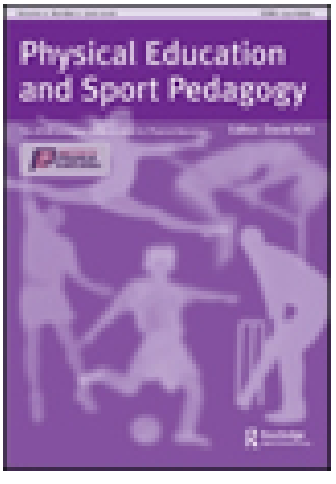

Physical Education and Sport Pedagogy
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/cpes20

SKIPing to motor competence: the influence of project successful kinesthetic instruction for preschoolers on motor competence of disadvantaged preschoolers

Irmak Hürmeriç Altunsöz[a] & Jacqueline D. Goodway[b]
[a] Physical Education and Sports Department, Middle East Technical University, Ankara, Turkey
[b] Department of Human Sciences, Kinesiology Section, The Ohio State University, A260 PAES Building, 305 W. 17th Ave, Columbus, OH 43210, USA
Published online: 27 Feb 2015.

To cite this article: Irmak Hürmeriç Altunsöz & Jacqueline D. Goodway (2015): SKIPing to motor competence: the influence of project successful kinesthetic instruction for preschoolers on motor competence of disadvantaged preschoolers, Physical Education and Sport Pedagogy, DOI: 10.1080/17408989.2015.1017453

To link to this article: http://dx.doi.org/10.1080/17408989.2015.1017453

Physical Education and Sport Pedagogy, 2015
http://dx.doi.org/10.1080/17408989.2015.1017453

SKIPing to motor competence: the influence of project successful kinesthetic instruction for preschoolers on motor competence of disadvantaged preschoolers

Irmak Hürmeriç Altunsöz[a*] and Jacqueline D. Goodway[b]

[a]*Physical Education and Sports Department, Middle East Technical University, Ankara, Turkey;* [b]*Department of Human Sciences, Kinesiology Section, The Ohio State University, A260 PAES Building, 305 W. 17th Ave, Columbus, OH 43210, USA*

(*Received 7 February 2014; accepted 5 December 2014*)

Background: Preschool children who are at risk have been shown to demonstrate developmental delays in their fundamental motor skills. The body of research on motor skill development of children indicates that these children, when provided with motor skill instruction, significantly improved their locomotor and object control (OC) skill performances.
Purpose: The purpose of this study and the primary research question was to examine the influence of two eight-week motor skill interventions (SKIP – successful kinesthetic instruction for preschoolers and SKIP-PI – SKIP-parent involvement) on the OC competence of preschoolers identified as disadvantaged.
Participants and setting: Seventy-two children (36 girls and 36 boys) from two Head Start centers participated in this study. Both centers were the part of the same child development council and had the same standard Head Start curriculum.
Data collection: Random assignment of children to intervention group in school A (SKIP or SKIP-PI) was performed. Random assignment of children to the comparison group in school B also occurred. Baseline measures of the test of gross motor development-2 (TGMD-2) were completed at the pretest. During the eight-week intervention the children received their regular Head Start program in addition to the SKIP and SKIP-PI conditions that took place during the school day. The comparison group received the regular Head Start program with no additional motor instruction. After completing the eight-week intervention all groups were tested on the TGMD-2 at the posttest and again one month after the intervention at a retention test. All data collection procedures were videotaped and analyzed by a trained researcher.
Data analysis: Descriptive statistics were performed to ascertain baseline measures of OC performance. Two 3 group (SKIP, SKIP-PI, comparison) × 2 time (pretest, posttest) or (posttest, retention test) × 2 gender (girls, boys) analysis of variance (ANOVA) with repeat measures were conducted to examine the influence of the interventions on OC performance and whether any differences occurred by gender. The statistic of interest was a group × time interaction and the group × time × gender interaction for 'pretest to posttest' and 'posttest to retention test' separately. Follow-up tests were performed if necessary by Statistical Analysis Software to identify where the differences lie. For posttest and retention test, 3 group (SKIP, SKIP-PI, comparison) × 2 gender (girls, boys) ANOVA was conducted to examine the group main effect, the gender main effect and the group by gender interaction.
Findings: The findings indicated the SKIP and the SKIP-PI groups were significantly different from the comparison group ($p < .017$), but both groups were not significantly different in OC skills from pretest to posttest. The results also indicated

*Corresponding author. Email: hurmeric@metu.edu.tr

the SKIP ($p = .00$) and the SKIP-PI ($p = .01$) were significantly different from the comparison group over time, but, both groups were not significantly different from posttest to retention test.
Conclusions: Overall, these findings show that young children who are disadvantaged demonstrate delays in their motor skills prior to intervention. If high quality structured motor skill intervention in the form of SKIP is provided, they can gain significant improvements in their OC skill development.

Keywords: young children; object control skills; SKIP; motor skill intervention; motor skill family intervention

Introduction

Individuals use their movement repertoires to participate in various physical activities across their lifespan (Gallahue, Ozmun, and Goodway 2012). This movement repertoire is developed as a result of combination of many factors such as experience, motor competence, enjoyment and environmental or individual constraints (Gallahue, Ozmun, and Goodway 2012; Haywood and Getchell 2009). In this movement repertoire, fundamental motor skills (FMS) are the primary skills in which individuals aged 2–7 years should gain a proficient level of competency in order to apply them for lifelong physical activities, sports and games (Gallahue, Ozmun, and Goodway 2012; Haywood and Getchell 2009; Seefeldt 1980; Stodden et al. 2008). In addition, research on FMS indicates that FMS proficiency may be positively associated with fitness (Barnett et al. 2008), body composition (Okely, Booth, and Chey 2004), outside-school physical activity (Raudsepp and Pall 2006), habitual physical activity (Fisher et al. 2005; MacNamara et al. 2011) and perceived motor competence of children (Goodway and Rudisill 1997; Stodden and Goodway 2007). It is argued that children with advanced levels of FMS proficiency are more likely to participate in physical activities and develop future habits for physical activities (Clark and Metcalfe 2002; Ericsson 2011; Stodden et al. 2008).

FMS have been seen as the 'building blocks' for lifetime physical activities (Payne and Isaacs 2011) and as 'the ABCs of movement' (Goodway and Robinson 2006; Hands 2012). A general misconception about FMS is that children acquire those skills naturally as a result of their growth and maturation (Gallahue, Ozmun, and Goodway 2012; Haywood and Getchell 2009). But, children need developmentally appropriate practice opportunities and specific skill-related feedback in order to develop FMS (Gabbard 2008; Goodway and Branta 2003; Payne and Isaacs 2011). In other words, systematic motor skill instruction should be provided for children to learn and practice FMS during the early years. The motor development literature (Gabbard 2008; Gallahue, Ozmun, and Goodway 2012; Payne and Isaacs 2011) emphasizes that the suggested time to instruct FMS is the early childhood years (2–7 years of age).

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

of physical activity participation and motor skill competency for their children by giving practice opportunities for both planned and unplanned physical activities (NASPE 2009).

Unfortunately, children in certain populations do not have equal opportunities to participate in physical activities and develop FMS (Barnett et al. 2013; Cools et al. 2011; Hardy et al. 2012; Iivonen and S??kslahti 2013). There are disparities in the physical activity levels of different groups with low income and minority children having lower physical activity levels than their middle income and white peers (Taylor, Baranowski, and Young 1998). One population of low income and predominantly minority children is a group known as preschoolers who are at risk. This group of children is identified as needing early intervention services to support their development. Preschool children who are at risk have been shown to demonstrate developmental delays in their FMS (Connor-Kuntz and Dummer 1996; Goodway and Branta 2003; Goodway, Crowe, and Ward 2003; Goodway and Rudisill 1996, 1997; Hamilton, Goodway, and Haubenstricker 1999). These developmental delays in FMS have been found to be true across geographic region and ethnicity for preschool children who are at risk (Goodway, Robinson, and Crowe 2010).

The body of research on motor skill development of children indicates that these children, when provided with motor skill instruction, significantly improved their locomotor and object control (OC) skill performances (Bardid et al. 2013; Connor-Kuntz and Dummer 1996; Goodway and Branta 2003; Goodway, Crowe, and Ward 2003; Martin, Rudisill, and Hastie 2009; Robinson and Goodway 2009). However, only one study has been conducted that involved parents in the intervention process (Hamilton, Goodway, and Haubenstricker 1999). This study revealed that when parents provided instruction to their children (under the guidance of an expert in motor development), the children significantly improved their OC skills (Hamilton, Goodway, and Haubenstricker 1999). This study was limited in that the sample size was small and not randomly selected. There appears to be a great need and potential for involving parents in promoting the motor development of young children, but limited data are available to guide this process.

Due to the limited number of studies on parental involvement in motor skill development, the value of involving parents in motor intervention is not known. However, the early childhood literature has consistently emphasized the critical role that parents play as the first teachers of their children (Bronfenbrenner 1989; Carpenter 2007; Chao et al. 2006; Dunst 2002; Freeman and Vakill 2004). More research is needed to examine the influence of motor skill intervention on FMS development and additionally to understand whether involving parents in promoting motor skills at home can make a difference on their children's motor development.

The purpose of this study and the primary research question was to examine the influence of two eight-week motor skill interventions (SKIP – successful kinesthetic instruction for preschoolers and SKIP-PI – SKIP-parent involvement) on the OC competence of preschoolers identified as disadvantaged. It was hypothesized that at baseline preschoolers would have delayed OC skills, with boys having significantly better skills than girls. It was also hypothesized that the motor skill intervention groups (SKIP and SKIP-PI) would have significantly better OC competence from pretest to posttest than the comparison group. It was further hypothesized that the group receiving parental enhancement of motor skills (SKIP-PI) would demonstrate greater pretest to posttest gains in OC competence than the SKIP group. A second research question examined the maintenance of any possible intervention effects from posttest to a retention test one month later. It was hypothesized that the motor skill intervention groups (SKIP and SKIP-PI) would maintain intervention effects with no significant decline in OC performance from posttest to retention test.

Method

Theoretical framework

Dynamical systems theory (DST) and ecological systems theory (EST) were utilized to build the design of the study. Each theory provides unique support for this study. Based upon DST, a child is seen as a self-organizing system and the complex interactions of many subsystems shape this self-organizing system. For example, the changes in the subsystems within the learner (individual), the task and the environment might lead to positive or negative outcomes regarding motor skill development (Gallahue, Ozmun, and Goodway 2012; Newell 1984, 1986). Given the powerful influence of the interactions of these three systems, a developmentally appropriate motor skill program (SKIP) was designed, taking into account learners' constraints [e.g. gender, socioeconomic status (SES), body mass index (BMI), current skill level, prior experience]. Then the investigators used this information to design the SKIP/SKIP-PI interventions by identifying tasks and task constraints (OC skills) and manipulating environmental constraints within the instructional environment (e.g. equipment and space). Specifically, the motor skill intervention was organized to maximize the relationships between and within these systems (Goodway and Branta 2003; Goodway and Rudisill 1996; Goodway, Crowe, and Ward 2003; Hamilton, Goodway, and Haubenstricker 1999). Similar to DST, EST defines the importance of many systems in the child's development (Bronfenbrenner 2005). It also provides an explanation to address the important role of parents and the home environment in child development. For this reason, parent involvement part of the motor skill intervention (SKIP-PI) was added into the study.

Settings

This investigation was conducted in two Head Start centers from a large Midwest urban city. Both centers were the part of the same child development council and had the same standard Head Start curriculum and identification criteria for children to be admitted into the program. Head Start is a national program within the USA, designed to provide education, health and family services for low income children (aged 3–5) to support their developmental needs. Based on the regulation of Title 45-Public Welfare (section 1305), families should meet the eligibility criteria to be selected for Head Start (USDHHS 2010). Thus, low family income, risk factor assessment and a readiness test are required to determine children's eligibility for Head Start. The Head Start centers in this study had similar demographic characteristics residing in inner city, low income communities with high rates of crime.

Participants

Seventy-two children (36 girls and 36 boys) from two Head Start centers participated in this study. Due to the potential for contamination effects the intervention took place in Center A and an equivalent center with very similar demographics, Center B served as the comparison site. In Center A ($n = 47$) there were 21 girls and 26 boys, 93.6% of whom were African American, 6.4% were Caucasian, the remaining were mixed race. In Center B ($n = 25$) there were 15 girls and 10 boys, 100% of whom were African American.

In the intervention site, Center A, there were three established preschool classes. Participants from the three classes were randomly assigned to a motor skill intervention group called SKIP ($n = 22$, 11 girls and 11 boys; SKIP) and a motor skill intervention plus parent

enhancement called SKIP-PI ($n = 25$, 10 girls and 15 boys; SKIP-PI). From the three established preschool classes, children in both the SKIP and SKIP-PI conditions were randomly assigned into three new classes (Classes A, B and C) for the purposes of motor skill instruction. Thus the experimental conditions involved Classes A, B and C involving children from both the SKIP and SKIP-PI groups to minimize any potential condition effects.

General demographic characteristics of children in all groups (SKIP, SKIP-PI, comparison) are presented in Table 1.

Design and variables

This study used a pre–post–retention experimental design. The design consisted of a 3 group (SKIP, SKIP-PI, comparison) × 2 gender (boys, girls) × 3 time (pretest, posttest, retention). The main dependent variable was OC skills of children and the independent variables were the SKIP and SKIP-PI programs.

Instrumentation

The dependent variable was OC competence as determined by the test of gross motor development-2 (TGMD-2, Ulrich 2000). The TGMD-2 is a standardized, criterion and norm-referenced test designed to assess 12 FMS of children aged 3–10 years (Ulrich 2000). The test includes two main subscales (locomotor and OC). For the purpose of this study, the OC subscale was utilized. The OC subtest has six main skills: strike, dribble, catch, kick, throw and roll. Each skill has performance criteria and three trials (one practice, two coded trials) are provided for children to perform the skill. If children meet the performance criterion, they get 1 point, if they do not, they get 0 points. Performance criterion points in each skill are summed to produce a total subscale raw score (0–48 points). Raw scores can be translated into standard scores and percentile ranks based upon age and gender. For data analysis, standard scores of OC skills were utilized. The standard testing protocol of the TGMD-2 was used and all children were videotaped in their performance. Coding of the performance criteria took place from the videotaped performance.

Table 1. Demographic characteristics of children in the groups.

Demographic characteristics	Total (all participants)	Center A		Center B
		SKIP	SKIP-PI	Comparison
Number of children	72	22	25	25
Sex	36 girls 36 boys	11 girls 11 boys	10 girls 15 boys	15 girls 10 boys
Race	69 African American 3 Caucasian	22 African American	22 African American 3 Caucasian	25 African American
Ethnicity	72 Not Hispanic/ Latino	22 Not Hispanic/ Latino	25 Not Hispanic/ Latino	25 Not Hispanic/ Latino
	M (SD)	*M* (SD)	*M* (SD)	*M* (SD)
Age (months)	48.41 (6.62)	48.05 (6.45)	49.47 (6.41)	47.68 (7.10)
Height (cm)	103.48 (6.44)	103.92 (5.93)	104.34 (4.99)	102.24 (8.03)
Weight (kg)	17.77 (3.21)	18.30 (4.14)	17.61 (2.35)	17.47 (3.11)
BMI	16.29 (2.68)	16.76 (2.22)	15.49 (3.57)	16.67 (1.76)

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

SKIP, SKIP-PI and comparison conditions

All children in the study attended a Head Start program consisting of a full day curriculum from 9 am to 4 pm before and after school day care. The curriculum in both Centers A and B was identical.

Comparison group

Children in the comparison group in Center B received the regular Head Start curriculum. Specifically, they attended the center five days per week. The gross motor part of the curriculum consisted of 20–30 min of outdoor play activities in a well-equipped playground (swings, slides, climbers, etc.) given appropriate weather or play in a large muscle activity area (unused classroom). The preschoolers were free to do whatever they wanted in the playground area, including sitting and chatting. The researchers regularly observed their outdoor activities at the playground area during the intervention period (4 or 5 days in a week) and verified that the children did not receive any skill instruction or any feedback by their classroom teachers. There was no organized outside activities arranged by the classroom teachers. Children generally engaged in running, jumping, climbing, using monkey bars, using slides and playing with the overhead ladder at the playground area or sat in the area and talked to another child. This was similar for the Center A.

Intervention groups

The children in the two intervention groups (SKIP/SKIP-PI) also received the regular Head Start curriculum as described above. On three days per week they engaged in free play like the comparison group. On two days per week they received the SKIP program instead of free play.

Two motor skill intervention packages were designed to apply to the preschool children in Center A. Both package 1 and package 2 used a previously validated (Goodway and Branta 2003; Goodway, Crowe, and Ward 2003) motor skill intervention called SKIP. However, in package 2 the children received the SKIP motor skill intervention plus a parent enhancement where parents were trained to work with their child at home on simple motor skill activities. This program was called SKIP-PI.

SKIP motor skill intervention

The SKIP program was designed to develop the OC skills of preschoolers through developmentally appropriate instruction and practices. All children in the SKIP and SKIP-PI groups received the same motor skill program. The SKIP intervention consisted of 16

sessions over an eight-week period with each session lasting 30 min. The total amount of instructional time for the intervention was 480 min (60 min for each week). The program was provided in a multipurpose room and an outdoor playground area based on availability and weather. In order to promote maximal learning trials all preschoolers had their own space and equipment while receiving the motor skill instruction. The SKIP program took place during the regular school day at the Head Start center.

The SKIP program consisted of six OC skills: throwing (72 min), catching (72 min), kicking (72 min), striking (72 min), bouncing (72 min) and rolling (72 min) along with a number of locomotor skills as part of the warm up activities. A direct instructional approach was utilized where student autonomy was low and the instructor controlled all aspects of learning environment. The instructor used a variety of effective teaching strategies such as demonstrations, explanations, feedback, cue words, task modifications (e.g. extending and refining) and manipulation of environmental factors such as ball size and distance from target during the implementation of the SKIP (Graham, Holt-Hale, and Parker 2007; Newell 1984). Instructional activities were aligned to the developmental level of the child, and tasks and feedback were adjusted to challenge each child at his/her own level by manipulating task and environmental constraints.

Lesson plans consisted of a 5 min warm up, two 12 min skill rotations and a 3 min closure. Lesson plans were developed based upon the critical elements of the skill, a developmental task analysis of the skills being taught arranging tasks from simple to complex, and the pretest level of the children in the intervention groups. Critical elements were embedded into the lesson plans in terms of providing feedback and cue words. For each skill, a task analysis was conducted, developing a series of activities that could go from easy to more complex. The task analysis involved manipulating different factors for a skill. For example, for throwing, the factors that were manipulated included distance from target, size of the target, physical prompts such as a scarf tied to the opposite leg and complexity of the environment in which the skill is being performed. A convention was developed for each skill indicating which factors would be manipulated first. The mean child attendance rate in the SKIP intervention was 77.79%.

The SKIP and SKIP-PI programs were implemented by a trained motor skill instructor at Center A. The instructor had two years of experience in assisting a university course of motor development and experience in teaching and working with children who had special needs. The instructor had Adapted Physical Education Endorsement Certificate and P-12 Teacher Licensure. The objectives of this study were clearly discussed with the instructor and a training session was conducted to identify the purpose of the study, the organization and implementation of the lesson plans and the instructor's responsibilities. The instructor's responsibilities were (a) to deliver the lesson plans developed by the researchers, (b) to ensure the lesson plans were delivered in a developmentally appropriate manner, (c) to give feedback to the participants during the motor skill instruction and (d) to interact with the researchers to assist in documenting the process of the motor skill instruction.

Intervention integrity of SKIP

Intervention integrity determines the extent to which the interventions were implemented as intended. Intervention integrity data were determined for all three classes in the SKIP condition across six randomly selected sessions by observing videotapes of the sessions. A check list was developed and used to compare the implemented lesson plans to the intended written lesson plans. The implemented lessons were checked for fidelity by two independent observers (the main researchers) to ensure that the instructional and pedagogical

objectives of the lessons were met by the instructor and the instructor adhered to the content of the lesson. Intervention integrity and inter-observer agreement was 100% on observed sessions for all classes.

SKIP-PI motor skill intervention

The SKIP-PI group received the regular SKIP intervention described above. However, they also received a parental enhancement (SKIP-PI), incorporating additional motor skill instruction delivered by the primary caregiver in the child's home, typically the mother. The aim of the family intervention was to reinforce those skills taught in the SKIP program and provide parent–child motor skill activities to be completed at home. The SKIP-PI intervention consisted of the SKIP program with 16 sessions at 30 min per session for 480 min of school-based instruction. Additionally the parental enhancement part of SKIP-PI involved 24 home-based sessions (nights or weekends) over an eight-week period with each session lasting 10–15 min. The exact day the parent did the activity depended on the parents' own schedule during the week. The parents used available spaces at home such as the living room, kitchen or yard. All preschoolers and their parents were provided with a bag of standardized equipment (playground ball, tennis balls, bean bags, scarves, balloons, milk jugs, rolled paper bats, bubble wrap and paper spots as markers) and all of the lesson plans prior to the intervention.

The family intervention lesson plans were created by the researcher and two motor development specialists, and were based upon developmental level of children (pretest results), prior SKIP lesson plans (Goodway and Branta 2003; Robinson and Goodway 2009), the critical elements of the eight skills (throw, kick, catch, strike, bounce, roll, jump and hop) in the SKIP intervention, reinforcement of existing SKIP activities and taking into account the limited space of the family home environment.

The lesson plan used simple language and lots of pictures. Each lesson included: (1) the skill and focus for the day (e.g. throwing–stepping with opposition), (2) list of specific equipment, (3) pictures of desirable performance with critical elements identified, (4) a detailed description of the activities with pictures of real performers and pictures for layout and organization of the activity, (5) cue words to reinforce the child's performance and (6) an evaluation form (game sheets) in order to evaluate the child's performance on that skill. The game sheet included a small challenge for the child covering the topic of the SKIP-PI lesson (e.g. how many times out of 10 can you catch a tossed fleece ball from 5 ft. with your hands?). The early lesson plans for the SKIP-PI program began with easy instructional tasks and then progressed to more difficult tasks across the intervention as the children developed their skills. The number of activities in the lesson plans varied based on the nature of the activity. Generally, one lesson plan lasted approximately 10–15 min.

In order to train the parents on the intervention, a 1.5 h workshop on developmental sequences of FMS and the SKIP-PI lesson plans was planned for parents. The parent workshop demonstrated the total body developmental sequences of 10 FMS (see Gallahue, Ozmun, and Goodway 2012 for a description of developmental sequences). Additionally short segments (3–4 min) from each lesson plan were demonstrated and parents got to try the activities receiving feedback from the investigators. However, only 7 of the 25 SKIP-PI parents attended the workshop, thus other measures were necessary to train the remaining parents. A variety of individual time slots were provided at child drop-off and pick-up times for parents to get a short training session (30–45 min) and take their equipment.

During the implementation phase of the SKIP-PI intervention a parent–child motor activity calendar was provided for each month. This activity calendar was set up weekly and included the three SKIP-PI lesson plans to be covered that week. It also included deadlines for returning the game sheets to the center. Children were provided with small rewards (like pencils and stickers) when a game sheet was returned to encourage parents to return their activity game sheets. Reminder notes were also put into children's folders that they took home and posters were placed by the children's mailboxes and on the classroom door to remind parents. Thus, reminder notes in folders, classroom posters, prompts to children and an incentive system of rewards were the strategies to promote parent compliance with the SKIP-PI activities.

Intervention integrity of SKIP-PI

Data on intervention integrity of the SKIP-PI were hard to collect because of the nature of the family intervention being conducted at home and the performance of the child not readily available to the investigators. However, specific strategies were created to help promote parent compliance with the activities provided in the lesson plans.

Each SKIP-PI lesson plan had an evaluation form called a game sheet. Parents were asked to fill out the game sheet after the completion of the lesson activities. Parents were also responsible for sending the evaluation form to the class after they were done with the activity to help ensure whether they performed the activities or not.

The expected game sheets were 24 from each parent and 600 in total from 25 parents in the SKIP-PI condition. Fourteen parents returned their game sheets and overall, the return rate was 16.66%. Other approaches to check compliance with the SKIP-PI condition were to ask the child in the SKIP-PI group what they liked about the home activities. Although no formal data were collected on this approach, children regularly reported what they did at home, and it appeared 18 out of 25 children performed the home activities with their parents despite not getting the game sheets back from the majority of these parents.

Overall procedures of the study

Institutional Review Board approval, Head Start approval and parental permission and child assent were secured prior to the study. Random assignment of children to intervention group in Center A (SKIP or SKIP-PI) was performed. Within Center B, 25 children randomly assigned to the comparison group. Baseline measures of the TGMD-2 were completed at the pretest. During the eight-week intervention the children received their regular Head Start program in addition to the SKIP and SKIP-PI conditions that took place during the school day. The comparison group received the regular Head Start program with no additional motor instruction. After completing the eight-week intervention all groups were tested on the TGMD-2 at the posttest and again one month after the intervention at a retention test. All data collection procedures were videotaped and analyzed by a trained researcher and a research assistant in accordance with the procedures outlined above.

Data analysis

Data analyses were performed based on the research questions of the study. Descriptive statistics were performed to ascertain baseline measures of OC performance. Two 3 group (SKIP, SKIP-PI, comparison) × 2 time (pretest, posttest) or (posttest, retention test) × 2

gender (girls, boys) analysis of variance (ANOVA) with repeat measures were conducted to examine the influence of the interventions on OC performance and whether any differences occurred by gender. The statistic of interest was a group × time interaction and the group × time × gender interaction for 'pretest to posttest' and 'posttest to retention test' separately. Follow-up tests were performed if necessary by Statistical Analysis Software to identify where the differences lie. For posttest and retention test, 3 group (SKIP, SKIP-PI, comparison) × 2 gender (girls, boys) ANOVA was conducted to examine the group main effect, the gender main effect and the group by gender interaction. For the analyses of the pre- to posttest data, a total of $N = 72$ was analyzed (SKIP $n = 22$; SKIP-PI $n = 25$; comparison $n = 25$). However, as is the nature of at-risk children we lost children who dropped out of the program or moved for the post-to-retention measures with a total of $N = 59$ (SKIP $n = 15$; SKIP-PI $n = 20$; comparison $n = 24$).

Results

This study aimed to examine the influence of two eight-week motor skill interventions (SKIP and SKIP-PI) on the OC competence of preschoolers identified as disadvantaged. The results were given in the following sections.

Baseline information of OC skill performance

First, it was hypothesized that at baseline preschoolers would have delayed OC skills, with boys having significantly better skills than girls. Baseline measures of OC competence revealed children in the SKIP, SKIP-PI and comparison groups had developmental delays in OC (SKIP = 14.14%, SKIP-PI = 9.56%, comparison = 8.92%). Overall, girls were at 10.94% and boys were at 10.53%. A 3 group (SKIP, SKIP-PI, comparison) × 2 gender (girls, boys) ANOVA on pretest OC standard scores was conducted to examine potential pretest gender, group or group × gender interaction differences. The ANOVA revealed a non-significant group ($F[_{2,\ 66}] = 2.26$, $p = .11$, $\eta^2 = .06$), gender ($F[_{1,\ 66}] = 0.008$, $p = .92$, $\eta^2 = .00$) and group × gender interaction ($F[_{2,\ 66}] = 0.22$, $p = .80$, $\eta^2 = .00$), indicating at the pretest groups and gender were statistically similar.

The effects of motor skill interventions (SKIP and SKIP-PI) on OC skill performance

It was hypothesized that the motor skill intervention groups (SKIP and SKIP-PI) would have significantly better OC competence from pretest to posttest than the comparison group. It was further hypothesized that the group receiving parental enhancement of motor skills (SKIP-PI) would demonstrate greater pretest to posttest gains in OC competence than the SKIP group.

A 3 group (SKIP, SKIP-PI, comparison) × 2 gender (girls, boys) × 2 time (pretest, posttest) ANOVA with repeated measures on OC standard scores was conducted to examine the influence of the intervention on OC competence from pretest to posttest. The analysis revealed a significant time main effect ($F[_{1,\ 66}] = 142.72$, $p = .00$, $\eta^2 = .68$). This result shows that OC skill performance of children significantly changed from pretest to posttest. The analysis also revealed a significant group × time interaction ($F[_{2,\ 66}] = 32.06$, $p = .00$, $\eta^2 = .49$), showing that groups differed from pretest to posttest for the OC skill performance of children. Follow-up tests were conducted between the groups to examine where the differences were reported. Three separate contrasts

were run between the groups, and a Bonferroni adjustment of the alpha (.05/3) resulted in a new alpha level of $p \leq .017$. The first contrast between the SKIP and the comparison group revealed a significant difference between groups over time ($F[_{1,\ 69}] = 45.81, p = .00$). The second contrast between the SKIP-PI and the comparison group showed a significant difference between groups over time ($F[_{1,\ 69}] = 47.61, p = .00$). The final contrast showed that there were no significant differences between the SKIP and SKIP-PI groups over time ($F[_{1,\ 45}] = 0.01, p = .93$). Three separate paired sample *t*-tests using pre- and posttest OC scores for each group separately indicated that the children in SKIP ($t\ [22] = -10.31, p < .001$ [two-tailed]) and SKIP-PI ($t\ [25] = -8.53, p < .001$ [two-tailed]) significantly improved their OC score from pretest to posttest. However, the children in the comparison group did not significantly improve their OC skill score ($t\ [25] = -0.90, p = .37$ [two-tailed]) from pretest to posttest. These results suggest that children in the SKIP and SKIP-PI conditions significantly improved their OC scores from pretest to posttest when compared to the comparison condition (Figure 1).

The analysis of ANOVA with repeated measures also indicated a non-significant time × gender interaction ($F[_{1,\ 66}] = 0.32, p = .57, \eta^2 = .00$) and group × gender interaction ($F[_{2,\ 66}] = 1.60, p = .20, \eta^2 = .04$). These results indicate that no significant gender differences were observed from pretest to posttest between the groups. In addition, a non-significant group × time × gender interaction was reported ($F[_{2,\ 66}] = 0.97, p = .38, \eta^2 = .02$), which means that both genders within the groups performed similar OC skill performance from pretest to posttest.

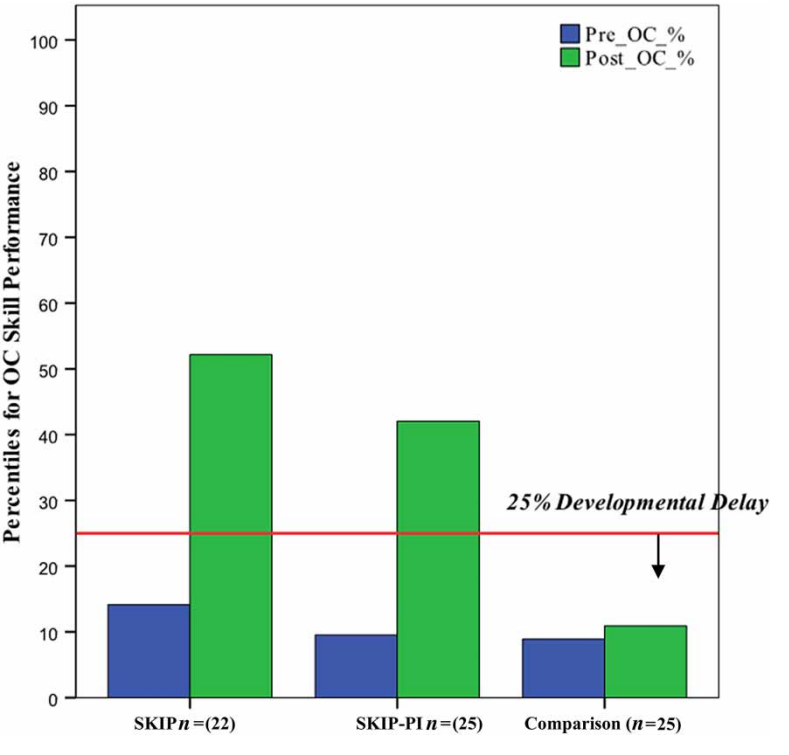

Figure 1. The percentages of OC skill scores in all groups.

Retention effects of interventions

A second research question examined the maintenance of any possible intervention effects from posttest to a retention test one month later. It was hypothesized that the motor skill intervention groups (SKIP, SKIP-PI) would maintain intervention effects with no significant decline in OC performance from posttest to retention test.

A 3 group (SKIP, SKIP-PI, comparison) × 2 time (posttest, retention test) × 2 gender (girls, boys) ANOVA with repeated measures was conducted, resulting in a non-significant time main effect ($F[_{1,\ 53}] = 0.00$, $p = .98$, $\eta^2 = .00$) from posttest to retention test. However, a significant group × time interaction ($F[_{2,\ 53}] = 14.48$, $p = .00$, $\eta^2 = .35$) was reported showing group differences in OC skills from posttest to retention test. Follow-up tests were conducted between the groups to examine where the differences were reported. Three separate contrasts were run between the groups and a Bonferroni adjustment of the alpha (.05/3) resulted in a new alpha level of $p \leq .017$. The first contrast between the SKIP and the comparison group revealed a significant difference between groups over time ($F[_{1,\ 59}] = 21.97$, $p = .00$). The second contrast between the SKIP-PI and the comparison group showed a significant difference between groups over time ($F[_{1,\ 56}] = 6.59$, $p = .01$). The final contrast between the SKIP and the SKIP-PI showed a non-significant difference between groups over time ($F[_{1,\ 33}] = 2.05$, $p = .16$) As a follow up, three paired sample *t*-tests were conducted to examine posttest to retention test changes in OC skills. A paired sample *t*-test reported that the OC skill scores of SKIP (t [15] = 2.69, $p = .017$ [two-tailed]) and SKIP-PI (t [20] = .00, $p = 1.00$ [two-tailed]) did not significantly change from posttest to retention test. A paired sample *t*-test showed a significant posttest (5.88) to retention test (6.96) changes for the comparison group (t [24] = −3.84, $p = .001$ [two-tailed]) in OC skill performance. In addition, the ANOVA with repeated measures indicated a significant time × gender interaction ($F[_{1,\ 53}] = 5.38$, $p = .02$, $\eta^2 = .09$) for the OC skill performance from posttest to retention test. Girls' mean scores decreased from 9.05 to 8.62 and boys' mean scores increased from 8.22 to 8.63. However, there was a non-significant group × time × gender interaction ($p = .25$) and no group × gender interaction ($F[_{2,\ 53}] = 1.84$, $p = .16$, $\eta^2 = .06$) were obtained as a result of ANOVA analysis.

ANOVA analysis also indicated a significant group effect ($F[_{2,\ 53}] = 21.43$, $p = .00$, $\eta^2 = .44$). *Post hoc* Tukey analysis showed that there were significant differences between the SKIP and the comparison group ($p = .00$) and between the SKIP-PI and the comparison group ($p = .00$). However, no significant difference was found between the SKIP and the SKIP-PI ($p = .95$). The ANOVA analysis also revealed a non-significant gender effect ($F[_{1,\ 53}] = 0.00$, $p = .98$, $\eta^2 = .00$) and group × gender interaction ($F[_{2,\ 53}] = 2.91$, $p = .06$, $\eta^2 = .09$) for the OC skill performance at the retention test. Both the SKIP and SKIP-PI groups were better than the comparison group at the retention test.

In summary, all three groups were categorized as having developmental delays at the pretest. The SKIP and SKIP-PI intervention groups made similar significant increases in their OC skills from pre- to posttest. In contrast the comparison group did not change their OC skills from pre- to posttest and was significantly lower than the SKIP/SKIP-PI groups at the posttest. From post- to retention test the SKIP/SKIP-PI groups maintained their OC performance. The comparison group significantly improved their OC skills from post- to retention test but was still significantly lower than the SKIP/SKIP-PI group at the retention test. Figure 2 represents the changes from pretest to retention test for each group.

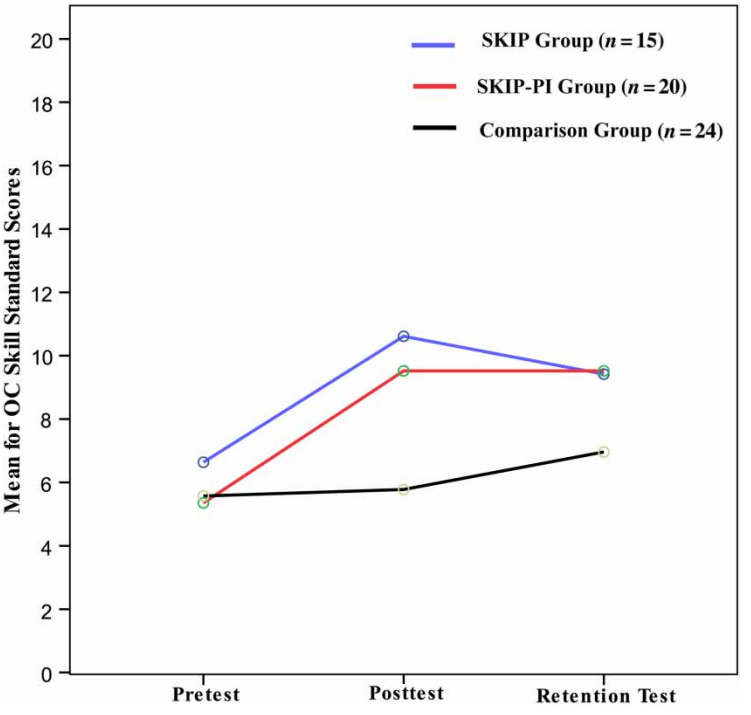

Figure 2. The changes of OC skill performance from pretest to retention test.

Discussion

Baseline information of OC skill performance

Children in all three groups (SKIP, SKIP-PI, comparison) had developmental delays in the OC skills at pretests. Children with low OC percentile score, especially below the 25th percentile (IDEA 2004), were categorized as developmentally delayed. These findings are in agreement with the motor development literature, showing that children in certain populations demonstrated motor development delays as a result of individual and environmental constraints (Goodway and Branta 2003; Goodway and Rudisill 1996; Goodway, Crowe, and Ward 2003; Hamilton, Goodway, and Haubenstricker 1999; Martin, Rudisill, and Hastie 2009; Robinson and Goodway 2009).

In this study, the developmental delays might be explained by a combination of individual or environmental constraints. Children at the pretest showed very low performance on OC skills, which suggests that children did not have any prior experience of OC skills. Although we have no direct evidence of this, anecdotal parent reports suggest unsafe outside environments limit opportunities for their children to engage in physical activity around their home and outdoor environments. Another possible reason might be explained by their parents' physical activity level or parents' encouragement for physical activity participation. Informal interviews with parents and classroom teachers supported that children had limited opportunities to go outside and play with their peers or siblings because of the dangerous neighborhood. In addition, parents indicated that they were not physically active. Many of the children spent much of their day in child care and this environment might be another factor in developmental delays. Factors such as the curriculum, equipment, space and developmentally appropriate practices for their students should be considered in

future research. In this study, there was no structured motor skill program included in the curriculum of the Head Start center. Informal but regular observations showed that children had unstructured physical activity sessions but they did not receive any motor skill instruction by their classroom teachers during these sessions. Furthermore, the Head Start centers had only one multipurpose room and limited equipment for the physical activity opportunities. It is obvious that a number of individual and environmental constraints exist for this group of children. More research is warranted to reveal the effects of constraints on developmental delays of children who are from disadvantaged circumstances.

The effects of motor skill interventions (SKIP and SKIP-PI) on OC skill performance

Children in the SKIP and SKIP-PI groups showed similar significant improvements in their OC skill performance from pretest to posttest. However, the comparison group had the same low level of performance in their OC skills across the intervention. The ANOVA with repeated measures revealed a significant group × time interaction from pretest to posttest, showing that 42% of the pretest to posttest changes in OC may be attributed the interventions.

Previous motor skill interventions found similar benefits of the motor skill interventions on the OC skill performance of children in disadvantaged circumstances. The children in the studies demonstrated improvement in their OC skill performance as a result of the motor skill interventions (Connor-Kuntz and Dummer 1996; Goodway and Branta 2003; Goodway, Crowe, and Ward 2003; Hamilton, Goodway, and Haubenstricker 1999; Robinson and Goodway 2009). In addition, Kirk and Rhodes (2011) examined 11 motor skill interventions and concluded that majority of the interventions were effective for preschoolers with developmental delays ($\eta^2 = 0.57–0.85$). Furthermore, in a meta-analysis, researchers found that motor skill interventions in 11 studies were effective to improve young children's FMS (Cohen's $d = 0.39$) (Logan et al. 2011). A recent intervention also found similar findings showing that young children in the Jump Start program (movement and physical activity program) improved their movement skill competency (Cohen's $d = 0.47$) (Jones et al. 2011). Like this study, the children in the comparison groups in the studies did not improve their motor skills across the intervention time frame. This suggests that structured interventions that engage in developmentally appropriate practices must be instituted if children are to improve their FMS.

The SKIP intervention in this study incorporates the tenants of a pedagogical model espoused by Metzler (2005). It is theoretically driven based upon manipulation of Newell's constraints (Newell 1984, 1986), identified intended learning outcomes and sequenced activities in a developmentally appropriate manner. SKIP also developed unique task structures for each of the OC skills aligning task to the developmental level of the child, providing clear and individualized progressions. There were well-articulated expectations of student behaviors and ongoing assessment of SKIP learning outcomes. Additionally, there were clear measures to determine faithful implementation of SKIP. Furthermore, SKIP aligned with the Active Start Guidelines for young children (NASPE 2009), literature reviews in motor development of children (Iivonen and S??kslahti 2013; Riethmuller, Jones, and Okely 2009; Venetsanou and Kambas 2010), guidelines in the physical activity literature (Lubans et al. 2010; Sluijs, McMinn, and Griffin 2008; Tucker 2008), teaching in the early childhood area [National Association for Education of Young Children (NAEYC)] and effective teaching strategies (Becker and Carnine 1980; Graham 2001; Graham, Holt-Hale, and Parker 2007; Silverman and Ennis 1996). Many of these approaches may have resulted in impacting the OC skills of the children in the SKIP and SKIP-PI programs.

Major intervention factors that might also be associated with the success of the intervention were that lesson plans demonstrated developmentally appropriate practice and high quality pedagogical approaches. Iiovenen and S??kslahti (2013) support this view in their literature review study. The researchers found that education programs are one of the positive determinants for motor development of children. A traditional instruction approach was chosen in order to deliver the motor skill instruction to the children in the SKIP group. This approach focuses on student learning with low autonomy of children (Becker and Carnine 1980). A large number of studies have reported the benefits of traditional instruction approach on student learning in physical education settings (Ayers et al. 2005; Miller, Vine, and Larkin 2007; Rikard, Boswell, and Boni 1993; Sweeting and Rink 1999).

On the other hand, children in the comparison group did not improve their OC skill performance and it may be suggested that the unstructured motor skill activities (recess or free play) that is a typical part of a Head Start program resulted in no improvement to OC skill performance. Prior studies had the same result about unstructured activities (Goodway and Branta 2003; Goodway, Crowe, and Ward 2003; Hamilton, Goodway, and Haubenstricker 1999; Robinson and Goodway 2009), showing that the curriculum of Head Start centers has failed to support children's motor development with unstructured motor skill activities. In addition, prior research in this population has demonstrated that disadvantaged communities present little or no opportunities for children to be active and often present significant barriers to engaging in motor skills (Goodway and Smith 2005). A major implication of this result is that Head Start policy-makers need to revisit the Head Start curriculum to structure motor skills in the curriculum. Children with or at risk of developing delays in Head Start centers should be instructed in a developmentally appropriate way which includes structured (planned) motor skill activities, specific skill-related feedback, task modifications, individualized learning, appropriate equipment, and enough space to perform the activities. It should be mentioned that free play or unstructured activities should also be provided for children in order to support their social, emotional, cognitive development or physical activity behaviors (NASPE 2009). However, Head Start centers should also meet NASPE's standards 1 and 3 for preschoolers about promoting motor competence (3) and structured PA (1).

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

The SKIP-PI program resulted in the improvement of OC skills across the intervention. However, contrary to the original hypothesis, the SKIP-PI group did not have significantly better OC skills than the SKIP group, but was significantly different from the comparison group which did not receive any motor skill intervention. One study that included parents into a motor skill intervention found similar findings, indicating that children in the intervention group improved their OC skill performance from pretest to posttest measures (Hamilton, Goodway, and Haubenstricker 1999). One big difference between Hamilton, Goodway, and Haubenstricker's (1999) study and this study is that parents were recruited to the Head Start center to instruct their children under the guidance of motor development experts in their study. In contrast to Hamilton and her colleagues' study, the parents in this study conducted their activities at home and received a brief training and a series of lesson plans with appropriate equipment in order to be able to engage in these activities. It should be noted that the SKIP-PI is the first family based motor skill intervention which enhanced parents' responsibility to improve children's motor skills and encourage physical activity participation at their home environment. We had hypothesized that the addition of parent instruction to the SKIP program would give 'value added' to the motor skill development of their children. However, the findings of the study did not support this supposition. We have examined our SKIP-PI data and methodological approach and have identified many lessons to be learned from this study.

The findings relative to SKIP-PI revealed that several methodological issues need to be examined and solved for future research. The hardest part about SKIP-PI is the inability to control the home environment and thus fidelity is hard to determine. Our approach to fidelity was to have parents return game sheets after an activity was completed. However, our return rate for these sheets was low. On the one hand, we know that some parents did not do the activities, whereas others did the activity but did not return the game sheet. Additionally we had no ability to observe the parents' and children's performance at home. In talking to the parents we believe that in future studies we will use tablets to both provide the lesson instruction via videotape on the tablet plus use the tablet's video-recording capability to video the child undertaking the activities and remotely send this back to the investigative team. This will allow us to examine fidelity at home and examine the child's performance as they undertake the activities giving us ongoing evidence of motor skill learning. We also need to re-consider the reminder and incentive systems for parents. Despite extreme poverty, the majority of our parents had smart phones and perhaps we can use text as a means to prompt parents to conduct the activities. Additionally we need to identify more culturally relevant reward systems for parents.

Further research is certainly warranted in this area. Despite the failure of the SKIP-PI condition we know that parents are critical role models for their children and an important part of their learning systems (Bronfenbrenner 1989; Carpenter 2007). Future studies should be undertaken to conduct high quality family based interventions to improve children's motor skill abilities and increase physical activity participation of children. In addition, the number of participants in the studies should be increased in order to have effective and efficient family based interventions for motor development of children.

Retention effects of interventions

The findings show that the SKIP and the SKIP-PI groups were able to maintain performance of their OC skills after the intervention. These findings add valuable information to the motor development literature, as few studies (Connor-Kuntz and Dummer 1996; Robinson and Goodway 2009; Valentini and Rudisill 2004; Zask et al. 2012) have used a retention test

to demonstrate motor learning. A systematic review study also showed that only 2 out of 17 studies included retention tests for following up children in the motor development interventions (Riethmuller et al. 2009). It is noteworthy that posttests of the motor skill interventions indicate immediate motor learning (performance) among children and retention tests of motor skill interventions show more permanent results in motor development (learning). Thus, retention test should be conducted in motor skill interventions to determine the quality of motor skill programs. Future research should conduct longitudinal studies to track how OC skill performance of these children in preschool persists as they enter kindergarten and elementary school. A surprising result was that the comparison group improved their OC performance from post to retention test. It may be that practice effects and familiarity with the test accounted for this finding. However, it is important to note that for the comparison group their scores were still in the range of developmental delays for OC skills (IDEA 2004).

Conclusions

Overall, these findings show that young children who are disadvantaged demonstrate delays in their motor skills prior to intervention. If high quality structured motor skill intervention in the form of SKIP is provided, they can gain significant improvements in their OC skill development.

References

Ayers, S., L. D. Housner, R. Gurvitch, T. Pritchard, M. Dell-Orso, H. Y. Kim, S. Dietrich, et al. 2005. "An Examination of Skill Learning Using Direct Instruction." *Physical Educator* 62: 136–144.

Bardid, F., F. J. Deconinck, S. Descamps, L. Verhoeven, G. De Pooter, M. Lenoir, and E. D'Hondt. 2013. "The Effectiveness of a Fundamental Motor Skill Intervention in Preschoolers with Motor Problems Depends on Gender But Not Environmental Context." *Research in Developmental Disabilities* 34 (12): 4571–4581.

Barnett, L., E. van Beurden, P. Morgan, L. Brooks, and J. Beard. 2008. "Does Childhood Motor Skill Proficiency Predict Adolescent Fitness." *Medicine and Science in Sports and Exercise* 40 (12): 2137–2144.

Barnett, L. M., T. Hinkley, A. D. Okely, and J. Salmon. 2013. "Child, Family and Environmental Correlates of Children's Motor Skill Proficiency." *Journal of Science and Medicine in Sport* 16 (4): 332–336.

Becker, W. C., and D. W. Carnine. 1980. "Direct Instruction: An Effective Approach to Educational Intervention with the Disadvantaged and Low Performers." In *Advances in Clinical Child Psychology*, edited by B. B. Lahey and A. E. Kazdin, Vol. 3, 429–473. New York: Plenum.

Berk, L. 2009. *Child Development*. 8th ed. Boston, MA: Pearson.

Bronfenbrenner, U. 1989. "Ecological Systems Theory." *Annals of Child Development* 6: 185–246.

Bronfenbrenner, U. 2005. *Making Human Beings Human*. Thousand Oaks, CA: Sage.

Carpenter, B. 2007. "The Impetus for Family-Centered Early Intervention." *Child: Care, Health and Development* 33 (6): 664–669.

Chao, P., T. Bryan, K. Burstein, and C. Ergul. 2006. "Family Centered Intervention for Young Children At-Risk for Language and Behavior Problems." *Early Childhood Education Journal* 34 (2): 147–153.

Clark, J. E., and J. S. Metcalfe. 2002. "The Mountain of Motor Development: A Metaphor." In *Motor Development: Research and Review*, edited by J. E. Clark and J. H. Humphrey, Vol. 2, 62–95. Reston, VA: NASPE Publications.

Conner-Kuntz, F., and G. Dummer. 1996. "Teaching Across the Curriculum: Language-Enriched Physical Education for Preschool Children." *Adapted Physical Activity Quarterly* 13 (3): 302–315.

Cools, W., K. De Martelaer, C. Samaey, and C. Andries. 2011. "Fundamental Movement Skill Performance of Preschool Children in Relation to Family Context." *Journal of Sport Sciences* 29 (7): 649–660.

Dunst, C. J. 2002. "Family-Centered Practices: Birth Through High School." *The Journal of Special Education* 36 (3): 139–147.

Ericsson, I. 2011. "Effects of Increased Physical Activity on Motor Skill and Marks in Physical Education: An Intervention Study in School Years 1 Through 9 in Sweden." *Physical Education and Sport Pedagogy* 16 (3): 313–329.

Fisher, A., J. J. Reilly, L. A. Kelly, C. Montgomery, A. Williamson, J. Y. Paton, and S. Grant. 2005. "Fundamental Movement Skills and Habitual Physical Activity in Young Children." *Medicine and Science in Sports & Exercise* 37 (4): 684–688.

Freeman, R., and S. Vakill. 2004. "The Role of Family Childcare Providers in Early Intervention." *Early Childhood Education Journal* 32 (2): 121–125.

Gabbard, C. P. 2008. *Lifelong Motor Development*. 5th ed. Dubuque, IA: Addison-Welsey.

Gallahue, D. L., J. C. Ozmun, and J. D. Goodway. 2012. *Understanding Motor Development: Infants, Children, Adolescents, Adults*. 7th ed. Boston, MA: McGraw-Hill.

Goodway, J. D., and C. F. Branta. 2003. "Influence of a Motor Skill Intervention on Fundamental Motor Skill Development of Disadvantaged Preschool Children." *Research Quarterly for Exercise and Sport* 74 (1): 36–47.

Goodway, J. D., H. Crowe, and P. Ward. 2003. "Effects of Motor Skill Instruction on Fundamental Motor Skill Development." *Adapted Physical Activity Quarterly* 20 (3): 298–314.

Goodway, J. D., and L. E. Robinson. 2006. "*SKIP*ing Toward an Active Start: Promoting Physical Activity in Preschoolers." *Beyond the Journal: Young Children* 61 (3): 1–6.

Goodway, J. D., L. E. Robinson, and H. Crowe. 2010. "Developmental Delays in Fundamental Motor Skill Development of Ethnically Diverse and Disadvantaged Preschoolers." *Research Quarterly for Exercise and Sport* 81 (1): 17–25.

Goodway, J. D., and M. E. Rudisill. 1996. "Influence of a Motor Skill Intervention Program on Perceived Motor Competence of At Risk African American Preschoolers." *Adapted Physical Activity Quarterly* 13: 288–301.

Goodway, J. D., and M. E. Rudisill. 1997. "Perceived Physical Competence and Actual Motor Skill Competence of African American Preschool Children." *Adapted Physical Activity Quarterly* 14: 314–326.

Goodway, J. D., and D. W. Smith. 2005. "Keeping All Children Healthy: Challenges to Leading an Active Lifestyle for Preschool Children Qualifying for At-Risk Programs." *Family & Community Health* 28: 142–155.

Graham, G. 2001. *Teaching Children Physical Education: Become a Master Teacher*. 2nd ed. Champaign, IL: Human Kinetics.

Graham, G., S. A. Holt-Hale, and M. Parker. 2007. *Children Moving: A Reflective Approach to Teaching Physical Education*. 5th ed. Mountain View, CA: Mayfield.

Hamilton, M., J. D. Goodway, and J. Haubenstricker. 1999. "Parent-Assisted Instruction in a Motor Skill Program for At-Risk Preschool Children." *Adapted Physical Activity Quarterly* 16 (4): 415–426.

Hands, B. P. 2012. "How Fundamental Are Fundamental Movement Skills?" *Active and Healthy Magazine* 19 (1): 14–17.

Hardy, L. L., T. Reinten-Reynolds, P. Espinel, A. Zask, and A. D. Okely. 2012. "Prevalence and Correlates of Low Fundamental Movement Skill Competency in Children." *Pediatrics* 130 (2): 390–398.

Haywood, K. M., and N. Getchell. 2009. *Lifespan Motor Development*. 5th ed. Champaign, IL: Human Kinetics.

House, A. E., B. J. House, and M. B. Campbell. 1981. "Measures of Interobserver Agreement: Calculation Formulas and Distribution Effects." *Journal of Behavioral Assessment* 3: 37–57.

IDEA (Individuals with Disabilities Education Act of 2004) – Part C and H. Pub. L. 108–446. 3. Dec. 2004. 118 Stat. 2647. Accessed September 8, 2008. http://idea.ed.gov.

Iivonen, S., and A. K. Sääkslahti. 2013. "Preschool Children's Fundamental Motor Skills: A Review of Significant Determinants." *Early Child Development and Care* 184 (7): 1107–1126.

Jones, R. A., A. Riethmuller, K. Hesketh, J. Trezise, M. Batterham, and A. D. Okely. 2011. "Promoting Fundamental Movement Skill Development and Physical Activity in Early Childhood Settings: A Cluster Randomized Controlled Trial." *Pediatric Exercise Science* 23: 600–615.

Kagan, S. L. 1999. "A5: Redefining 21st-Century Early Care and Education. Seventh Presidential Essay." *Young Children* 54 (6): 2–3.

Kirk, M. A., and R. E. Rhodes. 2011. "Motor Skill Interventions to Improve Fundamental Movement Skills of Preschoolers with Developmental Delay." *Adapted Physical Activity Quarterly* 28 (3): 210–232.

Logan, S. W., L. E. Robinson, A. E. Wilson, and W. A. Lucas. 2011. "Getting the Fundamentals of Movement: A Meta-Analysis of the Effectiveness of Motor Skill Interventions in Children." *Child: Care, Health and Development* 38 (3): 305–315.

Lubans, D. R., P. J. Morgan, D. P. Cliff, L. M. Barnett, and A. D. Okely. 2010. "Fundamental Movement Skills in Children and Adolescents: Review of Associated Health Benefits." *Sports Medicine* 40 (12): 1019–1035.

MacNamara, A., D. Collins, R. Bailey, M. Toms, P. Ford, and G. Pearce. 2011. "Promoting Lifelong Physical Activity and High Level Performance: Realising an Achievable Aim for Physical Education." *Physical Education and Sport Pedagogy* 16 (3): 265–278.

Martin, H. E., M. E. Rudisill, and P. E. Hastie. 2009. "Motivational Climate and Fundamental Motor Skill Performance in a Naturalistic Physical Education Setting." *Physical Education and Sport Pedagogy* 14 (3): 227–240.

Metzler, M. W. 2005. *Instructional Models for Physical Education*. Scottsdale, AZ: Holcomb Hathaway.

Miedel, W. T., and A. J. Reynolds. 1999. "Parent Involvement in Early Intervention for Disadvantaged Children: Does It Matter?" *Journal of School Psychology* 37 (4): 379–402.

Miller, J., K. Vine, and D. Larkin. 2007. "The Relationship of Process and Product Performance of the Two-Handed Sidearm Strike." *Physical Education and Sport Pedagogy* 12 (1): 61–75.

National Association for Sport and Physical Education. 2009. *Active Start: A Statement of Physical Activity Guidelines for Children Birth to Five Years*. 2nd ed. Oxon Hill, MD: AAHPERD Publications.

Newell, K. M. 1984. "Physical Constraints to Development of Motor Skills." In *Motor Development During Preschool and Elementary Years*, edited by J. Thomas, 105–120. Minneapolis, MN: Burgess.

Newell, K. M. 1986. "Constraints on the Development of Coordination." In *Motor Development in Children: Aspects of Coordination and Control*, edited by M. G. Wade and H. T. A. Whiting, 341–360. Dordrecht: Nijhoff.

Okely, A. D., M. L. Booth, and T. Chey. 2004. "Relationships Between Body Composition and Fundamental Movement Skills Among Children and Adolescents." *Research Quarterly for Exercise and Sport* 75 (3): 238–247.

Payne, V. G., and L. D. Isaacs. 2011. *Human Motor Development: A Lifespan Approach*. 8th ed. New York: McGraw-Hill.

Raudsepp, L., and P. Pall. 2006. "The Relationship Between Fundamental Motor Skills and Outside-School Physical Activity of Elementary School Children." *Pediatric Exercise Science* 18: 426–435.

Riethmuller, A. M., R. A. Jones, and A. D. Okely. 2009. "Efficacy of Interventions to Improve Motor Development in Young Children: A Systematic Review." *Pediatrics* 124: 782–792.

Rikard, G., L. Boswell, and B. Boni. 1993. "Teacher Effectiveness in Using Direct Instruction for Student Skill Acquisition." *Physical Educator* 50 (4): 194–200.

Robinson, L. E., and J. D. Goodway. 2009. "Instructional Climates in Preschool Children Who Are at Risk. Part I: Object Control Skill Development." *Research Quarterly for Exercise and Sport* 80 (3): 533–542.

Sandall, S., M. L. Hemmeter, B. J. Smith, and M. E. McLean. 2005. *DEC Recommended Practices: A Comprehensive Guide for Practical Application*. Longmont, CO: Sopris West.

Seefeldt, V. 1980. "The Concepts of Readiness Applied to Motor Skill Acquisition." In *Children in Sport*, edited by R. A. Magill, M. J. Ash, and F. L. Smoll, 31–37. Champaign, IL: Human Kinetics.

Shaw, D. S., T. J. Dishion, L. Supplee, F. Gardner, and K. Arnds. 2006. "Randomized Trial of a Family-Centered Approach to the Prevention of Early Conduct Problems: 2-Year Effects of the Family Check-up in Early Childhood." *Journal of Consulting Clinical Psychology* 74 (1): 1–9.

Silverman, S. J., and C. D. Ennis. 1996. "Enhancing Learning: An Introduction." In *Student Learning in Physical Education: Applying Research to Enhance Instruction*, edited by S. J. Silverman and C. D. Ennis, 3–8. Champaign, IL: Human Kinetics.

Sluijs, E. M., A. M. McMinn, and S. J. Griffin. 2008. "Effectiveness of Interventions to Promote Physical Activity in Children and Adolescents: Systematic Review of Controlled Trials." *British Journal of Sports Medicine* 42 (8): 653–657.

Stodden, D. F., and J. D. Goodway. 2007. "The Dynamic Association Between Motor Skill Development and Physical Activity." *Journal of Physical Education, Recreation and Dance* 78 (8): 33–49.

Stodden, D. F., J. D. Goodway, S. J. Langendorfer, M. A. Roberton, M. E. Rudisill, C. Garcia, and L. E. Garcia. 2008. "A Developmental Perspective on the Role of Motor Skill Competence in Physical Activity: An Emergent Relationship." *Quest* 60: 290–306.

Sweeting, T., and J. E. Rink. 1999. "Effects of Direct Instruction and Environmentally Designed Instruction on the Process and Product Characteristics of a Fundamental Skill." *Journal of Teaching in Physical Education* 18: 216–233.

Taylor, W. C., T. Baranowski, and D. R. Young. 1998. "Physical Activity Interventions in Low-Income, Ethnic Minority, and Populations with Disability." *Preventive Medicine* 15 (4): 334–343.

Tucker, P. 2008. "The Physical Activity Levels of Preschool Aged Children: A Systematic Review." *Early Childhood Research Quarterly* 23: 547–558.

Ulrich, D. A. 2000. *The Test of Gross Motor Development*. 2nd ed. Austin, TX: Proed.

USDHHS. 2010. "Head Start Program Policies and Fact Sheet." Accessed May 12, 2010. http://www.acf.hhs.gov/programs/ohs/.

Valentini, N. C., and M. E. Rudisill. 2004. "An Inclusive Mastery Climate Intervention and the Motor Skill Development of Children With and Without Disabilities." *Adapted Physical Activity Quarterly* 21 (3): 330–347.

Venetsanou, F., and A. Kambas. 2010. "Environmental Factors Affecting Preschoolers' Motor Development." *Early Childhood Education Journal* 37: 319–327.

Zask, A., L. M. Barnett, L. Rose, L. O. Brooks, M. Molyneux, D. Hughes, J. Adams, and J. Salmon. 2012. "Three Year Follow-up an Early Childhood Intervention: Is Movement Skill Sustained?" *International Journal of Behavioral Nutrition and Physical Activity* 9: 127.