III was the implementation of T-SKIP and posttest measures.
Phase I: Development of T-SKIP

The Original SKIP Program

The original SKIP program consisted of twelve FMS skills including both OC and LOC skills. The six LOC skills included run, jump, gallop, leap, hop and slide. The OC skills included throw, catch, kick, roll, dribble and strike. SKIP has been implemented either in a direct instruction or a high autonomy/Mastery Motivational Climate (MMC) approach (Goodway & Branta, 2003; Goodway, Crowe, & Ward, 2003; Robinson & Goodway, 2009). A typical SKIP lesson included an opening activity to raise the heart rate (fast paced game or moving to music), two or three rotations of skill practice on different skills, and 2-3 minute closure (Robinson & Goodway, 2009). The underlying premises driving the development of the original SKIP curriculum and lesson plans included:

- evaluation of the array of skill development of children
- developmental task analysis of each of the skills ranging from easy to more complex task progressions in line with skill assessments
- “slanted rope” approach providing for individualized and differentiated instruction, child success, & appropriate level of challenge
- repetitive cycles of skills & tasks across the program with opportunities to increase & decrease task complexity
- focus on critical elements & cues for children to remember
- child choice, autonomy with teachers as facilitators (in the mastery approach)
- focus on child proprioception & child self-evaluation promoting critical understanding between task persistence, movement acquisition, & task success

**Teacher-Led Successful Kinesthetic Instruction for Preschoolers (T-SKIP)**

The T-SKIP lessons were modified from the original SKIP curriculum (Goodway & Branta, 2003). Because the T-SKIP lessons were modified from the SKIP curriculum, this study served to validate the T-SKIP lessons. The original premises underlying the SKIP curriculum also held true for the T-SKIP lessons. The SKIP curriculum was transformed into the T-SKIP lessons based upon the empirical results of the pilot study, the feedback from the pilot SKIP teachers and consultation with the lead researcher’s advisor. The modification from SKIP to T-SKIP included:

- stronger focus on group instruction with less focus on individual instruction
- focus on one skill per lesson for the first two cycles of lesson plans
- after the first two cycles of lesson plans, two skills were implemented in each lesson and lesson tasks increased in complexity
- direct instruction pedagogy only
- lead teacher conducted all lessons with assistant teacher assisting with feedback and behavior management
- skill content focused mainly on OC skills, LOC skills were included in warm-up and break periods

The T-SKIP lessons included a total of 450 minutes of instruction with two, 30 minute sessions equaling 60 minutes of programming each week for eight weeks. Within
the 60 minutes of programming each week 48 minutes of dedicated instruction occurred for OC skills. The T-SKIP lesson plans were spread over eight weeks with 15, 30-minute (24 minutes of skill instruction) sessions providing a total of 360 minutes of OC instruction. The opening activities included a musical warm up to get children’s heart rates elevated. During the first two cycles of lessons when only one OC skill occurred, a LOC break that included running, jumping, leaping, hopping, galloping and sliding was also included in the lesson. An example of a LOC break is “follow the leader”. In follow the leader, the teacher would start off doing a skill like skipping and the children would follow, then the teacher would move to a skill like slide and the students would follow. The follow the leader game and other LOC breaks like it would occur for two-three minutes.

Starting with the third cycle of lessons, the LOC breaks ceased and LOC skills were featured during the musical warm-up only. For example, the students would listen to a song that included cues for performing skills like skip, hop and run to cadence that would have the children moving at a moderate pace. All lessons concluded with a closure about the skills learned for the day and a preview of the skills to be covered within the next lesson. Table 3.7 features a sample lesson plan. Teachers were provided with a block schedule of activity implementation (see Table 3.6).
<table>
<thead>
<tr>
<th>Session</th>
<th>Roll</th>
<th>Bounce</th>
<th>Kick</th>
<th>Throw</th>
<th>Catch</th>
<th>Strike</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>24m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>24m</td>
<td></td>
</tr>
<tr>
<td>5.1(9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>24m</td>
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<td></td>
<td></td>
<td></td>
<td>12m</td>
</tr>
<tr>
<td>6.2(12)</td>
<td></td>
<td></td>
<td></td>
<td>12m</td>
<td></td>
<td>12m</td>
</tr>
<tr>
<td>7.1(13)</td>
<td></td>
<td></td>
<td>12m</td>
<td></td>
<td>12m</td>
<td>12m</td>
</tr>
<tr>
<td>7.2(14)</td>
<td></td>
<td></td>
<td></td>
<td>12m</td>
<td></td>
<td>12m</td>
</tr>
<tr>
<td>8.1(15)</td>
<td></td>
<td></td>
<td></td>
<td>12m</td>
<td></td>
<td>12m</td>
</tr>
<tr>
<td>8.2(16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12m</td>
<td>12m</td>
</tr>
<tr>
<td>9.1(17)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12m</td>
</tr>
<tr>
<td>9.2(18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12m</td>
<td>12m</td>
</tr>
<tr>
<td>Total Min per Skill</td>
<td></td>
<td>72</td>
<td>72</td>
<td>72</td>
<td>72</td>
<td>72</td>
</tr>
</tbody>
</table>

Table 3.6. Original allotment of instructional skills to sessions

Note: Each session included 24 minutes of OC instruction totaling 432 minutes over 18 sessions out of the overall 540 minutes of each T-SKIP lesson.

The modified T-SKIP lesson plans were developed with the following outcomes desired:

- students receive optimal numbers of trials; minimal wait time and high success rates (Siedentop & Tannehill, 2000).
- lessons are appropriate and derived from a developmental perspective (e.g. Gallahue, Ozmun & Goodway, 2012; Goodway & Branta, 2003).
- each particular lesson derives from task analyses conducted for each skill.
• each lesson utilized a direct instruction, “teacher directed” (Rink, 2009)

emphasis.

Below is a sample T-SKIP lesson plan (Table 3.7):

<table>
<thead>
<tr>
<th>0-3 mins:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant teacher sets up the various stations of the day, refers to the pictures provided.</td>
</tr>
<tr>
<td>Follow the leader: With music of the lead teacher’s choice in the background, children clap the rhythm of the beat along with the teacher. The teacher has children follow him/her along the wall at each corner the teacher changes locomotor skills.</td>
</tr>
<tr>
<td>1. first wall, gallop</td>
</tr>
<tr>
<td>2. second wall, skip</td>
</tr>
<tr>
<td>3. third wall, hop (three hops each leg)</td>
</tr>
<tr>
<td>4. fourth wall, walk fast (swing your arms!!!)</td>
</tr>
</tbody>
</table>

Run back to the circle in the center. Sit on a polyspot.

3-5 mins: Lead teacher demonstrates the throw.

- Step with sticker foot
- Throw with sticker hand
- Throw as hard as you can
- Throw to the target

Facing the students, have two orange polyspots on the ground in a straight line. A third, green polyspot is directly in line with the two orange spots headed towards a target 3 feet away, waist height on the wall. Target is approximately 2ft x 2ft and is a hula-hoop. Stand with each foot on one polyspot and step with opposite foot onto the green polyspot and throw to the target. Demonstrate this without speaking. “I am going to throw this beanbag as hard as I can to the target, watch me”. Next breakdown, stepping with the green stickered foot (opposite foot) onto the green polyspot, throw with the sticker hand (dominant hand) and follow-through to my hip.


5-6 mins: Transition to stations

6-26 mins: Move on to progressions that lead teacher and assistant teacher will monitor

Continued

Table 3.7. A sample T-SKIP lesson plan
1. Overhand Throw the beanbag to a 3 ft. x 3 ft. target approximately 5 feet away

Every child has two orange polypots and one green polypot in a line towards the target. There is one station set up for each child around the motor room. Students will have one orange sticker on their dominant (throwing) hand and one green sticker on their non-dominant (opposite of throwing hand) foot. There are several baskets in the middle of the room full of beanbags and balls that the students will run and get after each throw. After the baskets are empty, teachers say, “freeze” and ask all the students to walk to pick up the balls and walk them to the baskets. When the baskets are refilled it is time to move to the next progression.

Task Extensions:

If a child successfully hits the target 3 out of 5 times, then the child can move back 2ft. This can repeat up to 11 ft. away from the target. If a child is capable of stepping with opposition, then the polypots serving as a physical prompt can be removed. Once the child reaches 11 ft., a tennis ball size foam ball will replace the beanbag.

**Safety rules:** 1. Students are not allowed to throw the ball at each other, 2. Students cannot retrieve any thrown balls until the teacher says so, they must go and get a new ball from the basket.

26-27 mins: Transition back to the polypot circle for closure

27-30 mins: Closure and cool down

The impact of weather. This study was located in a large, Midwestern city. The intervention took place during January, February and March. The weather typically averages between 28 and 42 degrees with an average of five inches of snowfall during January-March. The weather during this intervention was unseasonably cold between -20 degrees and 50 degrees with a cumulative snowfall of 19 inches. This uncharacteristic weather resulted in a loss of two weeks of intervention time with the schools closing several times during that time period. Therefore, the dosage of the intervention needed to be cut short from the original nine week, 540 minute T-SKIP/432 OC time minutes to
eight weeks (15 lessons), 450 T-SKIP/360 OC minutes. Each of the six OC skills received 60 minutes of instruction out of the originally planned 72 minutes.

<table>
<thead>
<tr>
<th>Session</th>
<th>Roll</th>
<th>Bounce</th>
<th>Kick</th>
<th>Throw</th>
<th>Catch</th>
<th>Strike</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>24m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>24m</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2.1(3)</td>
<td>24m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2(4)</td>
<td></td>
<td>24m</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>3.1(5)</td>
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<td>24m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2(6)</td>
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<td></td>
<td></td>
<td></td>
<td>24m</td>
</tr>
<tr>
<td>4.1(7)</td>
<td></td>
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<td></td>
<td></td>
<td>24m</td>
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<td>4.2(8)</td>
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<td>5.2(10)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6.1(11)</td>
<td></td>
<td></td>
<td></td>
<td>24m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2(12)</td>
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<td>24m</td>
</tr>
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<td></td>
<td></td>
<td>12m</td>
<td></td>
</tr>
<tr>
<td>7.2(14)</td>
<td></td>
<td>12m</td>
<td></td>
<td></td>
<td>12m</td>
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<tr>
<td>8.1(15)</td>
<td>12m</td>
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<td>12m</td>
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<tr>
<td>8.2(16)</td>
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<td>12m</td>
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<tr>
<td>9.1(17)</td>
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<td>12m</td>
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<td>9.2(18)</td>
<td>12m</td>
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<td>12m</td>
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<tr>
<td>Total</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 3.8. Actual implementation of instructional skills to sessions
Note: Each session included 30 minutes of T-SKIP/24 minutes of OC skill instruction totaling 450 T-SKIP and 360 OC minutes over 15 sessions.

**Teacher Coaching Materials**

Based upon the feedback received from the teachers in the pilot study T-SKIP materials were print-based and included visual aides such as task cards and picture cards.

The T-SKIP materials included the following content:
• general principles of motor development (PowerPoint slide notes provided)
• stages of throw, catch, strike and kick (skill pictures cards with verbal descriptions)
• critical elements of throw, catch, strike, kick, roll and bounce (skill pictures cards with written descriptions)
• demonstrations of each OC skill (skill pictures cards with written descriptions; live demonstrations and PowerPoint slide notes provided)
• cues and visual prompts necessary to promote developmentally appropriate skill acquisition (task picture cards with written descriptions; skill pictures cards with written descriptions; live demonstrations and PowerPoint slide notes provided)
• lesson plans (paper hard copies)

**Phase II – Delivering T-SKIP Coaching and Pretesting the Students**

Prior to the T-SKIP coaching, the lead researcher obtained consent from the ECTs. Additionally, the lead researcher spent a half-day in each T-SKIP teacher’s classroom as a way to build rapport with the teachers, observe the teachers behavior and get to know the teachers as well as their students prior to the coaching.

The T-SKIP teachers were involved in one, six-hour initial workshop with the lead researcher. The workshop protocols were based upon the lead researcher’s previous experience in providing professional development with motor development as well as the motor development and physical education literature. In addition, the findings from the physical education professional development literature (e.g. Armour & Yelling, 2004; Bechtel & O’Sullivan, 2006; Deglau & O’Sullivan, 2006; Patton & Parker, 2012; Ko,
Wallhead, & Ward, 2006; Ward & Doutis, 1999 as well as classroom professional development literature (Guskey, 1985; 2002; NPEAT, 2009; Shelton & Jones, 1996; Sinelnikov, 2009) informed the coaching protocols. The major findings from the physical education/classroom professional development literature used to inform this study are listed below (see Figure 3.7):

<table>
<thead>
<tr>
<th><strong>Not a one shot session. Teachers may require on-going coaching and support if the coaching included subject matter content and pedagogical strategies</strong></th>
<th>The coaching included a six-hour content session as well as continuing coaching and support on a faded schedule throughout the entire intervention. Teachers were informed that the lead researcher would be present throughout all intervention sessions to provide support. In addition, coaching refreshing and question answering occurred the Friday before each intervention week during the first three weeks of the program.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teachers need to feel empowered in their own learning, have a voice and a sense of autonomy</strong></td>
<td>Throughout the initial workshop, teachers were continuously asked if they felt comfortable with the pacing, content and style of the session. Teachers were asked if they wanted any content repeated, presented in a different way or if there were aspects that were not shown that they would prefer to see.</td>
</tr>
<tr>
<td><strong>A focus on student learning as a measure of success with success shown early and often</strong></td>
<td>Teachers were made aware of the past successes with SKIP during the workshop and were also prompted when students improved during T-SKIP sessions.</td>
</tr>
<tr>
<td><strong>Professional development should provide opportunities to gain an understanding of the theory underlying the knowledge and skills being learned</strong></td>
<td>Teachers were provided with a theoretical basis and the underlining motor development principles/physical education content needed to participate in T-SKIP.</td>
</tr>
</tbody>
</table>

Figure 3.7. Major findings from the physical education and classroom professional development literature

Continued
Professional development should be rooted in sound theory and be evidence-based

In addition, the initial workshop was based upon The Model of Teacher Change (Guskey, 2002)

Teachers need to participate in as well as provide peer-to-peer coaching

Teachers were able to see, walk through and peer teach in two sample lessons as well as all of the stages of each during the coaching session.

Teachers need to participate in active learning not passive listening

Teachers had to physically demonstrate all skills, progressions and lessons. Peer to peer demonstrations occurred as well as walk through demonstrations and lessons along with lead researcher occurred.

There were several outcome measures for the T-SKIP teachers for the initial workshop. These outcomes were categorized into what T-SKIP teachers would learn/be expected to know and what T-SKIP teachers would do/be expected to perform. Here are the intended outcomes of the T-SKIP teacher initial workshop:

What T-SKIP teachers were expected to know:

- the developmental sequences (stages) for throw, kick, catch and strike (Gallahue, Ozmun, & Goodway, 2012). There are no stages for roll and bounce.
- critical elements of a proficient performer for each of the skills. The critical elements are derived from elementary physical education textbooks (Graham, Holt/Hale, & Parker, 2013) as well as motor development materials (Gallahue et al., 2012; Hayward & Getchell, 2008; Payne & Isaacs, 2009)
- common errors that occur for each skill, typical patterns of performance including immature and mature patterns for each skill are to be understood as well as being able to visually identify each occurrence.
ECTs were expected to perform:

- demonstration of the six OC skills at a mature stage or at least a more advanced stage
- ability to provide verbal cues serving as verbal prompts for proper skill performance.
- ability to set up and demonstrate basic task progressions of each skill needed to follow lesson plans.
- ability to modify tasks based upon present level of performance and rates of improvement. In response to present level of performance/rate of improvement teachers were to modify equipment, use visual prompts and manipulate tasks accordingly.
- implement each lesson plan with fidelity, appropriate transitions and pacing, and ensuring student safety.
- ability to set up the equipment for each lesson appropriately

For every learning outcome sought within the initial coaching workshop, there was an assessment to ascertain the level of ECT success. The video exam served as an assessment of teachers’ motor development knowledge (this process was described above).

In order to determine teachers’ understanding of the content presented and ability to implement the progressions taught during the workshop informal assessments occurred depicted in Figure 3.8. Throughout the initial workshop, the lead researcher solicited teachers with questions in order to check for understanding of the content after
presentation of materials, during simulated activities and during the closure of each session. Figure 3.8 depicts the ECTs learning outcomes, the pedagogy the trainer utilized to achieve the learning outcome and the manner in which each learning outcome was assessed.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Train Pedagogy</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental stages of OC skills</td>
<td>• walk through in gym</td>
<td>• informal observational assessment</td>
</tr>
<tr>
<td>Critical elements</td>
<td>• observe video</td>
<td>• question/answer responses sought from video exam</td>
</tr>
<tr>
<td></td>
<td>• handouts as prompts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• teacher perform in gym</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• teacher observe a video of child &amp; identifying stage and critical elements</td>
<td></td>
</tr>
<tr>
<td>Cues</td>
<td>• physically in gym</td>
<td>• informal observational assessment</td>
</tr>
<tr>
<td>Common patterns of performance</td>
<td>• handouts as prompts</td>
<td>• question/answer responses sought from video exam</td>
</tr>
<tr>
<td></td>
<td>• observe video</td>
<td></td>
</tr>
<tr>
<td>Task progressions</td>
<td>• lecture discussion with PowerPoint</td>
<td>• informal observational assessment</td>
</tr>
<tr>
<td>Equipment/environmental manipulations</td>
<td>• handouts as prompts</td>
<td></td>
</tr>
<tr>
<td>Setting up/taking down environment</td>
<td>• observe video</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>• micro-teaching each other</td>
<td></td>
</tr>
</tbody>
</table>

Continued

Figure 3.8. Learning outcomes for teachers during the initial workshop
Figure 3.8 continued

| Common Pedagogy for Motor Environment | • instructor demonstration  
| Perform 6 OC skills | • physical demonstration  
| Demonstrate Task Progressions | • partner and group work with collaborative demonstration  
| Setup gym environment | • think-pair-share  
| Provide feedback and cues | • micro-teaching each other  
| Modify tasks appropriately | • informal observational assessment  
| Individualize instruction | • question/answer responses sought from video exam  
| Re-direct children to maintain behavior | • think-pair-share  
| Perform lessons with: | • micro-teaching each other  
| • fidelity | • informal observational assessment  
| • pacing | • question/answer responses sought from video exam  
| • smooth transitions | • think-pair-share  
| • closure | • micro-teaching each other  

Visually Identify:  
• stages  
• common errors  
• critical elements  
• instructor demonstration  
• physical demonstration  
• partner and group work with collaborative demonstration  
• think-pair-share  
• micro-teaching each other  
• informal observational assessment  
• question/answer responses sought from video exam  

As stated above, the ECTs experienced a six-hour initial workshop with the research team. Each teacher completed a demographic questionnaire prior to the start of coaching. When coaching commenced teachers learned a quick overview of motor development principles. Motor development principles consisted of definitions, models
and laws of developmental direction. Following principles of motor development, teachers learned the developmental sequences and stages of each OC skill in the gymnasium in the following order: catch, throw, roll, bounce, strike and kick. The workshop concluded with demonstrations of each skill and two mock lessons. The schedule for how the initial workshop occurred is below (see Figure 3.9).

<table>
<thead>
<tr>
<th>Time</th>
<th>Content</th>
<th>Researcher</th>
<th>Teachers</th>
<th>Assessment</th>
<th>Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 mins</td>
<td>Introduction and overview</td>
<td>Introduction of self, research team and project.</td>
<td></td>
<td></td>
<td>Lecture</td>
</tr>
<tr>
<td>5-6 mins</td>
<td>Getting to know each other</td>
<td></td>
<td>Introduction, background of self</td>
<td></td>
<td>Interactive</td>
</tr>
<tr>
<td>6-26 mins</td>
<td>Administer the demographic questionnaire</td>
<td></td>
<td>Complete questionnaire independently</td>
<td></td>
<td>Paper questionnaire</td>
</tr>
<tr>
<td>26-30 mins</td>
<td>Collect questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-45 mins</td>
<td>Overview of motor development principles and models</td>
<td>Provide PowerPoint presentation of content</td>
<td>Questions and answers</td>
<td></td>
<td>Lecture</td>
</tr>
</tbody>
</table>
| 45-75 mins | Demonstration of the stages of Kick, Throw, Catch and Strike | Demonstrate the stages of each skill  
Verbally ask teachers to perform each stage of each skill on command | Performs stages with lead researcher  
Performs each stage in order | Visual assessment | Interactive demonstration |

Figure 3.9. Schedule for the initial workshop

102
**Figure 3.9 continued**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Description</th>
<th>Evaluation</th>
<th>Interactive Demonstration</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-80 mins</td>
<td>Checking for understanding</td>
<td>Performance of each skill, critical elements and common errors</td>
<td>Using task cards and skill cards, teachers are to identify stages and common errors</td>
<td>Visual and verbal assessment, task cards provided</td>
</tr>
<tr>
<td>80-110 mins</td>
<td>Catch</td>
<td>In depth presentation of each stage of the catch, common levels of performance.</td>
<td>Interactive session. Do each of the tasks that the lead researcher demonstrates. Challenge video clip – provide a stage for them and have them task from the task list and set it up</td>
<td>Visual, Interactive</td>
</tr>
</tbody>
</table>

Continued
Figure 3.9 continued

<table>
<thead>
<tr>
<th>110-115 mins</th>
<th>Show videos of high and low performances for each skill</th>
<th>Asking what stage, critical elements and common errors are present</th>
<th>Written answers to the video exam questions</th>
<th>Video exam</th>
<th>Videos shown on screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>115-145 mins</td>
<td>Throw</td>
<td>repeat the same pattern as above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>145-180 mins</td>
<td>Roll</td>
<td>repeat the same pattern as above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>180-215 mins</td>
<td>Bounce</td>
<td>repeat the same pattern as above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>215-250 mins</td>
<td>Strike</td>
<td>Repeat same pattern as above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>250-285 mins</td>
<td>Kick</td>
<td>Repeat same pattern as above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>285-295 mins</td>
<td>Highlight the pedagogy within the lesson plan</td>
<td>Walk through a sample lesson that featured the above skills and incorporated scanning, pacing, freeze-replay, monitoring, back to the wall, proper demonstrations</td>
<td>Participate in the shortened lesson demonstrated by lead researcher</td>
<td>Visual and verbal</td>
<td>Interactive</td>
</tr>
<tr>
<td>295-305 mins</td>
<td>Beverage break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continued
Figure 3.9 continued

| 305-345 mins | Lesson plan implemented by teachers Teachers will have 10 mins to prepare each lesson, each group will provide a 5-minute snapshot of a lesson and receive feedback throughout. All groups will perform lessons. | Provide teachers with sample lesson plans, task and skill cards. Ask teachers to set up lesson. After teachers set up the lesson, emphasize the polyspot circle for entry, transition and closure. While the teachers implement the lesson, use freeze technique and highlight safety points, good pedagogical techniques, and corrections to pedagogy or content. | Teachers are placed into groups and asked to implement a lesson plan using the other teachers as students. All teachers complete this task. Teachers set up the lesson, implement the content use learned pedagogy, close the lesson and put away equipment. | Visual and verbal | Interactively written lesson plans, task cards and skill cards. |
| 345-360 mins | Closure | Teachers received a closure on content, given instructions on communicating with lead researcher about implementation of T-SKIP and provided with incentives for participating. | | | |

All of the teachers who participated in the initial workshop were highly engaged and eager to learn. All teachers asked questions throughout the session, asked for feedback on their demonstrations and wanted to make sure that they understood the content. All teachers seemed that they were very enthusiastic to start T-SKIP.
Pretesting of the Children on the TGMD-2

All students in both the experimental and comparison groups were pretested on the OC subscale of the TGMD-2 following standard testing procedures (Ulrich, 2000). Children were tested in groups of three to four and stood on a polyspot while the lead researcher demonstrated the first skill. Each student had one practice trial. If the lead researcher was satisfied that the students cognitively understood the task, then each student performed two more trials. The OC subscale testing protocol required approximately 15-20 minutes for a group of 3-4 students. All trials were video recorded and each student wore a colored and numbered jersey. Overall, pretesting procedures required 17-27 minutes per group of students.

Phase III – Intervention

Phase III of this study involved the delivery of the T-SKIP package (experimental condition) by ECTs to their students. The following section delineates the components of T-SKIP and the comparison condition including all details pertaining to its delivery.

Delivery of T-SKIP. All children in the experimental T-SKIP condition received the regular Head Start curriculum. In addition during the regular school day they received two sessions per week of the T-SKIP package taught by the ECTs. On the three days that the T-SKIP was not instituted the experimental students received the typical mandatory recess activities of the Head Start, which constituted of 30 minutes of unstructured free play in a well-equipped playground. Similarly, to the comparison condition, the lead researcher also observed the T-SKIP condition on four randomly selected days of recess. The same findings that occurred for the comparison group occurred for the T-SKIP group during free play.
The T-SKIP package occurred for eight weeks with two, 30-minute T-SKIP sessions per week that featured the content of Table 3.3. The original nine-week curriculum was condensed due to weather-related school closings as stated earlier. The ECTs completed the T-SKIP package with the use of assistant teachers because of the mandated student to teacher ratio. The assistant teacher was used at the discretion of the lead teacher. The assistant teacher monitored student behavior and provided feedback to participating students, assisted the lead teacher with physical demonstrations of skills such as the catch that required a partner, assisted with the setup and clean up lessons, and one-two times within each condition delivered the lesson in the lead teacher’s absence. The assistant teacher never delivered more than two lessons for the lead teacher in any condition.

**On-going coaching support for T-SKIP.** Throughout the intervention, on-going support was provided to each teacher. The frequency and amount of support varied based upon the teacher’s present level of performance. For weeks 1-2, the lead researcher met with each teacher ahead of time (preferably the day before or the Friday before the intervention) and prepared the teacher for setup and reviewed the skills to be taught. The lead researcher was present for each session. The lead researcher video recorded the sessions and provided coaching support throughout the entire lesson. For weeks, 3-5, the same support was provided for all teachers that existed in weeks 1-2 but the Friday meetings no longer occurred. Weeks 6-8, the lead researcher or members of the research team were present, recorded each session. No support of instruction was provided unless a T-SKIP teacher asked for help, asked a question, or if a safety concern occurred. During weeks 6-8 teachers rarely asked for support. During the 30 lessons that occurred
across the three sites for the five T-SKIP classes only three instances of support occurred. The instances were double-checking if the throwing demonstration was correct, seeking reassurance about the use of the physical prompts for the throw and help adjusting the strike for a left-handed hitter. Figure 3.10 highlights examples of coaching support that were present.

<table>
<thead>
<tr>
<th>Teacher Error</th>
<th>Support Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrated a skill incorrectly</td>
<td>After the demonstration, while assistant teachers monitored students, the lead researcher spoke to the lead teacher showed her the correct way to demonstrate. The lead teacher then froze the children, demonstrated the skill and sent the children back to their practice.</td>
</tr>
<tr>
<td>Incorrect set up of a task</td>
<td>When a task was set up incorrectly, the lead researcher showed the lead teacher how to correctly set up the task and fixed the error. If it happened again, the lead teacher would prompt the lead teacher of the error.</td>
</tr>
<tr>
<td>Incorrect use of physical prompts</td>
<td>When a scarf or sticker was placed on the child incorrectly, the lead researcher would point it out to the lead teacher and it would then be fixed.</td>
</tr>
<tr>
<td>Incorrect use of cues or feedback</td>
<td>Pulling the teacher aside, the lead researcher would offer suggestions for appropriate cues or feedback that are developmentally appropriate in substitution of incongruent or incorrect cues.</td>
</tr>
<tr>
<td>Not enough equipment set out for the students to keep trials high and wait time to a minimum.</td>
<td>The lead researcher would provide additional balls in the child’s basket or set up additional polyspot stations to increase numbers of trials and minimize wait time. The lead researcher prompted the lead teacher when there was a safe time to do so.</td>
</tr>
</tbody>
</table>

Figure 3.10. Examples of coaching and on-going support
Failure to appropriately monitor the lesson

When the lead teacher would have inappropriate positioning leaving his/her back to the majority of the class resulting in off-task behavior, multiple incorrect trials or unsafe situations, the lead researcher would alert the lead teacher when off task behavior occurred or when too many incorrect trials occurred. When an unsafe situation presented itself, the lead researcher immediately intervened.

Adding safety configurations to the set up

The lead researcher would create boundaries cones for skills such as striking to prompt the children of safe areas. Also, when an unsafe scenario occurred, the lead researcher would immediately intervene and freeze the children near potential danger. This most commonly occurred during striking stations. All safety interventions that occurred were immediately told to the lead teacher. During the striking lessons, because of safety concerns, the lead researcher placed a member of the research team near the students to ensure no students were hit with a bat. The members of the research team did not intervene but were available in case a safety concern arose. No safety concerns surfaced. This scenario occurred only during the last striking lesson (lesson 15).

Available for consultation and questions throughout

Whenever the teachers had questions they were instructed to approach the lead researcher during the session. Often this occurred in the form of double-checking critical elements, reassuring correct setups and reminders of cues.

**Delivery of comparison condition.** All children in the comparison condition received the regular Head Start curriculum including what constituted typical physical activity experiences for these children. Typical physical activity experiences consisted of unstructured free play in a well-equipped large muscle room or gymnasium. On rare occasions, as the intervention occurred during the winter and spring, free play could occur on a well-equipped outdoor playground. The lead researcher explained to the comparison group that neither a physical education teacher nor a motor development
expert could provide motor skill based instruction during this time that was outside of the normal curriculum.

In order to provide a description for well-equipped free play occurring at the comparison condition, a member of the research team observed three random days of free play. The observation utilized field notes in order to ascertain level of instruction, physical activity type and situational components. Utilizing field notes during free play helped to describe the type of free play that occurred at the comparison sites. During each of the three observations at all five comparison classrooms, the research team did not observe any behavior that was outside of the boundaries of the everyday Head Start curriculum. Examples of observed behavior included:

• climbing, sliding and swinging on standard playground equipment
• access to playground balls, basketballs and small basketball cylinders
• access to beanbags, scooters, bowling pins, hula hoops, paddles, and soccer balls
• musical instruments, music, and videos were available and on
• obstacle courses, such as running rails and stones, as well as polyspot pathways were set up

The children in the comparison group had access to similar equipment as the T-SKIP children (e.g. playground balls, soccer balls, basketball balls, beanbags) but rarely chose to utilize this equipment. Children mainly participated in LOC skills such as tag, chase and flee, playing on playground equipment, using hula hoops and scooters and occasionally participating in teacher-led activities such as “duck, duck, goose” or “Simon
Other than participating in games like “duck, duck, goose”, the teachers did not provide any structured physical activity or motor skill instruction. The patterns of behaviors mentioned above were consistent across sites.

**Description of Actual Teacher-Led Free Play for Comparison Group.** At both Comparison sites, no classes participated in free play outdoors due to weather. All free play activities occurred in a gross muscle space indoors. During free play, the lead teacher and assistant teacher for each class were always present. Table 3.8 depicts a sample of the findings for each of the each of the two Comparison sites. Note there was three Comparison classes at site one and two Comparison classes at site two. Each of the classes at site one used the same free play space. Classes one and two shared free play time and Class three entered after Classes one and two in consecutive order. As each class at Comparison site one displayed similar findings during free play, the findings from the two, 30 minute observations were synthesized into one observation for Comparison site one within Table 3.9. At Comparison site two, the two Comparison classes participated in free play at the same time, in the same space. As such, the findings from the observations at Comparison site two are synthesized together as one observation within Table 3.9.

As all nine observations at the Comparison sites produced similar findings, it was deemed appropriate to provide only a sample observation to avoid redundancy.
<table>
<thead>
<tr>
<th>Location</th>
<th>Space</th>
<th>Equipment Present</th>
<th>Synopsis of Field Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison Site 1</td>
<td>Indoor Gross Muscle Room</td>
<td>• Plastic mini-playground with a slide, climbing wall and a platform</td>
<td>Children entered and exited the room without order. Children had complete autonomy in activity choice. Children did not access the OC equipment available. Children played on the playground equipment, sat on the safety mats and played puzzles or other games they brought in from the classroom. Children played with scooters and hula-hoops. Teachers were watching the students play.</td>
</tr>
<tr>
<td></td>
<td>Approximately</td>
<td>• Small basketball hoop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25 feet long x 15 feet wide x 15 feet high</td>
<td>• Safety mats covering the area under the playground equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hard rubber surface at the rest on the rest of the room.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• OC skills equipment available: basketballs, playground balls, 12 inch gator skin balls, 3 inch balls</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• LOC skills equipment available: jump ropes, scooters, 1 tri-cycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hula hoops</td>
<td></td>
</tr>
</tbody>
</table>

Table 3.9. Sample observations of free play at Comparison sites.
Based upon the findings from the observations at the Comparison sites, students had access to OC equipment that may have been used to perform OC skills similar to those captured by the TGMD-2. Students during observations did not choose to utilize the OC equipment available to them with the exception of two boys dribbling and

| Comparison Site 2 | Indoor full-sized gymnasium with one basketball court | OC skills equipment available: basketballs, playground balls, 12 inch gator skin balls, 3 inch gator balls, full-size basketball hoops, yarn balls, footballs | LOC skills equipment available: jump ropes, scooters, 3 tri-cycles, Hula-hoops, musical instruments, polypsots, bowling sets, tunnels | Children entered and exited the room with order lining up at the door. Children participated in a game of “duck, duck, goose” with the assistant teachers. Lead teacher were talking to each other. After “duck, duck, goose” the teachers put on music that included Disney songs. When the music turned on, children had complete autonomy in play. All teachers were off to the side speaking with each other. Many children chose to play on scooters and with musical instruments. Two boys attempted to dribble a basketball and attempted to shoot at the full-sized hoop. Children chased each other in what may have been an unofficial game of tag. Three girls played with hula-hoops. Several children were standing around talking with each other. |
shooting at the basketball hoop. Students mainly chose to play on playground equipment, use scooters, tricycles or engage in play with peers. Therefore, students had opportunities to engage in OC skills during free play at the Comparison sites with classroom teachers present but chose to partake in other activities during that time.

**Novelty effects of video recording.** Whenever video recording occurs in a classroom novelty effects of the video recording can be an internal threat to validity (Ary et al., 2009). For children, this effect may be accentuated. Over time, novelty effects tend to withdraw (Ary et al., 2009). T-SKIP teachers were prompted about the potential novelty effects of the video camera and instructed to keep children’s focus on the activity and away from the camera. Positive praise for on task behavior during the first few weeks and placing the video camera in the same central location for each session helped lessen the novelty effects of the camera.

**Posttest of student dependent variables.** After the eight-week T-SKIP intervention all experimental and comparison students were posttested on the OC subscale of the TGMD-2. Test implementation procedures during the posttest were the same as the pretest. All testing procedures followed the standard protocol delineated within the TGMD-2 test manual.

**Inter-Rater Reliability for the TGMD-2**

Three members of the research team coded the results of the TGMD-2. Prior to coding, the members of the research team received training from the lead researcher in which 98% agreement occurred. In order to reduce error in the coding of the TGMD-2 inter-rater reliability (IRR) was conducted on the TGMD-2. Thirty percent of the total sample was coded for IRR by the lead researcher on the portion of the sample in which
the members of the research team coded. A 92.5% IRR agreement was calculated on the 30% IRR sample. An 85% IRR agreement is deemed appropriate IRR per the TGMD-2 manual (Ulrich, 2000). In addition, to reduce bias of coding from pretest to posttest and by experimental verses comparison groups, an additional 30% of the IRR sample was double-blind coded by an expert in motor development who was training in the TGMD-2 procedures. The double-blinded IRR coder was blinded to test time and subject assignment to group. The double-blinded IRR agreement achieved 98% agreement.

**Statistical Analyses**

A power analysis using optimal design (Raudenbush et al., 2011; Spybrook et al., 2011) revealed that 15 classes were necessary to power the study in a manner to yield an 80% likelihood of demonstrating a .50 effect size. Due to this study serving as both a validation study for the T-SKIP package and a feasibility trial for T-SKIP teachers, it was not possible to secure the necessary classrooms to power the study at 80% a priori. Instead, this study was powered a priori at a 50% likelihood of an effect size of .50 being revealed. Recognizing that sufficient power was not obtained, there was a risk that significance would not surface. However, the previous SKIP literature yielded substantial effect sizes ($\eta^2 = .60-.89$; e.g. Goodway & Branta, 2003; Robinson & Goodway, 2009) as did the pilot to this study ($\eta^2 = .68$; Brian, Goodway & Sutherland, in preparation). Therefore, the inherent risk built into the design of this study with statistical significance was minimized.

In order to address the five research questions in this study, separate dependent variable structures existed for teacher-level subjects and student-level subjects. For
research questions one and two, the teacher was the unit of analysis. Descriptive statistics were used to display trends and raw data for research questions one and two.

To analyze research questions three-five, a two-level nested hierarchical linear model (HLM) was conducted and analyzed using HLM 7.01 (Raudenbush et al., 2011). As the manipulation of the independent variable occurred on the teacher-level of this design, it was necessary to nest all student-level variables within teacher-level variables and use HLM. The intraclass correlation (ICC) coefficient was calculated to determine the percentage of variance in the outcome that was attributable to the teacher. For the purpose of this study, the teacher and the class are the same variable. As such, nesting the student into the teacher and then into the class would be a redundant analysis.

The purpose of the first HLM model was to determine OC skill gains from pretest to posttest for the students. Pretest scores were centered around the grand mean as covariance existed within pretest scores for students. Study condition was treated as a dummy code (T-SKIP, yes=1, no=0). Dummy codes representing T-SKIP verses Comparison conditions were first entered into the model in order to specify the contrast between groups.

Two additional HLM models occurred to address research questions four and five. For Research Question Four, to determine differential results based upon gender, gender was labeled as female (dummy codes for females were 1=yes and 0=no). Pretest OC scores were centered around the grand mean to account for covariance of pretest scores within the analysis. For Research Question Five, only the experimental T-SKIP group was included. Pretest OC scores were centered around the grand mean to be included as a covariate in the model.
The variables of pretest scores, gender, fidelity and group were entered as fixed-effects as random sampling occurred at the site level and students were located within intact classes. Gender and pretest scores are unable to be manipulated thus they were fixed effects. Fidelity and group were fixed effects because teachers were not randomly selected but rather situated within a site. All random assignment occurred at the site level in this study.

For the first two HLM models (main effect and gender), 122 students were nested within ten classes. For the final HLM (fidelity), only the T-SKIP subjects \( n=63 \) were nested within five T-SKIP teachers. Effect sizes (Cohen’s \( d \)) were calculated in a manner consistent with HLM analyses (Hox, 2010). For each outcome, the difference between students OC scores in each condition, as derived from the relevant HLM model, was divided by its pooled standard deviation. The resulting Cohen’s \( d \) yielded two coefficients, \( d \) and \( r \). The resulting \( d \) refers to the numbers of standard deviations in which the mean score of the posttest changed (either improved or regressed). The \( r \) is a coefficient of determination that when squared produces the amount of variance explained in percentage in the posttest scores that can be attributed to the T-SKIP package (Lomax & Hahs-Vaughn, 2012). Below is a summary of the research questions followed by statistical analysis used for each question.

**Research Question 1**

To what extent can ECTs demonstrate motor development and physical education knowledge and skills by the end of a six-hour initial workshop led by a motor development expert?
The results of each motor development video assessment were aggregated by group and displayed within a table and a histogram.

**Research Question 2**

To what extent can ECTs implement the T-SKIP lesson plans with fidelity across an eight-week MSI?

Fidelity was reported by percentage for each lesson by each T-SKIP teacher. The T-SKIP lesson fidelity percentage was reported in a line graph. A grand mean for each of the five T-SKIP teacher’s lesson fidelity was also reported in a histogram. In addition, grand means were also calculated for Level-1, core element fidelity and Level-2, highly desired fidelity. Level-1 and Level-2 grand mean fidelity percentages were displayed in a histogram.

**Research Question 3**

What are the effects of the eight-week T-SKIP package on the OC skills of preschool children who are disadvantaged?

**Hypothesis 3a.** The students will score below the 30\textsuperscript{th} percentile at the pretest and display motor skill delays for OC skills.

Descriptive statistics, tables and figures were reported to demonstrate the frequency of developmental delay at the pretest.

**Hypothesis 3b.** The T-SKIP group will significantly improve their OC skills from pretest to posttest as contrasted against the Comparison group.

To determine the effects of the eight-week T-SKIP package on the OC skills of preschool children who are disadvantaged, a two-level hierarchical linear model with student nested in teacher was used. For this model, standard scores from the TGMD-2
were used as the outcome variable. Standard scores were chosen to rule out age effects (Ulrich, 2000). The OC pretest standard score was centered around the grand mean in the Level-1 equation to control for pretest scores. The group variable was entered dichotomously (T-SKIP, yes=1 or no=0) and served as the predictor variable within the Level-2 model. All variables were entered as fixed effects.

**Research Question 4**

To what extent does gender influence the effects of the T-SKIP package on the OC skills of preschool children who are disadvantaged?

**Hypothesis 4a.** There will be no differential treatment gender effects of the T-SKIP package.

To determine whether the T-SKIP package’s effectiveness varied based upon gender, a two-level hierarchical linear model with student nested within teacher was used. For this model, OC standard scores from the TGMD-2 were used to rule out age effects. The OC standard score at the posttest was the outcome variable. The OC standard score at the pretest was centered around the grand mean. In addition, the gender variable was entered dichotomously as “Female, yes=1 or no=0” and was added to the Level-1 equation uncentered. Female was entered uncentered and as a predictor variable in the Level-1 equation. The group variable was entered dichotomously (T-SKIP, yes=1 or no=0) and served as the predictor variable. All variables were entered as fixed effects.

**Research Question 5**

To what extent does the Fidelity of the T-SKIP teachers predict posttest OC scores?

To determine whether fidelity influenced the effectiveness of the T-SKIP package, a two-level hierarchical linear model with student nested within teacher was
used. For this model, OC standard scores from the TGMD-2 were used to rule out age effects. The OC standard score at the posttest was the outcome variable. The OC standard score at the pretest was centered around the grand mean in the Level-1 equation to control for pretest scores. The fidelity variable served as a predictor variable within the Level-2 (the teacher level) equation. All variables were entered as fixed effects.

There were no hypotheses for research question five due to a lack of literature base to support a hypothesis. In addition, a HLM similar to the model run for fidelity was executed with core element, Level-1 fidelity as the predictor variable in the second level of the equation (teacher level) for the HLM. The purpose of this model was to determine the extent to which Level-1 core element fidelity influenced OC scores.

**Summary**

Within chapter three, a discussion of the methods conducted within this study to address research questions 1-5 occurred. The organization of the discussion for the methods was divided into the three phases of this study. Phase one involved the creation of all ECT coaching materials and T-SKIP materials. Phase two was the pretesting of all students on the dependent measures with phase three including the T-SKIP intervention. All research questions were tied to phases II and III. Chapter three concluded with a discussion focusing the rationale for the statistical analyses that occurred linked with each research question and hypothesis.
Chapter 4: Results

The purpose of this chapter is to report the results for an eight-week motor skill intervention (MSI), called Teacher-Led Successful Kinesthetic Instruction for Preschoolers (T-SKIP), implemented by trained early childhood teachers (ECTs) on the object control (OC) skills of young children who are disadvantaged. Chapter Four includes the results for the five research questions.

Research Questions and Hypotheses

Research Question 1

To what extent can ECTs demonstrate motor development and physical education knowledge and skills by the end of a six-hour initial workshop session led by a motor development expert?

In order to examine if ECTs understood the content presented to them each teacher was assessed on the motor development (MD) and physical education (PE) knowledge presented in the workshop and identified in the goals of the workshop. All skills were presented in order (catch, throw, roll, bounce, strike and kick) and after each skill ECTs took a test over the content. At the beginning of the test ECTs identified the stage of the skill or for bounce/roll, the common error within one of the critical elements of the skill. The structure of each video exam prohibited moving onto question two unless either the incorrect critical element was correctly identified, or the correct stage for the skill was recognized. After ECTs successfully answered the first question within
each individual exam, the remaining questions asked what verbal, physical, and visual prompts they would use for the child in the previously viewed video clip. Finally, at the end of each exam, ECTs were asked to list the critical elements for the skill. Before the group of ECTs could progress to the next skill, all individual ECTs had to achieve 85% on the assessment. Figure 4.1 shows the average skill score for the five ECTs.

Each ECT received a minimum of 85% competency after all skill quizzes except for the roll quiz. Teachers completed five of the six exams one time with the exception of roll, which occurred three times. Teachers scored 0% on both the first and second attempts of the roll exam due to an inability to correctly identify the critical element errors presented during the demonstration of the roll video. By the third roll exam, ECTs were able to correctly identify the critical element errors and thus were able to successfully complete the remainder of the roll exam at 90% accuracy.

![Initial Workshop Test Scores](image)

Figure 4.1. Means of the initial video exam for all skills
Based upon the results of Research Question One, the ECTs were able to demonstrate MD and PE knowledge by the end of the six-hour initial workshop. Teachers were able to successfully complete each of the six individual MD and PE video exams ranging between 88% and 94% competency.

**Research Question 2**

To what extent can ECTs implement the T-SKIP lesson plans with fidelity across an eight-week MSI?

To address Research Question Two, descriptive analyses including line graphs and histograms were used to graphically plot the results. The fidelity data was calculated as a percentage of the total possible fidelity points for a lesson and presented by lesson by ECT. For example, within the entire 15-lesson T-SKIP package the number of potential fidelity points within an individual lesson varied from 30-50 points. The lesson plan fidelity percentage for each individual lesson ranged from 22%-74% ($M=47\%$, $SD=12\%$). As there were five teachers who each taught 15 T-SKIP lessons there were 75 total T-SKIP lessons for which fidelity was calculated (see Table 4.1). During 7 of the 75 T-SKIP lessons across all five classrooms, the assistant teacher implemented all or part of the lesson in the lead teacher’s absence. The fidelity data for the seven lessons in which the assistant teacher implemented a portion of the lesson was included in the mean fidelity score and all fidelity by lesson tables (see Tables 4.1, 4.2 and 4.3) to provide an accurate description of what percentage of fidelity the students received. The lead teachers for classes 101 and 102 were absent for two lessons. The lead teacher for class 104 missed three lessons. The remaining two teachers from classes 105 and 103 taught all 15 lessons as no absences occurred for these teachers (see Table 4.1).
depicts the actual fidelity percentage calculated for each class (101-105) by lesson (1-15).

Teacher 104 reported the highest mean fidelity percentage ($M=52\%, SD=13\%$) and
Teacher 103 reported the lowest mean fidelity percentage ($M=38\%, SD=7\%;$ see Table 4.2). Teachers were able to implement T-SKIP with an overall 38%-52% mean fidelity percentage across 15 lessons with a grand mean of 47%.

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>101</th>
<th>102</th>
<th>103</th>
<th>104</th>
<th>105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson</td>
<td>ID</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>0.52</td>
<td>0.52</td>
<td>0.38</td>
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<td>2</td>
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</tr>
</tbody>
</table>

Table 4.1. Fidelity percentage by lesson for each teacher. Means and standard deviations are listed at the bottom for each teacher. Bold/underlined numbers represent the lesson that was implemented in part or in full by the assistant teacher.
Two levels of fidelity were calculated within this study. Level-1 fidelity included the core elements of the lesson that ECTs had to implement at 85% correct in order to receive fidelity credit (see Figure 4.2). The individual class range of Level-1 fidelity was 13%-96%, \( M=59\% , SD=19\% \). Level-2 fidelity included the items that were desirable but not considered core items, and the ECT received credit for implementing as either a yes or a no (see Figure 4.2). The range of individual class Level-2 fidelity was 13%-81%, \( M=34\% , SD=15\% \). The lessons where assistant teachers implemented a portion or all of the lessons were calculated as a part of Level-1 or Level-2 fidelity means and the lesson-by-lesson fidelity tables (see Table 4.2 and Table 4.3).

![Figure 4.2. Mean fidelity percentages of fidelity by teacher.](image)
As seen above, Figure 4.2 demonstrates mean fidelity percentages by teacher. Tables 4.2 and 4.3 display actual fidelity for each T-SKIP session by teacher. Table 4.1 displays Level-1 fidelity while Table 4.2 displays Level-2 fidelity.

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>101</th>
<th>102</th>
<th>103</th>
<th>104</th>
<th>105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1</td>
<td>0.75</td>
<td>0.61</td>
<td>0.39</td>
<td>0.74</td>
<td>0.36</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>0.67</td>
<td>0.83</td>
<td>0.58</td>
<td>0.78</td>
<td>0.61</td>
</tr>
<tr>
<td>Lesson 3</td>
<td>0.63</td>
<td>0.27</td>
<td>0.52</td>
<td>0.61</td>
<td>0.44</td>
</tr>
<tr>
<td>Lesson 4</td>
<td>0.61</td>
<td>0.40</td>
<td>0.43</td>
<td>0.48</td>
<td>0.32</td>
</tr>
<tr>
<td>Lesson 5</td>
<td>0.78</td>
<td>0.86</td>
<td>0.58</td>
<td>0.61</td>
<td>0.63</td>
</tr>
<tr>
<td>Lesson 6</td>
<td>0.67</td>
<td>0.29</td>
<td>0.26</td>
<td>0.48</td>
<td>0.35</td>
</tr>
<tr>
<td>Lesson 7</td>
<td>0.57</td>
<td>0.96</td>
<td>0.50</td>
<td>0.71</td>
<td>0.88</td>
</tr>
<tr>
<td>Lesson 8</td>
<td>0.22</td>
<td>0.35</td>
<td>0.43</td>
<td>0.36</td>
<td>0.48</td>
</tr>
<tr>
<td>Lesson 9</td>
<td>0.13</td>
<td>0.52</td>
<td>0.48</td>
<td>0.57</td>
<td>0.55</td>
</tr>
<tr>
<td>Lesson 10</td>
<td>0.19</td>
<td>0.55</td>
<td>0.52</td>
<td>0.58</td>
<td>0.74</td>
</tr>
<tr>
<td>Lesson 11</td>
<td>0.86</td>
<td>0.69</td>
<td>0.57</td>
<td>0.79</td>
<td>0.83</td>
</tr>
<tr>
<td>Lesson 12</td>
<td>0.79</td>
<td>0.50</td>
<td>0.50</td>
<td>0.48</td>
<td>0.59</td>
</tr>
<tr>
<td>Lesson 13</td>
<td>0.79</td>
<td>0.64</td>
<td>0.50</td>
<td>0.79</td>
<td>0.69</td>
</tr>
<tr>
<td>Lesson 14</td>
<td>0.86</td>
<td>0.71</td>
<td>0.50</td>
<td>0.86</td>
<td>0.79</td>
</tr>
<tr>
<td>Lesson 15</td>
<td>0.83</td>
<td>0.64</td>
<td>0.50</td>
<td>0.67</td>
<td>0.92</td>
</tr>
</tbody>
</table>

Table 4.2. Level-1 fidelity percentage for each lesson. Bold/underlined numbers represent the lesson that was implemented in part or in full by the assistant teacher.
Table 4.3. Level-2 fidelity for each lesson. Bold/underlined numbers represent the lesson that was implemented in part or in full by the assistant teacher.

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>101</th>
<th>102</th>
<th>103</th>
<th>104</th>
<th>105</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1</td>
<td>0.29</td>
<td>0.43</td>
<td>0.36</td>
<td>0.48</td>
<td>0.25</td>
</tr>
<tr>
<td>Lesson 2</td>
<td>0.30</td>
<td>0.29</td>
<td>0.22</td>
<td>0.67</td>
<td>0.38</td>
</tr>
<tr>
<td>Lesson 3</td>
<td>0.17</td>
<td>0.38</td>
<td>0.28</td>
<td>0.38</td>
<td>0.21</td>
</tr>
<tr>
<td>Lesson 4</td>
<td>0.32</td>
<td>0.35</td>
<td>0.16</td>
<td>0.48</td>
<td>0.37</td>
</tr>
<tr>
<td>Lesson 5</td>
<td>0.20</td>
<td>0.21</td>
<td>0.35</td>
<td>0.38</td>
<td>0.26</td>
</tr>
<tr>
<td>Lesson 6</td>
<td>0.33</td>
<td>0.18</td>
<td>0.15</td>
<td>0.39</td>
<td>0.24</td>
</tr>
<tr>
<td>Lesson 7</td>
<td>0.38</td>
<td>0.48</td>
<td>0.26</td>
<td>0.70</td>
<td>0.26</td>
</tr>
<tr>
<td>Lesson 8</td>
<td>0.24</td>
<td>0.20</td>
<td>0.16</td>
<td>0.14</td>
<td>0.18</td>
</tr>
<tr>
<td>Lesson 9</td>
<td>0.76</td>
<td>0.35</td>
<td>0.37</td>
<td>0.67</td>
<td>0.21</td>
</tr>
<tr>
<td>Lesson 10</td>
<td>0.81</td>
<td>0.26</td>
<td>0.29</td>
<td>0.13</td>
<td>0.33</td>
</tr>
<tr>
<td>Lesson 11</td>
<td>0.46</td>
<td>0.50</td>
<td>0.31</td>
<td>0.40</td>
<td>0.67</td>
</tr>
<tr>
<td>Lesson 12</td>
<td>0.33</td>
<td>0.27</td>
<td>0.36</td>
<td>0.22</td>
<td>0.53</td>
</tr>
<tr>
<td>Lesson 13</td>
<td>0.23</td>
<td>0.27</td>
<td>0.23</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Lesson 14</td>
<td>0.53</td>
<td>0.53</td>
<td>0.15</td>
<td>0.47</td>
<td>0.38</td>
</tr>
<tr>
<td>Lesson 15</td>
<td>0.25</td>
<td>0.36</td>
<td>0.17</td>
<td>0.18</td>
<td>0.21</td>
</tr>
</tbody>
</table>

In summary, T-SKIP teachers demonstrated a grand mean fidelity of 47% across all 15 lessons. Level-1 fidelity was demonstrated with a higher rate with a grand mean of 59%, while Level-2 fidelity occurred with a grand mean of 34%.

**Research Question 3**

What are the effects of the eight-week T-SKIP package on the OC skills of preschool children who are disadvantaged?

**Hypothesis 3a.** The students will score below the 30th percentile at the pretest and display motor skill delays for OC skills.

The descriptive statistics for each group (T-SKIP or Comparison) at the pretest are listed below by test measures and gender (see Table 4.4).
<table>
<thead>
<tr>
<th></th>
<th>OC Raw Scores</th>
<th>OC Standard Scores</th>
<th>OC Percentile Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>T-SKIP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>16.86</td>
<td>7.08</td>
<td>21</td>
</tr>
<tr>
<td>SD</td>
<td>6.61</td>
<td>2.11</td>
<td>17</td>
</tr>
<tr>
<td>Girls</td>
<td>15.38</td>
<td>6.63</td>
<td>18</td>
</tr>
<tr>
<td>SD</td>
<td>6.53</td>
<td>2.20</td>
<td>17</td>
</tr>
<tr>
<td>Boys</td>
<td>19.43</td>
<td>7.87</td>
<td>27</td>
</tr>
<tr>
<td>SD</td>
<td>6.04</td>
<td>1.69</td>
<td>16</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>15.98</td>
<td>6.32</td>
<td>16</td>
</tr>
<tr>
<td>SD</td>
<td>5.75</td>
<td>2.00</td>
<td>15</td>
</tr>
<tr>
<td>Girls</td>
<td>16.93</td>
<td>6.89</td>
<td>19</td>
</tr>
<tr>
<td>SD</td>
<td>5.53</td>
<td>1.93</td>
<td>16</td>
</tr>
<tr>
<td>Boys</td>
<td>15.19</td>
<td>5.84</td>
<td>12</td>
</tr>
<tr>
<td>SD</td>
<td>5.75</td>
<td>1.97</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 4.4. Pretest OC raw scores, standard scores and percentile ranks across group by gender.

The mean OC percentile rank across groups was the 18<sup>th</sup> percentile with T-SKIP students scoring a mean in the 21<sup>st</sup> percentile and Comparison students’ mean scoring in the 16<sup>th</sup> percentile. For all students in this study, 81% of the sample displayed mean percentile ranks below the 30<sup>th</sup> percentile and demonstrated developmental delays with their motor skills.

**Hypothesis 3b.** The T-SKIP group will significantly improve their OC skills from pretest to posttest as compared to the Comparison group.

The descriptive statistics for each group (T-SKIP or Comparison) for OC scores are listed below by test measure, test time and gender (see Table 4.5).
<table>
<thead>
<tr>
<th>T-SKIP</th>
<th>OC Raw Pre</th>
<th>OC SS Pre</th>
<th>OC Percentile Pre</th>
<th>OC Raw Post</th>
<th>OC SS Post</th>
<th>OC Percentile Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>16.86</td>
<td>7.08</td>
<td>21</td>
<td>26.48</td>
<td>10.37</td>
<td>54</td>
</tr>
<tr>
<td>SD</td>
<td>6.61</td>
<td>2.11</td>
<td>17</td>
<td>5.85</td>
<td>1.55</td>
<td>19</td>
</tr>
<tr>
<td>Girls</td>
<td>15.38</td>
<td>6.63</td>
<td>18</td>
<td>25.25</td>
<td>10.00</td>
<td>50</td>
</tr>
<tr>
<td>SD</td>
<td>6.53</td>
<td>2.20</td>
<td>17</td>
<td>4.98</td>
<td>1.40</td>
<td>17</td>
</tr>
<tr>
<td>Boys</td>
<td>19.43</td>
<td>7.87</td>
<td>27</td>
<td>28.61</td>
<td>11.00</td>
<td>62</td>
</tr>
<tr>
<td>SD</td>
<td>6.04</td>
<td>1.69</td>
<td>16</td>
<td>6.71</td>
<td>1.62</td>
<td>19</td>
</tr>
<tr>
<td>Comparison</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>15.98</td>
<td>6.32</td>
<td>16</td>
<td>15.98</td>
<td>5.61</td>
<td>13</td>
</tr>
<tr>
<td>SD</td>
<td>5.75</td>
<td>2.00</td>
<td>15</td>
<td>6.24</td>
<td>2.53</td>
<td>9</td>
</tr>
<tr>
<td>Girls</td>
<td>16.93</td>
<td>6.89</td>
<td>19</td>
<td>16.22</td>
<td>5.85</td>
<td>15</td>
</tr>
<tr>
<td>SD</td>
<td>5.53</td>
<td>1.93</td>
<td>16</td>
<td>6.91</td>
<td>2.70</td>
<td>17</td>
</tr>
<tr>
<td>Boys</td>
<td>15.19</td>
<td>5.84</td>
<td>12</td>
<td>15.78</td>
<td>5.41</td>
<td>12</td>
</tr>
<tr>
<td>SD</td>
<td>5.75</td>
<td>1.97</td>
<td>15</td>
<td>5.72</td>
<td>2.42</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 4.5. Descriptive statistics for pretest and posttest OC scores. Note SS=standard scores.

Figures 4.3 and 4.4 graphically display group mean OC standard scores by time (Figure 4.3) as well as group mean OC percentile ranks by time (Figure 4.4).
Figure 4.3. Group mean pretest and posttest OC standard scores. Note SS=standard scores, TS=TSKIP, C=Comparison.

Figure 4.4. Group mean OC percentile ranks by group, gender and time. The line at the 30th percentile represents developmental delay. Note: TS=T-SKIP and C=Comparison.
To determine the influence of the T-SKIP package on the OC skills of the T-SKIP students in the study, as compared to the Comparison group, a two-level hierarchical linear model (HLM) was run with students nested within teacher. The Intra-Class Correlation (ICC) coefficient for the HLM on OC standard scores was .30. The ICC was calculated using the sigma squared and tau coefficients produced from the HLM. The ICC builds an adjustment into the HLM to account for the amount of variance attributed to class/teacher within the model.

![Table 4.6. Results of the HLM for OC standard scores (OCSS). *p<.05](image)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>t</th>
<th>df</th>
<th>p</th>
<th>Cohen’s d</th>
<th>R</th>
<th>r²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison</td>
<td>5.66</td>
<td>.48</td>
<td>11.81</td>
<td>8</td>
<td>.000</td>
<td>.27</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td>T-SKIP</td>
<td>4.70</td>
<td>.67</td>
<td>7.02</td>
<td>8</td>
<td>.000</td>
<td>2.27</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td>Pretest</td>
<td>.50</td>
<td>.14</td>
<td>3.44</td>
<td>9</td>
<td>.007</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimates adjusted for covariates for post intervention data appear in Table 4.6. The coefficient associated with T-SKIP indicates the difference in post-test score between the treatment and comparison group. Specifically, the T-SKIP group had OC standard scores 4.70 points higher than children in the Comparison condition when controlling for pretest OC standard scores, (p<.001). In other words, when pretest scores equaled zero, students in the comparison group had a predicted posttest OC mean standard score of 5.66, compared to 10.36 for students in the T-SKIP group. The interpretation of the pretest slope is for every one point increase in pretest scores, both the T-SKIP group and the Comparison group were predicted to increase their OC standard score posttest means by half a standard point.
**Effect Size.** The effect size (Cohen’s $d$) for the main effect of group difference by posttest OC standard score was 2.27 (see Table 4.6). As OC standard scores were used for the analyses in this study it was appropriate to calculate the effect size using the OC standard scores. Mean posttest OC standard scores for each group were used along with pooled standard deviations of the OC standard scores to compute Cohen’s $d$. The Cohen’s $d$ was then translated into an $r$ coefficient of .75 and squared ($r^2 = .56$). Squaring the $r$ coefficient provided the amount of variance explained (56%) within the posttest OC standard scores that was attributed to the T-SKIP intervention (Lomax & Hahs-Vaughn, 2012; see Table 4.6).

The eight-week T-SKIP package produced statistically significant improvements in OC standard scores from pretest to posttest as compared to the Comparison group ($p<.001$). The pretest to posttest gains in OC standard scores resulted in OC percentile growth of 33 percentiles (21$^{rd}$ to 54$^{th}$ percentile) for the T-SKIP group. Given that there were strong effects for the influence of the T-SKIP package on OC skills ($d=2.27$; $r^2 = .56$) the next question was whether these effects were similar for girls and boys.

**Research Question 4**
To what extent does gender influence the effects of the T-SKIP package on the OC skills of preschool children who are disadvantaged?

**Hypothesis 4a.** There will be no differential treatment effects for gender for children in the T-SKIP package.

To determine the extent to which the T-SKIP package contained differential effects by gender, a two-level HLM was run with students nested within teacher and only the data from the T-SKIP group included. Gender was included as a predictor variable,
and pretest scores were centered around the grand mean to control for different pretest scores amongst the students (Table 4.7).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coef</th>
<th>SE</th>
<th>t</th>
<th>df</th>
<th>P</th>
<th>Cohen’s $d$</th>
<th>r</th>
<th>$r^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison Boys</td>
<td>5.64</td>
<td>.54</td>
<td>10.406</td>
<td>8</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-SKIP Boys</td>
<td>5.37</td>
<td>.79</td>
<td>6.819</td>
<td>8</td>
<td>.000*</td>
<td>2.72</td>
<td>.81</td>
<td>.66</td>
</tr>
<tr>
<td>Comparison Girls</td>
<td>-0.19</td>
<td>.42</td>
<td>-0.460</td>
<td>8</td>
<td>.658</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-SKIP Girls</td>
<td>-0.66</td>
<td>.58</td>
<td>-1.145</td>
<td>8</td>
<td>.285</td>
<td>1.93</td>
<td>.7</td>
<td>.49</td>
</tr>
<tr>
<td>Pretest Slope</td>
<td>0.47</td>
<td>.16</td>
<td>2.878</td>
<td>9</td>
<td>.018</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.7. The result of HLM for differential gender effects within the T-SKIP package. *$p < .05$*

There were no differential effects for gender with the T-SKIP package ($p = .285$). The ICC for the HLM on Research Question Four was 33%. When pretest scores equaled zero, boys in the Comparison group had a predicted posttest OC standard score mean of 5.64 and girls 5.45. When pretest scores equaled zero, boys in the T-SKIP group had a predicted posttest OC standard score mean of 11.01 and girls 10.16. For every one point increase in pretest scores, both the T-SKIP group and the Comparison group boys and girls increased their predicted posttest means by .47 standard score points.

It is interesting to note, that residual error variance due to gender was not significant ($\chi^2[.22, 8] = 1.96, p > .500$). A chi square analysis was conducted as an output of the HLM to determine if residual variance due to error was significant or not. Simply put, all teachers in the T-SKIP classes did not have differential treatment effects for gender with both boys and girls in their classes having similar intervention gains.

In summary, there were no significant differential effects for the T-SKIP package based on gender. Boys and girls in the T-SKIP condition both improved their OC
standard scores. Comparison boys and girls did not improve their OC standard scores at
the posttest, and Comparison girls displayed slightly lower OC standard scores at the
posttest. Chi square analyses determined that the ECTs did not teach boys or girls
differently. Overall, the results for Research Question Three show that the T-SKIP
package results in significantly better OC skills for the T-SKIP group as opposed to the
Comparison group, and that the results for research question four indicates improvements
for both boys and girls. Given that the ECTs on average delivered the T-SKIP package
with 47% fidelity, it is worth examining the relationship between student scores on OC
skills and intervention fidelity.

**Research Question 5**

To what extent did the fidelity of the T-SKIP teachers predict posttest OC scores?

For only the T-SKIP group while controlling for pretest scores a two-level HLM was
conducted to determine how fidelity affected posttest OC scores fidelity was entered into
the model as a predictor variable.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% Fidelity</td>
<td>7.89</td>
<td>1.51</td>
<td>5.20</td>
<td>3</td>
<td>.014</td>
</tr>
<tr>
<td>100% Fidelity</td>
<td>4.91</td>
<td>3.01</td>
<td>1.64</td>
<td>3</td>
<td>.201</td>
</tr>
<tr>
<td>Pretest Slope</td>
<td>0.27</td>
<td>0.11</td>
<td>2.41</td>
<td>4</td>
<td>.073</td>
</tr>
</tbody>
</table>

Table 4.8. HLM for overall fidelity

The ICC for overall fidelity was 11%. When controlling for pretest scores, fidelity
for the T-SKIP group had a non-significant impact on posttest OC standard scores
($p=.201$). If fidelity equaled 0% and pretest scores equaled 0, then the T-SKIP predicted
posttest means equaled 7.89 standard score points. If fidelity equaled 100%, then
predicted posttest group means for the T-SKIP group equaled 12.80 standard score points. Thus, for every 1% increase in fidelity, T-SKIP posttest scores were predicted to increase .12 standard score points.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>SE</th>
<th>T</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% Fidelity</td>
<td>7.38</td>
<td>3.12</td>
<td>2.36</td>
<td>3</td>
<td>.099</td>
</tr>
<tr>
<td>100% Fidelity</td>
<td>5.02</td>
<td>5.25</td>
<td>0.95</td>
<td>3</td>
<td>.410</td>
</tr>
<tr>
<td>Pretest Slope</td>
<td>0.27</td>
<td>0.10</td>
<td>2.60</td>
<td>4</td>
<td>.060</td>
</tr>
</tbody>
</table>

Table 4.9. Results for HLM for Level-1, core element fidelity

An additional two-level HLM was performed that also controlled for pretest scores to determine the extent to which Level-1 fidelity predicted OC standard score gains for the T-SKIP group. Fitted means for post intervention Level-1 fidelity appear in Table 4.9. Controlling for pretest scores, Level-1 fidelity did not statistically improve posttest scores (p=.319). The ICC for Level-1 fidelity equaled 12% and the HLM adjusted for the resulting teacher effects. Additionally, if Level-1 fidelity equaled 0%, then T-SKIP predicted posttest means equaled 7.38 standard score points. If Level-1 fidelity equaled 100%, then predicted posttest group means for the T-SKIP group equaled 12.40 standard score points. For every 1% increase in Level-1 fidelity, T-SKIP posttest scores were predicted to increase .12 standard score points.

In summary, the 100% fidelity coefficient reported in Table 4.8 can be interpreted to mean that if a T-SKIP expert were to implement the program at 100% then the OC standard score mean would be 14.31. The predicted T-SKIP expert OC standard score mean is almost twice the predicted OC standard score mean for 0% fidelity (7.89) and approximately 40% larger than the actual post intervention OC standard score of 10.37.
earned with 47% fidelity. Therefore, as fidelity improved, OC standard scores improved. As Level-1 fidelity was considered core element fidelity, it is important to note that each class earned its highest fidelity percentage in Level-1 fidelity. When compared to overall fidelity and Level-2 fidelity, which can be interpreted as the fidelity that is highly desired, Level-1 fidelity occurred the most during the eight-week T-SKIP intervention. Practically speaking, it is desirable to earn the highest fidelity percentage in Level-1 fidelity because it centers on skill practice. Despite the highest marks for the ECT’s fidelity occurring within Level-1 fidelity, it was not significantly related to posttest OC standard scores ($p= .410$). The absence of statistical significance for fidelity may be due to a lack of a priori power secured for the HLM models.

**Summary**

Five research questions were addressed during this study. Research Questions One and Two involved the ECTs and sought to demonstrate the ECTs’ knowledge during the initial workshop and, subsequently, their ability to deliver the T-SKIP package with fidelity. Research Questions Three-Five addressed the extent to which the OC skills of young children from disadvantaged settings improved as a result of the T-SKIP package and also, whether the acquisition of OC skills varied by gender and level of fidelity. Based upon the results of the T-SKIP package, the ECTs were able to demonstrate knowledge as a result of the initial workshop. Subsequently the ECTs were able to implement T-SKIP with a grand mean of fidelity at 47% with Level-1, and core element fidelity occurring at a 59% accuracy rate.

With T-SKIP implemented at a 47% accuracy rate, the young children in the T-SKIP group statistically improved their OC skills after eight weeks ($p<.001$) when
contrasted against the Comparison group. The results of the eight-week T-SKIP package displayed gains in OC standard scores (7.02 to 10.37), OC raw scores (16.86 to 54.11) and OC percentile ranks (21st to 54th).

Differential effects of T-SKIP by gender were ruled out \((p=.201)\) from the results of the HLM for gender. Moreover, the percentage of fidelity for T-SKIP lesson implementation did not statistically impact OC posttest scores for the T-SKIP group \((p=.410)\). However, it was predicted that every 1% point increase in fidelity might improve posttest OC standard scores by .12 points, thus demonstrating a positive linear relationship between fidelity and OC posttest scores that was not statistically significant. Overall, the T-SKIP package produced a strong statistically significant effect \((d=2.27, r=.75, r^2=.56)\) on the OC skills of young children who are disadvantaged.
Chapter 5: Discussion

The purpose of this chapter is to discuss the results of the T-SKIP package, including strengths and limitations to T-SKIP. I will first discuss the results of Research Questions 1-2 that focused on teachers. Next, I will examine the results of Research Questions 3-4 and discuss the influence of T-SKIP on the OC skills of the boys and girls who participated in this study. Finally, I will conclude with implications and future research.

Influence of T-SKIP Coaching on Teacher’s Knowledge

As stated in Chapter 3, before ECTs implemented T-SKIP, they first participated in an initial six-hour coaching workshop where they received all T-SKIP content and materials. Research Question One addressed the extent that the ECTs could demonstrate MD and PE knowledge by the end of a six-hour initial workshop led by MD/PE experts. The goal of the workshop was that the ECTs would be able to physically, verbally, and in written form demonstrate knowledge of PE/MD by the end of the workshop.

Specifically, the intended outcomes of the T-SKIP teacher initial workshop were:

- the developmental sequences (stages) for throw, kick, catch and strike (Gallahue, Ozmun, & Goodway, 2012). There are no stages for roll and bounce.
- critical elements of a proficient performer for each of the skills. The critical elements are derived from elementary physical education textbooks (Graham, Holt/Hale, & Parker, 2013) as well as motor development materials
(Gallahue et al., 2012; Hayward & Getchell, 2009; Payne & Isaacs, 2009; TGMD-2 Ulrich, 2000)

- common errors that occur for each skill. Typical patterns of performance including immature and mature patterns for each skill were demonstrated, as well as ability to visually identify each occurrence.

Despite a wide range of goals the only formal assessment of the ECTs during the initial workshop was through a written response to six MD video exams that corresponded to each of the six OC skills. The teachers were able to formally demonstrate written knowledge of MD/PE by completing these six MD video exams that corresponded with each OC skill. Their results displayed an 88-94% success rate. The ability of the teachers to do well in these video exams may be attributed to teachers learning the content of each skill through the consistent structure provided in the workshop and due to active learning/peer support throughout the workshop.

The focus of the six-hour PD workshop was on necessary MD/PE and T-SKIP content, including detailed knowledge of the six OC skills included in TSKIP. Each ECT was taught the six OC skills in the following order: catch, throw, roll, dribble, kick and strike. I taught the ECTs the developmental sequences and critical elements of each OC skill through interactive videos and live demonstrations and also through active learning.

Teachers successfully completed each individual exam (mean skill scores = 90% Catch, 88% Throw, 89% Roll, 92% Bounce, 93% Strike, and 90% Kick) successfully the first time, except for roll, which required three attempts to achieve over 85% success. Teachers could not identify the common error present during the roll exam until the third
attempt. It is unclear why the roll required three attempts at the video exam in order to complete at an 85% success rate, however their struggles corresponded with difficulties during the teaching of the skill. During the teaching of the roll, teachers struggled to verbally answer probing questions for their understanding of the roll. In addition, when I demonstrated common errors of the roll, the ECTs could not answer what error I demonstrated until after several attempts. I am not certain why the roll was a struggle for the ECTs and the other skills were not. My uncertainty is compounded by the fact that the roll was the third skill I presented. I presented roll in the same manner as the first two skills and after the ECTs worked through their initial anxieties surrounding the content. Teachers were eventually able to correctly identify common errors and correctly verbalize answers to probing questions. However, the teaching of roll will need to be reevaluated and future research should probe ECTs when they are unable to successfully demonstrate knowledge for a skill during a video exam.

One of the aspects of the workshop that was effective was that I did not progress to the next video exam (from catch, to throw, to roll etc.) until all of the ECTs successfully passed each video exam by providing written responses at an 85% success rate. To complete the video exam, the ECTs watched two five-second clips with a child performing a stage of the skill (Throw, Catch, Strike, and Kick). For roll and bounce, as there are no stages for these skills, the two five-second clips contained a child performing the skill with one common error. I counter-balanced the order of how the skills were presented (either a high performing child or a low performing child) on the video exam to avoid a pattern that was easy to detect. After watching a clip, the ECTs’ written exam asked what stage (or common error) was present for the skill. After identifying the
skill/common error, teachers then identified what was the focal element of the skill (on which to focus prompting) in order to elicit a more proficient pattern of movement. Teachers then identified verbal, visual, and physical prompts to align with the focal element. Finally, the ECTs were asked to name the critical elements for the skill. After the ECTs completed the written exam for each skill, I collected the forms and checked to determine if the ECTs completed the portion of the exam at 85%.

I liked the video exam because the exam represented knowledge necessary for implementing T-SKIP. It is important that ECTs understand critical elements, common errors, and how to prompt students correctly. Moreover, ECTs need to focus on one aspect of a skill when teaching a new learner to avoid overwhelming the student. The video exam not only assessed the ECTs’ MD/PE knowledge, but also reinforced translating the knowledge to students in a direct, specific, and aligned manner. Formal assessment of the ECTs’ ability to demonstrate knowledge was obtained through the written test, which allowed for assessment of individual achievement without contamination from peers.

In addition, the video exam was a quick way to formally assess the ECTs during the workshop. I was quickly able to decide if the ECTs captured 85% accuracy on the exam or not by determining whether they correctly identified the correct stage or common error. If the ECTs could not identify the correct common error/stage then all subsequent prompting questions would also be incorrect. The limitation to the written test from the MD video exams is that I was unable to determine the competency of the teachers to provide physical demonstrations and verbal task representations and cues to the children. Despite this limitation, I would still recommend completing the video exams
in future workshops. If time permitted I would also recommend asking the teachers to observe a child demonstrating a skill and make the appropriate instructional decisions in order to determine their effectiveness in this more practical area.

A second goal of the workshop was to assess what the ECTs were expected to perform (verbal and physical) through an informal assessment.

The ECTs were expected to demonstrate:

- the six OC skills at a mature stage or at least a more advanced stage
- ability to provide verbal cues serving as verbal prompts for proper skill performance.
- ability to set up and demonstrate basic task progressions of each skill needed to follow lesson plans.
- ability to modify tasks based upon present level of performance and rates of improvement. In response to present level of performance/rate of improvement teachers were to modify equipment, use visual prompts and manipulate tasks accordingly.
- implementation of each lesson plan with fidelity, appropriate transitions and pacing, and concern for student safety.
- ability to set up the equipment for each lesson appropriately

I informally assessed the ECT’s ability to verbally and physically demonstrate MD/PE knowledge via observations of the OC practice trials and the practice implementation of the lesson plans during the workshop. I observed that the ECTs were able to physically exhibit MD/PE knowledge because they appeared to demonstrate each
critical element, skill, and practiced portions of the lesson plans correctly. Furthermore, when the ECTs were questioned to check for understanding, all ECTs were able to answer my questions correctly.

Unfortunately, formal data was not collected on the ECTs’ ability to physically and verbally demonstrate MD/PE knowledge, and thus future research is needed to actually quantify that data. Therefore, it was impossible to substantiate to what degree physical and verbal competency existed. The decision was made to not use a formal assessment on the physical and verbal aspects of MD/PE knowledge due to the time constraints surrounding the workshop. It was not practical or realistic to expect more than six hours of workshop time with the ECTs who had hectic schedules. Teachers’ time is precious and valuable. It may be difficult to obtain more than six hours of initial workshop time with teachers to complete more assessments. I am not certain whether future research could capture more data, but I recommend that an effort be made to do so in future studies.

**Cultivating ECT Buy-in with T-SKIP**

The research team demonstrated the content and provided practice of skills for the ECTs in a manner that focused on how the students benefited from T-SKIP. Seeing students benefit from T-SKIP right away elicited buy-in from the ECTs on the use of T-SKIP and promoted positive attitudes of teachers to T-SKIP (Guskey, 2002). Once the ECTs observed that their students were learning and improving OC skills quickly, the ECTs appeared to buy into T-SKIP and became excited about teaching T-SKIP to their students. Thus, demonstrating content in a manner that displayed practical outcomes for the ECTs was a strength of the initial workshop.
Limitations of the Initial Workshop

Despite the ECTs appearing to buy into T-SKIP and seeming excited about implementing T-SKIP in their classrooms, the logistics of the workshop could improve. Content was demonstrated to the ECTs through video, live, and peer demonstrations. Unfortunately, no preschool children were in attendance at the workshop to demonstrate how skills actually look when observing children perform them (although children were included in video demonstrations). Including young children within the second portion of the initial workshop pertaining to lesson plan practice (outside of the video) may improve the transfer of learning from the workshop to the classroom by mimicking the actual environment in which the ECTs would teach T-SKIP. Moreover, including preschool children into the workshop may increase ECT buy-in with T-SKIP by further reinforcing how young children would learn quickly. Therefore, I would keep the structure used during the first half of the workshop where the ECTs learned content knowledge the same. But I would infuse preschool children into the second half of the workshop where teachers practiced lessons and progressions.

Furthermore, a lack of inclusion for support staff within the initial workshop was a limitation of this study. The decision was made to lessen the degree that T-SKIP depended on assistant teachers based upon the results of the pilot study. Within the pilot study, assistant teachers struggled to implement their assigned portion of SKIP with fidelity. Therefore, it was decided to minimize the assistant teacher’s formal role in T-SKIP and only ask assistant teachers to provide behavioral and procedural support to the ECTs during T-SKIP. Anecdotal evidence surfaced that assistant teachers wanted to be part of the initial training and wanted more responsibility in delivering T-SKIP. In future
studies I would recommend involving both the lead and assistant teachers in the professional development workshop and giving both teachers responsibility in delivering T-SKIP.

In addition, center coordinators were invited to the initial workshop but not required to attend. Not requiring the center coordinators to attend the initial workshop was a missed opportunity to have the center coordinators provide the ECTs with additional coaching and support throughout T-SKIP. Center coordinators are present daily at all Head Start sites and provide the ECTs with constructive teaching feedback through observations of their everyday programming. If center coordinators would have attended the initial workshop, and been provided with the T-SKIP materials, they could have provided constructive feedback to the ECTs on T-SKIP. Therefore, an opportunity may have been missed to utilize the center coordinator to assist with providing on-going coaching and support to the ECTs by not requiring center coordinators to attend the initial workshop.

Furthermore, it is a goal of Head Start to involve the parents of the children as much as possible within the learning process. Parents were not involved in this study outside of soliciting consent for their children to participate in T-SKIP. It would have been valuable to do a one-shot evening workshop for parents about motor skill development in their children and explain the T-SKIP package. Future research should consider involving parents in the T-SKIP package in line with Head Start guidelines.

Finally, the duration of the initial workshop was both a strength and weakness. Having the initial workshop in one day was convenient for scheduling, cost effective and ensured that all ECTs received the same amount of initial instruction. However, the
ECTs appeared restless by the end of the workshop. Moreover, observations of the affect of the ECTs showed burnout, which may have compromised the ECTs’ ability to retain information by the end of the workshop. Therefore, when implementing a workshop to ECTs it may be advantageous to consider multiple workshops with shorter durations if feasible.

**Efficacy of Instructional Materials**

A number of instructional materials were provided to the ECTs to assist them in learning and applying the content both in the workshop and in the classroom. The teachers received task cards, skill cards, and task analyses sheets as part of their instructional supplemental materials. The task analysis sheets, task and skill cards were designed to support the ECTs’ knowledge of the OC skills as they went through the workshop and implemented the T-SKIP lessons. These supplemental materials also served to assist the ECTs to provide individualized instruction to each learner in a manner similar to a MD/PE expert. Modifying tasks based upon the present level of performance of an individual learner is considered a best practice (Rink, 2009) and requires expert-level knowledge and experience (Subban, 2006). The task analysis sheets and task/skill cards assisted the ECTs who did not possess expert-level knowledge by providing the ECTs with a reference to diagnose skill errors and prescribe modifications to instructional tasks.

The use of the task analysis sheets along with lesson plans, task cards, and skill cards helped to simplify the content into manageable chunks by focusing on one particular aspect of each skill at a time. When a skill contained multiple critical elements, teachers who were new at teaching the content might provide feedback on
multiple aspects of the skill simultaneously and potentially overwhelm a new learner. Using task analysis sheets that are in alignment with each OC skill and lesson plan helped keep the ECTs focused during the workshop and provided guidance with how to deliver the content to students in a manageable manner.

Even though no formal data was captured, it was apparent to the research team that the ECTs were overwhelmed with the new content at the beginning of the initial workshop when the first skill of catching was presented. The ECTs appeared to look at each other and ask questions, frantically wrote down notes, shook their heads, held their hands to their face and appeared stressed during the first thirty minutes of the workshop. However, the consistent structure that was provided for each of the six OC skills seemed to provide comfort to the ECTs. By the second skill (Throwing), the ECTs answered questions more quickly, became engaged in learning, seemed to have fun and started to provide peer-to-peer coaching during practice of each subsequent skill. As the workshop progressed across the morning the ECTs appeared to grow in confidence. Unfortunately, no formal data captured this aspect of the ECTs’ journey through the initial coaching workshop. Future research should attempt to formally capture attitudinal and affect changes of the ECTs during the initial workshop.

The supporting materials appeared to be very beneficial during the initial workshop as the ECTs were observed using them during practice sessions for each skill. However, the ECTs rarely used the supporting materials during the actual implementation of the lessons outside of glancing at the lesson plans before the lesson started and occasionally during the lesson. The teachers seldom used the supplemental materials despite always carrying their T-SKIP binder that contained all supplements.
Additionally, it was unknown whether the ECTs used the supports to prepare each lesson. During informal conversations with the ECTs, some did report looking at the supplements before some of the first few lessons. One suggestion might be to create large posters and pictures of the stages/critical elements of the OC skills to hang on the wall. A large visual aid may help ECTs use lesson plan supports during the lesson without requiring them to use their binders. Future research is needed to determine whether the ECTs used the supporting materials and the amount of efficacy the supporting materials had on the ECTs’ ability to implement T-SKIP.

Overall, I think the supporting materials were valuable for the teachers. However, in future studies I would also provide instructional videos through a website or a jump drive as an additional supplement. Emerging evidence within the motor learning literature demonstrates that video modeling may help improve the learning of a new skill as compared to live modeling (Schmidt & Lee, 2013). Providing ECTs with additional video support may improve their learning of the content. Future research is needed to determine if video support is valuable in conjunction with paper reference material.

In summary, the ECTs were able to demonstrate between 88-94% on each MD video exam. Informal observations revealed that the ECTs could demonstrate verbal and physical PE/MD knowledge. I would keep the structure of the first half of the workshop (MD/PE content) intact while re-thinking the instruction surrounding roll. However, it is recommend to include children into the second portion of the workshop focusing on practice of lessons and progressions. Including preschool children into lesson plan practice, along with the task/skill cards, and additional video resources may assist with transfer of learning into the classroom. Future research needs to consider splitting the
workshop into multiple sessions with shorter duration, and attempting to formally assess verbal and physical MD/PE knowledge by ECTs. Creating more workshop sessions, with shorter durations may improve attention capacity. However, creating more sessions may also be difficult to accomplish logistically given the difficulties with scheduling multiple ECTs and the threat that not all ECTs will attend each session. The results of the formal video exam and informal observations provided an answer to Research Question One displaying that the ECTs could demonstrate MD/PE knowledge by the end of the six-hour initial workshop.

**Ability of ECTs to Implement T-SKIP with Fidelity**

Teachers were able to learn MD/PE knowledge necessary to implement T-SKIP as indicated above. However, it was important to determine if the ECTs could translate their new knowledge into the classroom and deliver T-SKIP with fidelity. Although the workshop was effective in developing important MD/PE knowledge, I knew a single training session was not going to be sufficient to help the ECTs transfer knowledge learned from the initial workshop into the classroom. According to Shelton and Jones (1996), providing teachers with continuous PD as opposed to a one-shot workshop better ensures that teachers will make changes in the classroom based upon the content learned within PD. In addition, the ECTs in the pilot to this study required on-going coaching and support to deliver SKIP with fidelity. Teachers were provided with continuous PD throughout the implementation of TSKIP in the form of on-going coaching and support and not just a one-shot workshop (Shelton & Jones, 1996). Thus, Research Question Two sought to examine if ECTs were able to translate their new knowledge gained from the
workshop. Specifically, could the ECTs implement T-SKIP lesson plans across the eight-week intervention as originally intended?

**Lesson Plan Fidelity.** Lesson plan fidelity for every T-SKIP lesson was calculated. Lesson plan fidelity served as a measure of the internal validity for the intervention (O’Donnell, 2008). The research team video recorded each T-SKIP lesson and all ECTs wore wireless microphones in order to support calculation of fidelity. At first, the ECTs were hesitant to wear wireless microphones. Some ECTs verbalized that wearing the microphone made them feel uncomfortable and nervous. Teachers were reassured that no one without Institutional Review Board approval would listen to the recordings and that under no circumstances would any recordings be shared with the ECTs’ supervisors. That reassurance seemed to ease the ECTs’ hesitation towards wearing wireless microphones.

Despite the ECTs’ initial hesitation with wireless microphones, their use is recommended to continue to support calculation of fidelity through video recordings. Teachers appeared concerned with “doing a good job” and communicated that they wanted to be perceived as “good teachers.” After engaging in informal conversation with the ECTs, I decided that a live rater who was present during the lessons might create extra anxiety for ECTs who were already nervous about “doing a good job.” This observation is in line with the educational research literature and may be considered a novelty or Hawthorne Effect (Ary et al., 2009). Thus I used video to calculate fidelity with accuracy. The decision to calculate fidelity from a video recording was productive as the ECTs’ discomfort with the wireless microphone wore off quickly, after one lesson for the most part. Also, re-watching the video to calculate fidelity helped me make future
decisions on how much and what types of coaching were needed. For example, when the ECTs struggled with critical elements, setting up tasks or providing aligned, correct prompts, I focused on these areas in my coaching. During a throwing demonstration, when an ECT stepped with the wrong foot and struggled with the direction of where to start her feet, I stopped her, and told her to step with her sticker foot (put a sticker on her opposite foot) and pointed her in the correct direction. However, if ECTs struggled with pacing or with a secondary aspect of the lesson, coaching occurred after the lesson.

Being able to view the lessons via video and calculate fidelity after each lesson enabled me to capture each aspect of the lesson and make better informed coaching decisions during the subsequent lesson. I would recommend that future research calculate fidelity day-by-day during the intervention in order to inform subsequent coaching decisions.

**Overall Fidelity.** Overall, the ECTs demonstrated a 47% mean fidelity score aggregated from each T-SKIP lesson throughout the eight-week intervention. At first glance, a 47% fidelity score appears low. I hoped that the ECTs would achieve overall fidelity above 50%. Some educational guidelines have suggested that fidelity below 50% provides significant threats to internal validity of the study (Durlak & Dupree, 2008; O’Donnell, 2008; Ward, personal communications, 2014) although no actual formal benchmark exists (Glanz, Rimer, & Viswanath, 2008).

The 47% fidelity found in this study was not surprising. I actually saw it as a positive as the ECTs had no previous experience and they had first learned the content during the initial workshop. In addition to calculating overall fidelity, I divided fidelity into Level-1 and Level-2 fidelity measures. Level-1 fidelity included the core elements of the lesson that pertained to skill practice. Essentially, it was believed that without
Level-1 fidelity there would be limited skill practice and learning (see Chapter 3 for more details). Overall, the ECTs achieved 59% Level-1 fidelity.

In contrast, Level-2 fidelity items of the lesson plans included the components of the lesson that were highly desired best practices and good pedagogy amongst MD/PE experts (e.g. Gagen & Getchell, 2006; Rink, 2009; Robinson, Webster, Logan, Lucas, & Barber, 2012). But I believed that if Level-2 fidelity items were not achieved, skill practice for the students could still ensue. Teachers received credit for Level-2 fidelity simply for including the Level-2 item regardless of quality (see Chapter 3 for more details). An example of Level-2 fidelity included having a locomotor break in between OC progressions. Locomotor breaks helped to break up the monotony of repetitive skill practice and also provide students with physical activity focusing on locomotor skill development. However, physical activity and locomotor skills were not the focus of this study (OC skills were the focus). Including the locomotor break was a good part of the lesson, but not critical to learning OC skills.

Unfortunately, the ECTs only achieved 34% Level-2 fidelity. Although no formal data was collected on why the ECTs achieved such a low Level-2 fidelity score, anecdotal observations and communication with the ECTs revealed that the ECTs were focused on providing as much skill practice as possible and that the ECTs did not seem to value or understand the importance of including all of the Level-2 fidelity items that included aspects such as musical warm-up, previewing the next lesson, and modifying tasks. For example, one ECT in particular would often forget her music for the warm-up. When asked why she was not implementing the musical warm-up she told me that she felt rushed to enter and exit the gym and wanted to make sure that the students received
as much skill practice as possible. Despite conversations with the ECT that she had more time than she thought, the ECT continued to skip the musical warm-up even when the music was brought for her.

Another example of missed Level-2 points occurred with the modification of tasks for individual and class levels of performance. Most of the ECTs in this study experienced significant difficulty in modifying tasks for individual learners and seldom changed the lesson to optimize class level performances. The ECTs were told that lesson plans were written for all sites in the same manner and that it was expected that the ECTs would modify tasks within the lesson to account for student differences. I frequently prompted the ECTs to look at task analysis sheets to make adjustments for their students and even offered suggestions on how to change the lessons to improve student learning. Unfortunately, unless I directed a specific change to a lesson plan, the ECTs never modified the lesson with the exception of adding or removing locomotor breaks.

Modifying tasks for individuals and for the entire class may require a deeper content knowledge, and thus it was not surprising that the ECTs lost the majority of Level-2 points in the modification category. Moreover, modifying tasks to the individual needs of the student is a best practice within both PE and motor development (Gagen & Getchell, 2006; Robinson et al., 2012). Perhaps once the ECTs felt more comfortable with motor development content and with PE pedagogy it is possible that they would modify tasks for individual and group needs.

I believe that parceling fidelity into categories helped to determine where the ECTs lost overall fidelity points in order to target coaching support on the areas in which fidelity suffered the most. In the beginning, coaching and support from the lead
researcher focused on the Level-1 fidelity items. Teachers needed support to set up tasks, needed confirmation of correct demonstrations, required warning about pacing and transition time, and also needed prompting to provide verbal cues to the children. While providing coaching and support in the areas that the ECTs needed the most, it became apparent that the ECTs were surprisingly aware of their shortcomings during T-SKIP. Teachers would often ask if a demonstration was correct, if the set up was right and how their timing was going. Teachers communicated that they felt supported by the research team. The ECTs’ perceived level of support might have been a result of the research team providing assistance to the ECTs, when they felt they needed it the most.

As the ECTs navigated across the lessons of the eight-week intervention, the type of support that the ECTs needed to implement T-SKIP appeared to change. Although I did not collect data on the amount and type of support teachers needed, I was at every session and was the only person who provided coaching and support. I felt that I changed coaching support from a focus on Level-1 fidelity items to a focus on Level-2 fidelity as the ECTs became more familiar and comfortable with the T-SKIP. Again, an example of providing Level-1 coaching support occurred when an ECT incorrectly demonstrated the throw by stepping with the wrong foot. I stopped the ECT, put a sticker on her opposite foot and told her to tell the class to step with the sticker foot. The sticker foot was in the lesson plan but the ECT did not have it on her foot. Examples of coaching support surrounding Level-2 fidelity included the ECTs asking if they could implement an extra locomotor break, skip a locomotor break, and change the musical warm up or prompting the ECTs to modify tasks. Teachers’ perceptions of being supported through on-going coaching appeared to be important to the ECTs’ buy-in for implementing T-SKIP.
Anecdotal conversations with the ECTs revealed that the ECTs felt supported throughout the intervention and confident in the power of T-SKIP to improve their students. However, the ECTs claimed that without the backup of the research team they would have been scared to initially begin T-SKIP as the content was so novel.

Becoming less reliant on coaching and support to implement Level-1 items speaks to the ability of the ECTs to provide opportunities for their students to correctly practice OC skills. Unfortunately, a shortcoming of this study was that no formal data was calculated on how much coaching and what type of coaching/support occurred throughout the intervention. However, I believe that on-going coaching and support was necessary and helped to create an environment for students to learn OC skills. Future research is needed to determine if ECTs would improve fidelity and lessen reliance on the research team if ECTs only had limited coaching and support. Additionally, future research needs to capture the type, frequency and duration of coaching supports through T-SKIP.

In summary, dividing fidelity between Level-1 and Level-2 items helped to qualify the 47% overall fidelity score. I believed that differentiating between the categories of fidelity was necessary because not all fidelity items translate equally. In this regard I believed that the items in Level-1 fidelity were more important and necessary than Level-2 items. As stated above, the ECTs only achieved 34% Level-2 fidelity, which lowered the overall fidelity score. Fortunately, Level-1 fidelity was the highest recorded fidelity but improving Level-2 fidelity would help to improve overall fidelity and the internal validity of T-SKIP. Separating fidelity into Level-1, core elements and Level-2 highly desired fidelity was a strength of this study and added to the previous
SKIP studies. Future research is needed to determine how to improve all fidelity measures and strengthen the internal validity of T-SKIP.

**Student Learning from T-SKIP**

The primary research question (RQ3) of interest in this study was the effect of the eight-week T-SKIP package on the OC skills of preschool children who are disadvantaged. Even though fidelity needed to improve, the ECTs did provide their students opportunities to practice OC skills throughout the eight-week T-SKIP package. Therefore, it was important to examine the extent to which young children from disadvantaged settings who received T-SKIP improved their OC skills. The next section focuses on Research Question Three and discusses the magnitude of how the ECTs improved the OC skills of their students through T-SKIP.

**Pre-Intervention Developmental Delays in FMS**

Although there was no primary research question directly associated with baseline measures of OC skills, Hypothesis 3a considered the pre-intervention developmental level of the children in this study. I hypothesized that the majority of children in this study would be developmentally delayed with their OC skills at the pretest (Hypothesis 3b) as many young children from socioeconomically disadvantaged environments typically demonstrate delays with FMS (Goodway & Branta, 2003; Goodway, Crowe & Ward, 2003; Goodway, Robinson & Crowe, 2010; Robinson & Goodway, 2009). The results of this study supported Hypothesis 3b and revealed that 81% of the participants were below the 30th percentile at the pretest scoring an overall mean of the 19th percentile. The T-SKIP group scored a mean OC percentile rank of 21 and the comparison group scored a mean OC percentile rank of 16. These data are in line with a
recent study that revealed 86% of children from similar disadvantaged settings as the
current study demonstrated developmental delays when tested (Goodway et al., 2010).

All of the students in this study were enrolled in Head Start and received Head
Start’s current standard of practice from their classroom teachers. Head Start’s current
standard of practice consisted of at least 30 minutes of daily, unstructured, teacher-
supervised, free play that is well equipped (USDHHS, 2013). When children were
outside, they could access typical playground equipment like “jungle gyms.” When
children had free play indoors, some facilities had smaller jungle gyms set up in a gross
motor space or in a gymnasium. Throughout the eight-week intervention, all sites during
both indoor and outdoor free play provided the children with access to a variety of
equipment needed to practice OC skills. All sites provided a variety of balls and contexts
in which they could experience OC skills. The only exception was the skill of strike. In
most sites there no bats with which the students could strike.

The pretest scores of all students T-SKIP and Comparison students were
consistent with the pretest OC percentile ranks collected within the pilot study \((n=79,
M=17, SD=2.5)\). The developmental delay in pretest scores standard scores suggests that
free play alone may not fulfill Head Start’s goal of developing gross motor skills in their
children. Based on these data and those from other studies, it appears well equipped free
play is not a sufficient vehicle through which to develop FMS (Apache, 2005; Kirk &
Rhodes, 2011; Logan, Robinson, Wilson, & Lucas, 2011; Riethmuller et al., 2009).

It is clear from the pretest results of T-SKIP and other MSIs in the literature (e.g.
Apache, 2005; Draper, Achmat, Forbes, & Lambert, 2012) that children need motor skill
intervention (MSI) to acquire FMS and also to remediate their developmental delays
This study used an intervention called Successful Kinesthetic Instruction for Preschoolers (SKIP) that has been successfully validated to improve the FMS of young children from disadvantaged settings. However, prior research with SKIP involved utilizing an expert in MD or PE to implement SKIP. Although the results from prior SKIP studies (e.g. Goodway & Branta, 2003; Robinson & Goodway, 2009) revealed significant improvements in FMS as a result of SKIP, the ecological validity of these findings is limited as few experts exist in early childhood centers (ECCs; McWilliams et al., 2009). Thus I undertook modification of SKIP to account for the ECTs’ lack of background in MD and PE and changed SKIP to T-SKIP so that ECTs with limited background in MD/PE could learn to provide a MSI to their students (see Chapter 3 for modifications from SKIP to T-SKIP).

The Influence of T-SKIP on OC Skills of Young Children who are Disadvantaged

It was important to determine to what extent young children from disadvantaged settings who were developmentally delayed in FMS and received T-SKIP could improve their OC skills. Thus, Hypothesis 3b suggested the T-SKIP group would significantly improve their OC skills from pretest to posttest as compared to the Comparison group. In order to exam Hypothesis 3b statistically, I conducted a two-level HLM with students nested within teacher. The results of the HLM showed that T-SKIP students were predicted to have a higher posttest OC standard score than Comparison students (T-SKIP $M=10.63$; Comparison $M=5.66$, $p<.001$).

Answering the extent to which T-SKIP improved the OC skills of the students in the T-SKIP group served to validate T-SKIP as an evidenced-based package. After 450 minutes of T-SKIP instruction over eight-weeks, T-SKIP students improved their OC
scores on the TGMD-2 by over 50% (21st percentile at the pretest to 54th percentile at the posttest). In addition, the T-SKIP students moved from being developmentally delayed (M=21st percentile) to scoring in the typically developing range for OC skills (M=54th percentile) as measured by the TGMD-2. In contrast, the Comparison group went from the 16th percentile at the pretest to 13th percentile at the posttest.

**Explaining the T-SKIP Group Findings: A Dynamic Systems Perspective**

Dynamic systems theory (DST) suggests that movement is an emergent phenomenon and a product of the multiple sub-systems influencing the system (the child). The significant pretest to posttest changes in OC skills for the T-SKIP group as compared to the Comparison group can be interpreted from a DST perspective (Newell, 1986; Thelen & Ulrich, 1991). In this study the OC skill gains (T-SKIP group) or no OC skill gains (Comparison group) is the movement output of the “system” (preschool child). In order to help categorize sub-systems, Newell (1986) classified potential sub-systems into three categories of constraints. Newell’s constraints were categorized as organismic, task, and environmental.

Organismic constraints deal with constraints internal to the organism such as balance, motivation, age, and neurological maturation. This study was not designed to examine which constraints were the underlying mechanisms driving the emergence of OC skills. However, this study did aim to account for several major organismic constraints such as gender and developmental level. I accounted for gender during the analysis (refer to Chapter 4 and the section below). I also took age into account when developing tasks. However, I utilized a developmental approach and focused on developmental level (not age) to create tasks. I also considered the motivational level of
the students by creating short, variable tasks, including locomotor breaks between OC tasks, and using various types of targets within tasks. The overall task of T-SKIP was to produce proficient performances of six OC skills as defined by the TGMD-2 (catch, throw, roll, bounce, strike, and kick). To prompt a proficient motor pattern, I broke down each skill into multiple tasks that progressed from easier to harder to complex.

I designed the task progressions within T-SKIP based upon the previously validated SKIP program. Over the past twenty years, SKIP has evolved and developed good tasks and progressions that successfully manipulate environmental constraints. Both SKIP and T-SKIP are similar in that they feature the same core elements within their infrastructure. Some of the core elements of SKIP/T-SKIP are focusing on developmentally appropriate tasks sequentially aligned to the present level of performance for each individual learner, and doing so in a repetitive cycle of skills and tasks. Both SKIP and T-SKIP provide students task opportunities that increase and decrease in complexity. Students are able to successfully navigate through the complex tasks of SKIP/T-SKIP partially due to teachers focusing on critical elements and key words for children to remember.

Environmental constraints are conditions outside the body of the learner within the learning environment including equipment modifications, the teacher, the motor space, and the weather. On a macro-view of the study, I changed the environment in the early childhood centers to provided structured physical activity to enhance the learning OC skills. To change the environment, I coached the ECTs to deliver T-SKIP and provided them with developmentally appropriate equipment. As a result, I manipulated
the environmental constraints of the students by changing their gross motor environment from free play to T-SKIP and perturbed the OC skills for the TSKIP students.

Manipulating task constraints perturbed the systems of the TSKIP students to improve their OC skills. In addition, environmental constraints such as equipment accommodated for individual differences allowed for further perturbation of OC skills. Therefore, T-SKIP students’ OC skill gains at the posttest are the output of the interaction between participating in developmentally appropriate tasks, taught by the ECT who received T-SKIP coaching, all designed to accommodate the organismic constraints present within the T-SKIP student.

Comparison Results

The HLM for Research Question Three showed that when pretest scores equaled zero, Comparison students were predicted to obtain a mean OC standard score of 5.66 at the posttest (see Table 4.6). During T-SKIP, the Comparison students only received well-equipped free play (see earlier in this chapter or Chapter 3 for a description). I visited each of the five sites (Comparison and T-SKIP) three times over the course of the eight-week intervention and observed free-play. Additionally, I observed free play during the pretest and posttest for all students at each site at least two times and as many as five times. My observations of free-play at each site provide support to rule out contamination effects (T-SKIP being implemented) threatening the internal validity of the study. During these Comparison observations, all students were exposed to equipment necessary to participate in OC activities yet none chose to use that equipment (see chapter 3 for more details). Moreover, the ECTs rarely provided any feedback, structure or prompting to students during free play at any site. When the ECTs did provide structure
it was typically in the form of a game like “duck, duck, goose” or “hot potato.” Although
the students seemed to enjoy those games, the results of this study provide evidence that
no learning outcomes occurred as a result of their participation in well-equipped free
play. The observations at each site during free play lends further evidence that the only
difference in the environment between the T-SKIP and the Comparison groups was the
60 minutes of T-SKIP instruction that the experimental children received from their
ECTs.

As stated above, the Comparison students’ posttest OC scores did not change
from the pretest scores after eight weeks (16th to 13th percentile ranks). In fact, the
percentile ranks of the students in the Comparison group regressed due to the children
getting older and some of the children shifting TGMD-2 age categories. Simply put, the
Comparison students aged but did not improve their motor competence across
developmental time thus their percentile declined. Moreover, the results for the
Comparison children in this study provides support to the supposition stated earlier that
young children need to be taught OC skills in order to obtain OC competence.
Furthermore, well-equipped free play as the only source of OC instruction does not yield
necessary improvements in OC competence.

**Magnitude of the Impact of T-SKIP on OC scores.** It is salient that percentile
ranks and standard scores improved for T-SKIP students and regressed for Comparison
students. It is also apparent that the results of this study are consistent with the pilot
(Brian, Goodway, & Sutherland, in preparation) and previous SKIP studies (Goodway &
Branta, 2003; Robinson & Goodway, 2009). What is not clear is if the T-SKIP package
can produce results similar to that of the prior SKIP studies, which were led by experts?
In order to provide a direct comparison between T-SKIP and the SKIP studies, I calculated effect sizes from T-SKIP, the pilot (Brian et al., in preparation, and two SKIP studies (Goodway & Branta, 2003; Robinson & Goodway, 2009). The effect size calculated for T-SKIP was Cohen’s $d$ and based on the means and standard deviations within this study. The HLM used in this study does not yield the $\eta^2$ effect size that the ANOVA with repeated measures produced in the previous SKIP studies. Therefore to create a direct comparison with the previous SKIP studies, the Cohen’s $d$ calculated in this study was converted into a $\eta^2$ (see Table 5.1). In order to convert the Cohen’s $d$ into $\eta^2$ and also $\eta^2$ into Cohen’s $d$ I used the conversion formula between $r$ and $d$ found in Rosenthal (1994). The effect size for this study was $d=2.27$ and can be interpreted to mean that the students were 2.27 standard deviations higher at the posttest when contrasted against the scores of the Comparison group. In addition, $\eta^2=.56$ can be interpreted as 56% of the variance in OC posttest scores can be attributed to the T-SKIP intervention.
<table>
<thead>
<tr>
<th>Study</th>
<th>Duration</th>
<th>Dose</th>
<th>$\eta^2$</th>
<th>Cohen’s $d$</th>
<th>$r$</th>
<th>$r^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodway &amp; Branta (2003)***</td>
<td>12 weeks, 2 x 45 mins.</td>
<td>1080 mins.</td>
<td>.70</td>
<td>3.06</td>
<td>.84</td>
<td>.70</td>
</tr>
<tr>
<td>Robinson &amp; Goodway (2009)*</td>
<td>8 weeks, 2 x 30 mins.</td>
<td>470 mins.</td>
<td>.73</td>
<td>3.96</td>
<td>.85</td>
<td>.73</td>
</tr>
<tr>
<td>Brian, Goodway, &amp; Sutherland (in preparation)**</td>
<td>6 weeks, 2 x 30 mins.</td>
<td>360 mins.</td>
<td>.61</td>
<td>2.50</td>
<td>.78</td>
<td>.61</td>
</tr>
<tr>
<td>T-SKIP****</td>
<td>8 weeks, 2 x 30 mins.</td>
<td>450 mins.</td>
<td>.56</td>
<td>2.27</td>
<td>.75</td>
<td>.56</td>
</tr>
</tbody>
</table>

Table 5.1. A comparison of effect sizes between the SKIP studies and T-SKIP.
*Robinson & Goodway compared direct instruction with high autonomy. The report effect size was from the direct instruction group for Comparison. **Brian et al. (in preparation) implemented SKIP with master ECTs. ***Goodway & Branta used direct instruction, SKIP with experts. ****T-SKIP used direct instruction T-SKIP with ECTs. Only 15 lessons occurred for T-SKIP.

Robinson and Goodway (2009) yielded the strongest effect size as a result of a direct instruction, expert-led SKIP program (note: the high autonomy pedagogy portion of Robinson & Goodway was omitted from this comparison as T-SKIP was a direct instruction program). Goodway and Branta (2003) displayed similar effects to Robinson and Goodway but with almost three times the curricular dosage (see Table 5.1). The effects of SKIP (Robinson & Goodway, 2009; $\eta^2=.73$) were higher than T-SKIP ($\eta^2=.56$) across a similar amount of time (8 weeks for T-SKIP and 8 weeks for SKIP, Robinson, & Goodway, 2009). Please note that Brian et al. (in preparation) used the SKIP program (and not T-SKIP) with master ECTs who had over 15 years of experience teaching in ECCs. The ECTs who implemented T-SKIP had between 1-15 years of teaching time. Years of general teaching experience may enhance the effect of T-SKIP and future research is needed to determine to what extent that general teaching experience affects T-
SKIP results. Given that this study lacked a priori power and that HLM procedures tend to yield more accurate results than other parametric procedures, which over inflate estimations, it is quite revealing that substantial effect sizes emerged from this study.

The similar results between Goodway and Branta with Robinson and Goodway indicated a potential ceiling effect occurring between 8-12 weeks. Moreover, despite Goodway and Branta conducting SKIP for twelve weeks, the effect size reported at \( \eta^2 = .70 \) was lower than the effect size from Robinson and Goodway \( \eta^2 = .73 \). With Robinson and Goodway implementing SKIP at only eight weeks and producing a higher effect size than Goodway and Branta, it is possible that a diminishing return (effect sizes) on investment (time) may occur after eight weeks. However, an alternate final interpretation may be that as researchers continued to replicate SKIP studies, findings influenced and improved the task structure underlying SKIP and the effect sizes continued to improve through time. Future research should examine this issue.

**Increasing the Ecological Validity of SKIP through the T-SKIP package**

The T-SKIP package addresses the largest gap within the MSI literature, ecological validity/translational power (Logan et al., 2011, Riethmuller et al., 2009). The T-SKIP package provides structured MSI to students delivered by classroom teachers. As most previous MSI and SKIP studies used a MD expert to implement the MSI and few ECCs in the USA employ MD experts it was necessary to develop the T-SKIP package so that the results could translate to actual early childhood centers. Therefore, the results of this study increase the translational power of SKIP by creating a package (T-SKIP) that the ECTs could implement to their students.
It is salient that T-SKIP may be an effective package to teach young children OC skills. What is unclear is how much the ECTs affect the results of this study. It is important to parcel out teacher effects of curricula and programs to gauge a better understanding of programming effectiveness towards student learning. Conducting HLM during educational research where the students are nested within teachers provides an Intraclass Correlation Coefficient (ICC) that can better help understand this phenomenon. ICC’s range between 0-1 and are defined as the “the proportion of the variance explained by the grouping structure in the population,” (Hox, 2010, p. 15). The grouping structure in this study was the teacher and thus the ICC provides an explanation of teacher effects on the OC posttest scores. Understanding teacher effects within educational research is imperative because no two teachers are the same and it is important that packages such as T-SKIP are effective across teachers who differ. The ICC from the HLM predicting OC posttest scores was 30%. This means 30% of the variance explained by the HLM can be attributed to the individual teacher. An ICC at 5% is negligible (Hox, 2010). However, many intervention studies contain ICCs between 5-20% and are interpreted as low (Kwok et al., 2009). The 30% ICC reported in this study may be considered moderate or high (Kwok et al., 2009).

The 30% ICC reported in this study may be attributed to two factors: teaching experience of the ECTs and environmental constraints present at the different Head Start sites. As stated in Chapter 3 (see Figure 3.4), the ECTs had little teaching experience in teaching FMS and variable sporting experience. The lack of teaching experience and variable sporting experience amongst T-SKIP ECTs may account for the moderate ICC but future research is needed to confirm this suggestion.
Summary for RQ 3

In summary, after receiving the T-SKIP package, T-SKIP students were predicted to significantly improve posttest OC standard scores and remediate motor delays. The improvement of the T-SKIP students occurred in contrast to Comparison students who did not achieve predicted OC standard score growth in the same amount of time. The ICCs for the HLM on posttest OC standard scores was higher than desired. Despite the high ICC, the T-SKIP package appeared to produce positive outcomes. As such a further analysis of the fidelity accrued by T-SKIP ECTs is needed to predict the impact of fidelity on students’ posttest OC skills.

Gender and the T-SKIP Package Intervention

The data from Research Questions Three demonstrate the students in the T-SKIP group significantly improved their OC skills as a result of the T-SKIP package. As we look deeper into the intervention effects, it is important to examine the issue of gender as the MD literature has consistently reported gender differences as early as the preschool years (Goodway, Robinson, & Crowe, 2010). As such, Research Question Four sought to examine to what extent does gender influence the effects of the T-SKIP package on the OC skills of preschool children who are disadvantaged. It was hypothesized that there would be no differential treatment effects for gender in the T-SKIP package.

The pretest OC percentile ranks in regards to gender are contrary to the previous literature. Historically, young girls demonstrate greater delays with their OC skills then young boys (Garcia, 1994; Garcia & Garcia, 2002; Goodway et al., 2010). For the Comparison group, girls mean OC percentile rank (19th) was higher than boys (12th). In contrast, T-SKIP boys pretest mean OC percentile rank was 27th and girls 18th. The T-
SKIP group displayed pretest OC percentile ranks consistent with the MSI literature (Garcia, 1994; Garcia & Garcia, 2002; Goodway et al., 2010) but the Comparison group did not. It is not clear what was going on with regard to the Comparison group.

Despite inconsistent findings for gender between groups at the pretest, it was important to discern that T-SKIP met the needs of both boys and girls by not containing any differential effects for gender. As such, an HLM was conducted to determine the extent to which T-SKIP was effective for both gender. The results showed that boys and girls in the comparison group had similar predicted OC posttest standard scores (boys $M=5.64$; girls $M=5.45$). In addition, boys and girls in the T-SKIP group also had similar predicted posttest scores (boys $M=11.01$; girls $M=10.16$). The HLM reported no statistically significant differences in posttest OC standard scores by gender for either group (T-SKIP, $p=.285$; Comparison, $p=.658$). Thus, it can be concluded that there were no differential intervention effects reported by gender for this study.

The posttest results for T-SKIP in regards to gender correspond with the previous literature in that girls catch up with the boys (Goodway et al., 2010). It is possible that there were no differential effects for the T-SKIP package by gender because of the manner in which the ECTs received coaching and the teacher’s delivered the TSKIP package. During the initial coaching session, all content focused on identifying the developmental stage present for the student and instructing by present level of performance, not gender. Teachers were instructed that skill prompting had to be congruent with the present level of performance of the student regardless of gender. The tasks within T-SKIP did not provide provisions for gender. Moreover, tasks were designed to extract the most efficient pattern of performance across gender through a
direct instructional pedagogy. The HLM for gender yielded a Chi Square to report the amount of error variance within the HLM for gender attributed to the teacher. The Chi Square was not significant ($\chi^2[.22, 8]=1.96, p >.500$). As a result, the Chi Square provides support to claim that the research team achieved the goal of coaching the ECTs to achieve OC competency for both boys and girls.

It was unclear why the gender differences historically present within the MSI literature did not exist within Comparison group for this study but did for the T-SKIP group. Future research is needed to determine whether gender differences still exist in other locations or if the lack of difference was isolated to the Comparison subjects in this study. Regardless, both boys and girls improved their OC skills within the T-SKIP group in the same manner support the claim that gender effects did not influence the results of T-SKIP.

**Fidelity and Posttest OC Scores**

Research Question Five sought to determine the extent that fidelity of the T-SKIP teachers predicted posttest OC scores? An HLM was conducted, nesting students within teacher for the T-SKIP group only, as fidelity was only pertinent to the T-SKIP group. The results of the HLM showed that if ECTs implemented T-SKIP with no fidelity and with a pretest score of 0, then posttest OC mean standard score were predicted to equal 7.89. A standard score of 7 equals the 16th percentile, which is coincidentally the same pretest OC standard score as the comparison group. Conversely, if ECTs implemented T-SKIP with 100% fidelity then posttest OC standard scores were predicted to equal 12.80. A standard score of 12 equals the 75th percentile. Furthermore, for every 1% that fidelity
increased, would result in a corresponding increase in posttest OC standard scores of .12 points.

Despite fidelity showing a linear relationship with OC standard score points, the relationship between these variables was not significant \((p=.201)\). Unfortunately, the lack of a priori power in the design of this study may be a contributing factor for the lack of statistical significance within the HLM for fidelity. If I achieved statistical power at the beginning of this study, it is possible that significance would have appeared for the fidelity HLM. Future research within a fully powered study is needed to support the above claim.

Fidelity was non-significantly predicted to influence the OC skills of the students within this study as a result of the HLM. Given that a 1% increase in fidelity resulted in improvements in posttest OC standard scores by .12 points, it seems critical to find ways to improved teacher’s implementation fidelity. Some possible suggestions to improve fidelity include improving the initial coaching workshop (as seen earlier) and instructional materials, and the supports in place for ECTs during T-SKIP. Perhaps one way to undertake this is inclusion of video-based support along with printed supporting materials. In addition, I recommended including large visual aids such as posters of critical elements or task sequences within the gross motor space to assist ECTs with the delivery of T-SKIP. Future research is needed to determine the efficacy of including the additional supports listed above. Regardless, improving fidelity needs to be a primary concern in future T-SKIP studies.
Low Internal Validity or Strong Efficacy of T-SKIP?

As addressed in Chapter 1, the internal validity present for T-SKIP may be a limitation due to low fidelity percentages. The ECTs only scored a 47% overall fidelity but did score a 59% Level-1 fidelity for the core elements / behavioral items that pertained to OC skill practice. To address the potential internal validity limitation present within T-SKIP, I conducted two calculations. The two calculations were the HLM for fidelity predicting OC scores and the effect sizes for the HLM predicting posttest OC scores from T-SKIP. First, as described above, every 1% increase in fidelity predicted a .12 increase in OC posttest scores. Although not significant, the relationship between fidelity and OC posttest scores is positive and linear. As such, I believe that increasing the sample size for a future study will yield a significant relationship between fidelity and OC posttest scores. A significant relationship between fidelity and OC scores may provide strong evidence for T-SKIP being the factor influencing posttest OC scores and addressing the question of internal validity for T-SKIP.

Regardless of the HLM for fidelity being non-significant, T-SKIP yielded very strong effect sizes. In addition, the effect sizes produced from T-SKIP were parallel to the effect sizes produced from previous SKIP studies (see Table 5.1). As can be seen from Table 5.1, when fidelity increases (e.g. Robinson & Goodway, 2009), effect sizes increase. Therefore, future research is needed to increase the sample size to power the HLM for fidelity in order to strengthen the claim that T-SKIP is an internally valid package for improving OC scores of young children who are disadvantaged.
Future Research Recommendations

There are many future recommendations based upon the results of this study that can be divided into recommendations for the initial workshop, for the motor skill intervention, and methodological recommendations. For the initial workshop, I would keep the structure used during the first half of the workshop where the ECTs learned content knowledge the same. But I would include preschool children into the second half of the workshop where teachers practiced lessons and progressions. If time permitted I would recommend asking the teachers to observe a child and make the appropriate instructional decisions in order to determine their effectiveness in this area.

Next, I would recommend involving the lead and assistant teachers, as well as center coordinators and parents in the initial workshop. Increasing the knowledge base of the supporting staff to the lead teachers may increase the ease of implementation for lead ECTs and increase fidelity. Moreover, involving the parents in T-SKIP may be advantageous because it is in the Head Start mission to incorporate the parents within the learning process of their children. Additionally, if parents continued the practice of OC skills learned through T-SKIP at home, it may increase the magnitude of learning by the students. Finally, future research should attempt to formally capture attitudinal and affect changes of the ECTs during the initial workshop. In addition, an exit survey may help to provide evidence of affect, learning, and dispositions towards the workshop.

Recommendations for the Motor Skill Intervention

Overall, I think the supporting materials were valuable for the teachers. However, future research is needed to determine whether the ECTs used the supporting materials and the amount of efficacy the supporting materials had on the ECTs’ ability to
implement T-SKIP. In future studies, along with paper materials, I would also provide instructional videos through a website or a jump drive as an additional supplement as well as large posters and pictures of the stages/critical elements of the OC skills to hang on the wall.

Congruent with investigating the efficacy of supplementary materials, it is important to determine optimal dose-response rates for students to improve OC skills through the direct instruction pedagogy of T-SKIP. Actual dose-response rates for the efficacy of T-SKIP and SKIP implemented through direct instruction are unknown. We can infer from the previous literature that SKIP can be effective anywhere between 6-12 weeks of implementation at 30-45 minutes, two times per week. However, no study has directly compared dose-response rates for SKIP and this study is the only T-SKIP study. Therefore, future research is needed to provide evidence for optimal dose-response rates for SKIP/T-SKIP.

In addition the manner in which we assessed fidelity needs further consideration. Parceling fidelity into Level-1 and Level-2 behavioral items was a good first start to develop fidelity. However, the behavioral items within each level of fidelity need to be analyzed individually in order to provide a more in depth analysis for what ECTs actually did in the classroom. A more in depth analysis may yield a more accurate fidelity percentage to better determine if ECTs implemented the core items of the lessons plans that actually predicted the OC gains for the students.

In addition, creating modified versions of T-SKIP to accommodate additional learning goals such as literacy or math is highly recommended. Increasing the variety of learning outcomes to include motor, math and literacy outcomes within T-SKIP may
increase the satisfaction of T-SKIP by parents, ECTs, Head Start administrators and center coordinators.

**Methodological Recommendations**

As stated in Chapter 3, this study lacked a priori power. Therefore, it is highly recommended to increase the sample size to achieve a priori power. Having a priori power may address the lack of significance for the HLM on fidelity. In addition, increasing the sample size will allow for a group randomized controlled trial. During this study, random assignment occurred at the site level and two-level HLM were performed nesting student within teacher. With random assignment occurring at the site level, a three level HLM (students nested within teacher nested within site) would have been a more rigorous analysis. However, there was insufficient power to conduct a three-level HLM. Therefore, future studies need to increase the sample size to be able to conduct a three-level HLM for a more rigorous analysis.

Finally, the design of this study does not accommodate for specific causal interpretations for why students learned OC skills. For example, I am unable to directly state that practice trials, the T-SKIP package, the specific tasks, or the actual pedagogy and/or feedback of the teachers caused OC improvement. I can only infer that it was the T-SKIP package, as a whole, that promoted OC growth in T-SKIP students. As I did not track feedback and numbers of practice trials it is impossible to determine the influence feedback and practice trials on OC learning. Future research needs to calculate feedback and practice trials in order to more specifically determine what caused OC growth in the T-SKIP children within this study.
Implications

There are many implications that are applicable to a variety of different groups as a result of this study. The implications from this study are applicable to but not limited to ECTs, early childhood teacher education, policymakers, and ECC executive staff. In addition, implications are relevant for ECC support staff, ECTs educators, and to the physical education teacher education field.

Implications for Early Childhood Centers

Early childhood centers need to consider revamping the curriculum and common standards of practice to include structured motor skill activities along with unstructured free play. I am not advocating for the removal of unstructured free play because unstructured free play promotes a variety of positive outcomes (Robinson et al., 2012). However, if ECTs do not directly teach FMS, young children’s FMS will not change and it is well documented that unstructured free play does not result with children learning FMS (Gagen & Getchell, 2009; Robinson & Goodway, 2009).

Not only is T-SKIP a valid and reliable option for improving the OC skills of young children, it is not unreasonable to require that ECTs implement T-SKIP for 60 minutes per week. Asking ECTs to implement 60 minutes of programming, especially in a full-day ECC is a justifiable request especially when students can quickly remediate their motor delays. Thus, early childhood programs need to build instructional motor programs, like T-SKIP into their curriculum. Moreover, ECCs need to consult the Active Start guidelines (NASPE, 2009) when making curricular and policy decisions around gross motor skills.
Additionally, continuing PD is not required for ECTs within MD/PE. Early childhood teachers are required to complete continuing PD in accordance with Head Start policy. Requiring a small portion of continuing PD to include MD/PE may significantly improve ECTs’ ability to implement structured motor programming for their students.

**For Early Childhood Education Teacher Education**

Currently little to no coursework in MD/PE occurs in pre-service programs for pre-service ECTs and as such ECTs are often unaware of the need for structured motor skill activity (McWilliams et al., 2009). Being unaware of the need for structured motor skill activity, may result with ECTs believing that unstructured physical activity is sufficient to develop FMS. As a result, many ECTs unintentionally neglect the underlying mechanisms driving gross motor skill development. Many ECTs believe that by providing unstructured free play they are promoting gross motor skill development in their students but research shows that structured motor programs are more proficient with deriving motor outcomes in young children. Therefore, it is highly recommended that early childhood teacher education require MD and PE content within their initial training experiences to create a knowledge base for how to teach gross motor skills.

**For Physical Education Teacher Education (PETE)**

Many PETE programs provide pre-service training for PE that covers preschool-12th grade. Preschool-3rd grade students need continual structured motor programming to learn and improve their FMS. Along with the Active Start guidelines (NASPE, 2009), SHAPE America (2014) supports the continued growth for FMS through its physical education national standards (SHAPE, 2014). Physical education/teacher education programs need to continue to provide MD content and field experiences that include
exposure to young children for its pre-service teachers. There is a marked developmental difference in the motor skills of young children during the early years. Therefore, it is important that PETE continues to educate future PE teachers by providing them with MD content and exposure to developing pedagogy by using field experiences at preschools and K-3 settings.

Many PE programs are removing MD or lack MD in their core. Physical education/teacher education needs to include MD in its core curriculum in order to continue to align with the SHAPE America’s Initial PETE Standards (2014) as well as SHAPE America’s National Standards for PE (2014). Aligning with the SHAPE America (2014) standards and the Active Start guidelines (NASPE, 2009) by including MD content and early childhood pedagogy in PETE will help to ensure that young children will receive developmentally appropriate structured motor experiences geared towards FMS competence from their PE professionals.

**Overall Summary and Conclusion**

In summary, T-SKIP is both feasible for ECTs to implement and a valid program to remediate the delays of young boys and girls who are disadvantaged. The ECTs within this study received an initial workshop that aligned with the recommendations of the PE and classroom PD literature. By the end of the initial workshop, the ECTs were able to demonstrate knowledge of PE and MD. The students involved in this study presented developmental delays at the pretest (81% of students scored below the 30th percentile at the pretest) that were consistent with the MSI literature. The dose of 450 minutes of T-SKIP implemented at 47% fidelity resulted in the T-SKIP boys and girls remediating their motor delays and scoring at the 54th percentile at the posttest. The Comparison
group showed no OC percentile rank improvement from pretest ($M=16^{th}$) to posttest ($M=13^{th}$).

There are over 950,000 young children enrolled in Head Start preschool centers across the USA who would most likely report similar findings to the Comparison students in the study. As such, it is critical to the overall health and well-being of young children from disadvantaged settings that ECTs learn to implement structured FMS programming like the T-SKIP package to effectively teach FMS to their students. Overall, the results of this study demonstrate that T-SKIP is feasible for ECTs to implement and is a valid program to improve the OC skills of young children who are disadvantaged, regardless of gender. Therefore, Head Start needs to include structured FMS activities like the T-SKIP package in their policies along with unstructured free play to meet Active Start Guidelines and achieve the gross motor skill outcomes that Head Start desires to achieve with their students.


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Appendix: Institutional Review Board Approval Letter
Dear Dr. Goodway,

The Behavioral and Social Sciences IRB APPROVED BY EXPEDITED REVIEW the above referenced research. The Board was able to provide expedited approval under 45 CFR 46.110(b)(1) because the research meets the applicability criteria and one or more categories of research eligible for expedited review, as indicated below.

Date of IRB Approval: November 13, 2013
Date of IRB Approval Expiration: November 13, 2014
Expedited Review Category: 6, 7

In addition; the research was approved for the inclusion of children (permission of one parent sufficient).

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 Federalwide Assurance #00006378.

All forms and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Michael Edwards, PhD, Chair
Behavioral and Social Sciences Institutional Review Board