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Young Athletes Intervention: Impact of Motor Development

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Abstract

Background The preschool years are a crucial period for supporting motor skill development in young children with developmental disabilities who often experience deficits in motor skills. While research has shown that it is possible for young children with disabilities to make significant motor gains with motor interventions, existing research in this area often lack a rigorous research design, sound theoretical underpinnings, or programmatic features that reflect the breadth of motor skills that are essential during this important developmental period. This study was conducted to examine the effectiveness of the Young Athletes intervention to promote motor development in preschool aged children with disabilities.

Method Fifty preschool classrooms of children with disabilities ($N = 233$) were randomly assigned to an intervention group that participated in the Young Athletes (YA) intervention or a control group. Measures of children's' motor skills were assessed using the Peabody Developmental Motor Scale (PDMS) and the Vineland Teacher Rating Form (VTRF) before and after the eight week intervention period. Teachers and parents who represented the YA intervention group completed post surveys regarding the benefits of participation in the YA intervention.

Results Hierarchical Linear Modeling (HLM) indicated significant Time X Treatment interaction on three subscales (stationary, locomotion, object manipulation) of the PDMS. Children who participated in the YA intervention exhibited mean gains of 7 - 9 months on PDMS subscales compared to mean gains of 3 - 5 months in the control group. Children participating in the YA intervention also showed significantly greater gains on the gross motor subscale of the VTRF than the control group. The effects of the YA intervention did not differ with regards to gender or primary disability. Teachers and parents reported benefits for children such as improvements in specific motor skills, kindergarten readiness skills, and social/play skills.

Conclusions A comprehensive theoretically based motor intervention implemented at a pivotal developmental period can promote the motor skill development of children with developmental disabilities in a relatively short period of time. Implications for practice and directions for future research are explored.

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Young Athletes Intervention: Impact on Motor Development

The preschool time period is the ideal time to promote motor development and engagement in physical activities given the rapid growth taking place in young children. During the preschool years, children are learning to use their bodies in complex ways (e.g., jump, climb, catch) which require motor skills such as locomotion, motor planning, balance, and object manipulation. As these skills become more coordinated, children can be observed walking backwards and sideways, jumping greater distances and heights, and throwing a ball overhand and underhand (Provost et al., 2007a,b).

While motor skills develop naturally among most typically developing preschoolers, young children with disabilities often experience deficits in this area (e.g. Emck, et al., 2009; Goodway, et al., 2003; Provost et al., 2007 a, b; Wuang et al., 2008). For example, Provost et al. (2007a, b) found that preschoolers with developmental delays had significant impairments in motor skills that require balance and motor planning. Because motor skills are viewed as "building blocks" for many areas of development (e.g. precursors to kindergarten readiness such as pre-reading, pre-writing and pre-math skills), limitations in early motor skill development can lead to a broad array of difficulties in other skill areas that are dependent upon these skills (Piek, et al., 2008; Brown et al., 2009b; Cahill, 2009; Seymour, Reid, & Bloom, 2009; Iverson, 2010). Therefore, it is important that young children with disabilities are provided with *direct and intentional instruction* for motor skill development during the preschool years (Green et al., 2009; Marton, 2009; Pan et al., 2009; Provost et al., 2007b). However, in a systematic review of preschool motor skill interventions, Riethmuller, Jones, and Okely (2009) highlighted the limited number of interventions that had both a sound theoretical base to their development and high research standards for evaluation of their efficacy. Of the more than 8,000 studies reviewed, only 17 met the authors' established criteria and of these studies, only three had high methodological quality. Further, for those few programs that reported positive effects on motor development, it was difficult to determine what contributed to the efficacy as there was wide variation in the number of motor skills addressed and in the different intervention components utilized. Several other researchers concur with both the need for theoretically

sound motor programs for preschoolers and the general lack of research on such programs (Brown, et al., 2009b; Priest, 2006; Goodway & Branta, 2003).

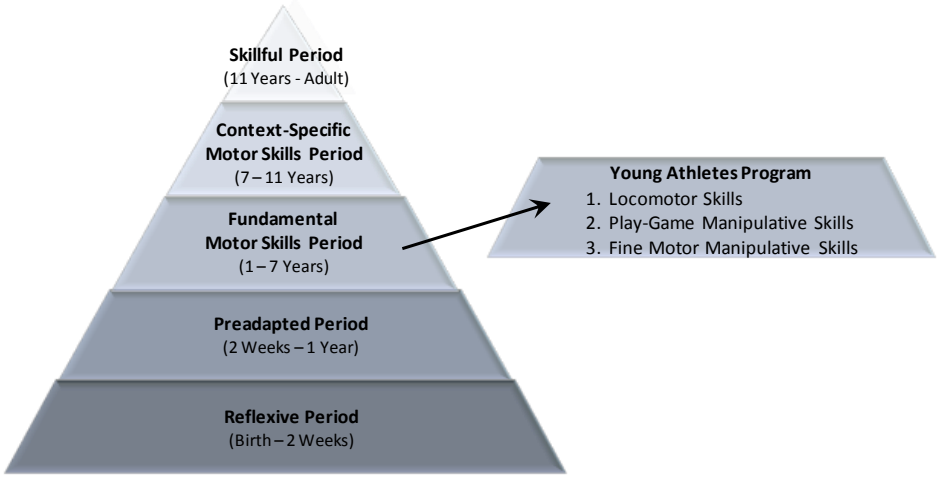
Notwithstanding Riethmuller's finding from the meta-analysis, recent literature does indicate that children who have developmental delays can make significant motor gains in a few weeks (Goodway and Branta, 2003; Apache, 2005). While these and other studies demonstrate change in motor skills, they are limited in a number of ways. For example, many studies of motor skill development only measure object manipulation (Goodway & Amui, 2007; Amui, 2006; Hamilton, 1999) or object manipulation and locomotion (Apache, 2005; Gooday & Branta, 2003a, 2003b). In addition, while preschool motor programs should have a strong conceptual base, and address the full range of motor skills developed during the preschool years, many studies are limited in scope to the development of perceptual motor skill (Swabey & Yeo, 1998), kicking and throwing (Bergen, 2000), run, hop, balance, kick, catch (Rutledge, 1983); dance (Venetsanou; 2004) and do not address the breadth of motor skills which develop in the preschool years (Clark, 2005). These limitations have particular relevance when developing motor programs and assessing motor outcomes for young children with developmental delays. For example, children with autism and related disorders have challenges with proprioception, sense of their body's position and their body position as they move (Redlich, 2010). This in turn impacts balance, limb movement and coordination which supports both object manipulation and locomotion. Further, since young children with developmental delays exhibit challenges related to stationary motor skills such as balance and postural control (Manjiviona & Prior; 1995; Provost, et al., 2007; Vicari, 2006) it is important that both the scope of measurement *and* the breadth of motor programs focus on *all* components of motor development.

To address the limitations of previous studies and explore approaches to improve the motor skills of preschool children with disabilities, we expanded the Young Athletes (YA) initially developed by Special Olympics Inc. and adapted it for use in preschool classrooms. The YA intervention (Favazza, et al., 2011) is based on Clark's "mountain of motor development" (Clark, 1994; Clark, 2005; Clark and Metcalfe, 2002) (see Figure 1).

The "mountain of motor development" represents a sequential, cumulative progression in acquiring motor skills. The skills taught in YA directly correspond to the Fundamental Motor Skill Development Period during the preschool years (i.e., locomotion

skills, play game manipulative skills, fine motor manipulative skills). These skills, which form the foundation for

Figure 1. *Motor Development Periods*



later skill development and participation in physical activities, enable children to control their bodies and manipulate their environment to perform complex movements used in everyday activities. It is important to note that the development of these fundamental skills is not maturationally driven however, but requires environmental support and multiple opportunities to acquire and hone more efficient and effective skills. Simply stated, these skills do not just develop – they must be taught and practiced.

The YA intervention focuses specifically on foundational skills (visual tracking, motor imitation), walking and running, balance and jumping, trapping and catching, throwing, striking, and kicking. These motor skills build upon one another, scaffolding from one period to the next (Gabbard, 2000; Payne & Isaacs, 2002). When provided with opportunities to develop these skills, preschoolers use underlying skills such as motor planning and coordination, grasp/release and visual-motor integration (Clark, 1994; Provost, et al., 2007a,b). The development of these same motor skills is also important for learning behaviors which are simultaneously developing such as basic coordination, balance, posture needed for self feeding, grasping objects, and writing.

While Young Athletes appears to have the essential or key ingredients of motor curriculums for young children and appears to be conceptually sound and covers the breadth of skill developed during the preschool years, there has been no research on the effectiveness of YA in promoting motor development in young children with disabilities. Moreover, the real test of YA is in its ability to improve the motor skills of preschool children with developmental delays who have considerable motor deficits in all three primary areas: stationary skills (balance, postural control), locomotion (run, hop, and skip), and object manipulation (catch, throw). Therefore, the purpose of this study was to determine the impact of participation in the YA intervention on the motor development of preschool children with developmental delays.

Methods

Participants.

Classes. Fifty preschool classes from 26 schools from Rhode Island and North Carolina participated in this study. Class size varied from 5-16 children per class and represented a variety of settings: public and private preschool settings and child development centers. Thirty-four of the classes (69%) were inclusive classes (had at least 3 children with disabilities) and 15 (31%) were self-contained classes.

Children. While all children in each class participated in YA, a two step criteria was used to select children with disabilities for data collection. Consent letters were distributed to parents of all children in participating classes. Once consent was obtained the child's disability diagnosis was provided by the teacher from school records. For each child who met the disability recruitment criteria: *Children with an Intellectual Disability, including those with Developmental Delays, with the recognition that some children may have accompanying behavioral differences or a secondary diagnosis (e.g., Autism Spectrum Disorder, Pervasive Developmental Delay)*, a secondary criterion was used to determine which children could be included in the data collection. Children were included in data collection if he/she was able to a) walk independently, b) follow simple directions and, c) attend to motor tasks during testing. Children with significant motor challenges (e.g., uses a wheelchair or walker and therefore does not walk independently), has difficulty following simple directions were

excluded from data collection as it was likely they could not be reliably tested on motor assessments (See Table 1).

The ABILITIES Index (AI) (Simeonsson & Bailey, 1988, 1995) was completed by teachers to determine which children met the secondary criteria for inclusion in data collection. Because children with the same disability can vary in severity, and therefore may respond differently to the YA intervention (have more/less motor ability, stamina, and vitality), it was important to obtain this descriptive information. The ABILITIES Index (Simeonsson & Bailey, 1988) provides a profile of a functional measure of a child's abilities across 9 major areas (**A** Audition Left Ear, Right Ear, **B** Behavior & Social Skills Social Skills, Inappropriate Behavior, **I** Intellectual Functioning, **L** Limbs Left Hand, Left Arm, Left Leg, Right Hand, Right Arm, Right Leg, **I** Intentional Communication Understanding Others, Communicating with Others, **T** Tonicity Degree of Tightness, Degree of Looseness, **I** Integrity of Physical Health , **E** Eyes Left Eye, Right Eye, **S** Structural Status). The resulting profile provides a comprehensive picture of the child's abilities and disabilities. In each domain, the teacher rates the student, where normal is assigned a score of 0 and profound disability is assigned a score of 5. The highest score obtainable is 95 with higher scores indicating more significant disability. The AI has generally strong reliability and validity with strong test-retest reliability (.77, Bailey, 1993) and strong validity (Buysse, 1993). The Addendum to the ABILITIES Index (Favazza & Zeisel, 2009) was developed to provide additional descriptive information about the types and frequencies of therapies children were receiving (e.g.: physical therapy, occupational, therapy, speech therapy, language therapy, hippo therapy, behavioral therapy) that could impact motor skill development.

Table 1. *Child Characteristics*

	Gender total		Age			Primary Diagnosis					Secondary Diagnosis				
	Male	Female	3	4	5	DD	ASD	CD	ID	Other	CD	DD	ASD	ID	Other
#	186	47	55	122	56	169	47	6	4	7	61	14	1	1	19
%	80%	20%	24 %	52 %	24 %	72 %	20%	3%	2 %	3 %	64 %	15 %	.5%	.5 %	20%

NOTE 1. DD (Developmental Delay), ASD (Autism Spectrum Disorder), CD (Communication Disorder), ID (Intellectual Disability) Other (Cerebral Palsy, Hearing Impairment, Visual Impairment) Physical Impairment, Behavioral Disorder, Dual Sensory Impairment)
NOTE 2. All children had a primary diagnosis and 93children (41%) had a secondary diagnosis.

The AI ratings enabled teachers and project staff to determine the severity of a child's disability (and therefore their ability to be reliably tested) rather than using only the disability label. Two hundred and thirty three children (187 boys, 47 girls) from the 50 classes met criteria for data collection. Of the 233 children, 123 (52%) were from North Carolina and 111 (47%) were from Rhode Island.

Design and Procedures.

Design. A randomized Pretest-Posttest Control Group Design was used. Specifically, the 50 preschool classes were randomly assigned to one of two groups: Intervention or Control. The YA Intervention classes had 113 children and the control classes had 120 children. Classes randomly assigned to the intervention group participated in pretest, the eight week YA intervention and, post-test. Classes randomly assigned to the control group received pre-test and post-test only.

Components. Riethmuller and his colleagues (2009), in their systematic and extensive review of preschool motor programs, recommend that programs be at least one hour per week, implemented in smaller time slots (e.g., a 90-minute program would be broken up into 3, 30 minute sessions); that teachers and teacher assistants deliver the motor programs as this maximizes potential for sustainability, minimizes implementation cost, and enhances participation level as they already have a relationship with the students (Dowda, et al., 2004); and that participation in professional development will likely increase fidelity, competence, confidence and enthusiasm. Based on these recommendations an eight week motor development intervention was designed to be delivered three times per week for 30 minutes per session by preschool teachers and their assistants. There were 24 comprehensive Young Athlete lessons that corresponded to the eight motor skill units. Each thirty minute scripted lesson included an Opening Motor Movement Song (4-5 minutes); motor games and activities (approximately 20 minutes); Closing (Cool Down) Motor Song (4-5 minutes). These 24 lessons included motor activities for foundational skills (visual tracking, motor imitation), walking and running, balance and jumping, trapping and catching, throwing, striking, and kicking and one review week. In addition, a one-page summary card with abbreviated lesson components for the entire week was created to enable the teacher to

make a quick reference to the key features of the lesson while implementing the YA intervention. Teachers were also provided with 2 YA Kits that included a variety of equipment such as balls, scarves, bean bags, cones, beams, etc. Teachers were asked to use only the materials provided in the YA kits.

Given the importance of family involvement (Dunlap & Fox, 2007; DEC, 2007; NAEYC, 2003; NASPE, 2002), a home component was developed to compliment the lessons presented by teachers at school. The Home Component included a 1-2 page communication sent home to families once a week that provided a description (narrative with pictorial demonstrations) of the 4-6 activities presented that week, suggestions for how to use the YA activities with family members, a list of equipment used at school with a substitution list of everyday household items (e.g. using a laundry basket to throw a ball into, using a kitchen towel for the scarf game) that can be used, and the opening and closing YA songs. Because the YA intervention was implemented as a class-wide program, the parents of all children from each YA class received a weekly communication. In addition, the parents of children from the intervention group who were included in data collection completed a post survey about the intervention and observations about their child related to motor development and/or the YA intervention.

Training. Prior to implementing the YA intervention, teachers and their assistants from the YA intervention group were provided a three hour training session consisting of: background on YA; an overview of the new expanded YA intervention; a demonstration of the ways in which the YA equipment can be set up and used. The training also included suggestions for how to structure YA within the class, how best to utilize other adults during YA implementation and, how to individualize instruction for children with diverse abilities. While all teachers would be implementing the same lessons three times a week for 8 weeks, the lesson format could vary within each class to accommodate learning differences, space accommodations, and size of the class.

Teachers were encouraged to adapt the lessons according to the individual needs of their children (DEC, 2007). For example, if a child was unable to jump over a hurdle, they could encourage a child to step over the hurdle. Likewise, if a child was unable to throw a beanbag under-handed, the teacher would provide hand-over-hand assistance for this motor movement to enable the child to successfully complete the task with the individualized

levels of support. In this way, the motor tasks were matched to each child's ability. In all instances teachers were encouraged to gradually decrease the amount of assistance over time, as the child progressed in the mastery of a skill. Teachers were also encouraged to embed the child's culture and language in the YA intervention by allowing children to choose motor movements during the Opening and Closing Songs and using language (e.g., Spanish) during the intervention or home communication that was consistent with children's culture and language (Culturally & Linguistically Appropriate Services (CLAS), 2000). Training also included overview of the data collection procedures such as how to complete all of the assessment forms. Every teacher participated in the training however, teachers who represented the control group received only the training related to data collection at the onset of the study.

Measures

Several measures were used to assess: 1) motor skill development and 2) fidelity of implementation.

Motor Skill Development. Two instruments were used as pre-post measures to assess children's improvement in motor skills. Research staff administered the Peabody Developmental Motor Scales – Second Edition (PDMS) (Folio & Fewell, 2008) and teachers completed the Vineland II, Teacher Rating Form (Sparrow, et al., 2005). Each is briefly described below. The PDMS is widely used in research with preschool children with disabilities and has high reliability for all subscales with the coefficient alpha indices of internal consistency for all above .89, test-retest all above .82 and inter-rater reliability all above .96. Three subscales from the PDMS were used to measure motor skill: locomotion, stationary and object manipulation subscales. Each child's motor development was assessed by project staff that had previous experience using the PDMS. Motor testing took approximately 20-30 minutes per child, depending on the child.

The Vineland-II Teacher Rating Form (VTRF), Second Edition (Sparrow, et al., 2006) was completed by teachers prior to the start of the YA intervention and during the corresponding time period for the control classes and, at completion of the 8 week intervention. The VTRF is a widely used assessment of children ages 3-21 in preschools and elementary and secondary schools. It is designed to be completed by teachers and includes 4 domains: communication, daily living skills, socialization, and motor skills. The VTRF employs a

rating scale format in which the teacher rates the child's adaptive behaviors on a 0-2 scale (2 = usually; 1 = sometimes or partially; 0 = never). The VTRS was normed on over 2,000 children (3-18 years of age) with reliability and validity established at satisfactory levels for both typically developing children and those with intellectual disability, autism and a wide range of other disabilities.

Post -Intervention Survey. Both teachers and parents from the YA classes completed a post intervention survey about the benefits of YA participation and observations of changes in motor behavior that they would attribute to YA participation. Post surveys were distributed to all teachers and to all parents of children who participated in the data collection aspect of the study.

Fidelity of Implementation. Four indicators were used to determine the quantity of exposure to the YA intervention and fidelity of implementation: attendance, Teacher Evaluation and Implementation Log (TEIL), the Fidelity of Implementation Checklist and the YA Home Record. The first fidelity indicator, *attendance,* was taken in all classes to ascertain the amount of the YA intervention each child from the implementation group was exposed to. Percentage of exposure to the intervention was measured by collecting school attendance on the children for the days on which the intervention was implemented. For the second fidelity measure, teachers completed a weekly log, the TEIL, to indicate which YA activities were completed and the amount of time in YA intervention. The activities from the YA lessons were incorporated into the TEIL and each day a YA lesson was implemented, teachers completed a checklist of activities that corresponded directly to the YA lessons. For example, in Week One (Foundational Skills), there are 6 activities in the Day One Lesson: Opening Song, I Spy, Scarf Game, Inchworm Wiggle, Bridges and Tunnels, Closing Song. This same procedure was repeated for all YA lessons across the 8 week intervention.

A third indicator of fidelity was used once a week by research staff who observed teachers implementing the YA intervention using the *Fidelity of Implementation Checklist*. Once a week, research staff recorded the occurrence or nonoccurrence of each activity within a YA lesson and the length of lesson. Prior to conducting classroom observations, all project staff participated in Fidelity of Implementation coder training in situ. In addition, two research staff completed 33% of lesson observations together and calculated inter-rater

agreement to ensure that reliability between observers was maintained. If agreement fell below 80%, retraining occurred to ensure that coders were following the same procedures. The same instrument was used by research staff who observed in control classes during the motor activities or physical education to document the *nonoccurrence* of YA activities. These observations in the control class occurred twice during the 8 week time period. Lastly, parents of children who participated in the YA intervention were asked to complete a *YA at Home Record* indicating if they used YA activities at home.

Results

Severity of Disability. As a first step, we employed the ABILITIES Index (AI) (Simeonsson & Bailey, 1988) to determine the severity of disability over and beyond their diagnosis from school records. Two hundred and thirty three children (187 boys, 47 girls) from the 50 classes met criteria for data collection. Children's AI scores ranged from 1 to 32 with higher scores indicating more severe disabilities. Groups did not differ in AI level; children in the intervention group (M = 6.56, SD = 7.74) were no different in the severity of their disability than children in the control group (M = 7.11, SD = 7.31). Further, with regard to therapeutic services, almost all children (84%) received speech therapy, more than half of the children (55%) received occupational therapy, and a few received physical therapy (17%). Again, there were no differences between the number of children who received therapy and the nature of that therapy in the YA intervention and control groups.

Fidelity of Implementation. School attendance record was used to determine the percentage of exposure to the YA intervention for the days on which the intervention was implemented. The intervention occurred 3 days a week for 8 weeks or 24 days. Attendance records indicated that children attended 21-24 days, or 88-100% of the YA intervention.

Teachers completed the *Teacher Evaluation and Implementation Log* (TEIL), to indicate which YA activities were completed in each lesson. Across the 8 weeks, teachers had an opportunity to lead 187 YA activities from the lessons. Results from the TEIL indicate that on average teachers completed 89%-98% of the 187 YA activities. Also, weekly time spent in the YA intervention was 89-92 minutes. For the few teachers who did not complete lessons their reasons were related to the behaviors of the children, the absence of an adult which changed the adult-child ratio, or difficulty of the motor activity for children.

Another indicator of fidelity was observing teachers as they implemented the intervention using the *Fidelity of Implementation Checklist*. Once a week, two research staff recorded the occurrence or nonoccurrence of each activity within in a YA lesson. Teachers completed on average, 90% (167/186) of the YA activities. (Inter rater reliability, using Delta software, yielded a Kappa of .91 and Delta of .95.) Research staff also observed in the control classes twice during the 8 week period of time to document the nonoccurrence of YA in these classes. Results showed that YA did not occur in the control classes.

The YA at Home Record was used to assess parent implementation of YA at home. Once a week parents of children in the YA intervention group were asked to complete the YA Home Record, indicating how often they used YA activities at home. Results showed that only 46% of the 113 families completed the YA Home Record, indicating they used YA activities at home on average of 2 times per week. No further analysis was undertaken as the data was not a representative sample of the participating families. Moreover, we could not assume that those who failed to complete the YA at Home Record did or did not use YA at home. In fact some teachers indicated that parents who did not submit the YA at Home Record reported that they liked using YA at home.

Motor Skill Development. To assess the motor gains of children in the YA intervention and control groups, a three-level mixed model hierarchical linear regression (HLM) with time nested within child and child nested within class was used. This nesting creates non-independence between observations. Hierarchical linear modeling (HLM) incorporates this non-independence in the model through the estimation of random effects (Burchinal & Appelbaum, 1991; Raudenbush & Bryk, 2002; Singer, 1998). These models were three level mixed models with time at level one, child at level two, and classroom at level three and with estimates for random intercepts.

The model included Time, Treatment, and the Time X Treatment interaction as key predictors in explaining motor changes assessed by the Locomotion, Object Manipulation, and Stationary motor subscales of the PDMS and Gross and Fine motor subscales of the VTRF. V-scale scores were used when analyzing VTRF data because a majority of children scored below the threshold for age equivalents, thus, age equivalents were not able to be computed for a large portion of the sample. State was included as a covariate for all models. Means and standard errors can be found on Table 2.

Results indicated a main effect for Time on all three of the PDMS subscales. As expected, children's motor skills at Time 2 were significantly more advanced than their motor skills at Time 1, Stationary AE $F = 92.50$, $p < .001$; Locomotion AE $F = 166.81$, $p < .001$; Object Manipulation AE, $F = 92.71$, $p < .001$. There were no main effects on any of the subscales for Treatment. However, the time effects observed in the PDMS subscales were further explained by a Time X Treatment interaction.

A significant Time X Treatment interaction emerged for both the Locomotion ($F = 23.33$, $p < .001$, $d = .26$) and Object Manipulation ($F = 23.09$, $p < .001$, $d = .38$) PDMS subscales. Children in the YA intervention group gained on average 7 months on the age equivalent scales, compared to average gains of 3 months for children in the control group. Simply stated, the motor skills of young children participating in the intervention improved at twice the rate of

Table 2. *Model based Means and Standard Errors on subscales of PDMS and VTRF motor scales.*

	Control		Young Athletes			
	Time 1	Time 2	Time 1	Time 2	Interaction F	*d*
PDMS[1]						
Object Manip.	37.06 (1.20)	39.52 (1.20)	37.08 (1.17)	44.44 (1.17)	23.09***	.38
Locomotion	36.88 (1.39)	40.14 (1.40)	37.31 (1.36)	44.48 (1.35)	23.33***	.26
Stationary	34.10 (1.72)	38.78 (1.73)	34.40 (1.69)	43.22 (1.69)	8.70**	.21
VTRF[2]						
Fine Motor	10.46 (.21)	10.82 (.17)	11.36 (.19)	11.53 (.20)	.46	-
Gross Motor	11.85 (.27)	11.58 (.27)	11.57 (.26)	12.07 (.26)	4.82*	.27

*$p < .05$ **$p < .01$ ***$p < .001$

[1]PDMS Subscales use Age-Equivalent Scores
[2]VTRF Subscales use V-Scale Scores

children in the control group who did not participate in the intervention. D-type effect sizes indicate a small statistical effect for the Time X Treatment interaction for Locomotion and Object Manipulation. Results also indicated a significant Time X Treatment interaction in favor of children in the YA intervention group with gains of almost 9 months on the PDMS Stationary subscale compared to gains of 5 months for the children in the control group, (*F*

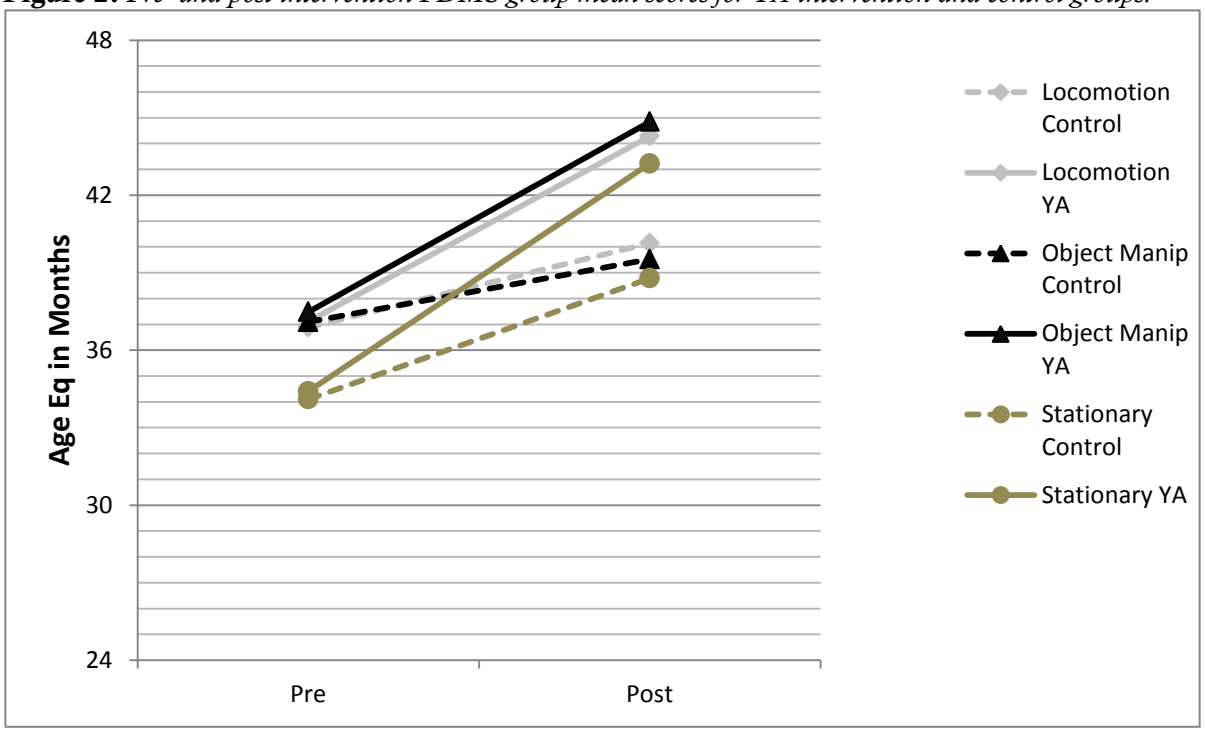
= 8.70, $p < .01$, $d = .21$). A d-type effect size indicated a small statistical effect for the Stationary subscale. (See Figure 2.)

Teacher ratings on the VTRF Fine Motor subscale showed a main effect for Treatment (F= 4.11, $p < .05$) but no main effect for Time, nor was there an interaction between Time and Treatment. There were also no Time or Treatment main effects on the Gross Motor skills subscale. However, there was a significant Time X Treatment interaction on the Gross Motor

subscale, $F = 4.82$, $p < .05$, $d = .27$. A d-type effect size indicated a small statistical effect. Taken together these findings suggest that not only did motor skills improve based on ratings made by a trained observer (PDMS), but also that teachers saw significant motor improvement in the children.

As a follow up, the effects of gender and disability on the motor gains made by children in the YA intervention group were examined. Results of a series of *t*-tests indicated no differences in motor gains between boys and girls nor were there differences as a function of children's primary diagnosis.

Figure 2. *Pre- and post intervention PDMS group mean scores for YA intervention and control groups.*



Post Intervention Surveys. All teachers completed the post survey about the benefits of YA. A content analysis of the post intervention survey responses was applied following the

Johnson and La Montagne (1993) six-step procedure. Research staff read all responses to identify reoccurring patterns or themes (e.g., child made gains in motor; child made gains in social development). If a single response had multiple meanings (e.g., "They learned to hop on one foot and they learned to take turns."), the response was separated into two responses for the purpose of creating two distinct units of analyses (improved motor ability, improved kindergarten readiness skills). Once final categories of responses were identified, a definition was written for each category and then two coders read the definitions and sorted the responses into the categories. The outcome of the category sorting was used to calculate the inter-rater reliability. The frequency (and percentage) of responses within a category was used to indicate the strength of a category. For example, a category that had 50 responses would be a viewed as a strong indicator of observed behavior in children whereas a category with 3 responses would indicate that very few observations of those behaviors were reported.

Parents were given the option to complete their survey by phone or by paper survey. Eighteen parents (16%) completed the survey by phone and 71 parents (63%) completed the survey on their own. In all, 89 parents (79%) completed the post intervention survey, providing 84 distinct comments reflecting benefits of participating in the intervention. Most responses fell into the following categories: improved motor skill, social and play skills and kindergarten readiness skills (See Table 3). Two individuals who were naïve to the category development independently read the category definitions and sorted responses into the categories. Inter-rater reliability on the Family Survey was 85% and 91% agreement in sorting of the parent responses into the identified categories.

The same procedure was applied to analyze teacher responses to questions about benefits of YA participation and observations of changes in children who participated in the project. Teachers provided 150 comments on the benefits of participating in YA and responses were separated into 5 distinct primary categories: improved motor skills, improved kindergarten readiness skills, and increased enthusiasm, confidence and abilities in social and play skills, new language, new leadership skills. Inter-rater reliability on the Teacher Surveys was 93% and 97% agreement in sorting of the teacher responses into the identified categories.

Responses from both teachers and parents overlapped on three distinct categories: motor skills improvements, improvements in kindergarten readiness skills and, increased enthusiasm confidence and abilities in play and social experiences. Teachers also noted that some children acquired new language and leadership skills while parents noted an increased in physical exercise and activity level and more enjoyable family playtime with their child. Examples of specific comments from teachers and parents are provided in Table 4.

Table 3. *Response Categories from Post Surveys*

Category	Category Definition	Frequency of Teacher Responses	Frequency of Parent Responses
Motor Skill	Observed an improvement of specific gross or fine motor skills (e.g., run, walk, throw, catch, kick, balance, coordination)	94 comments 62%	37 comments 44%
Kindergarten Readiness Skills	Observed an increase in the use of common skill needed in kindergarten (e.g., following directions, turn taking, attention, participation)	37 comments 25%	11 comments 13%
Social and Play Experiences	Observed improvements in social and play skills and/or increased enthusiasm, confidence in the play and social activities	14 comments 9%	20 comments 24%

Table 4. *Teacher and Parent Post Survey Responses*

	Teacher Comments	Parent Comments

Motor Skill Improvements	• *Most children could not keep feet together and bunny hop, now they can.* • *Jump over a hurdle and land on 2 feet* • *L could not catch, now she can keep eye on ball/bean bag.* • *Developed his throwing & catching skills with more accuracy* • *Improved balance and better trunk control* • *Improved hitting skills with racket* • *Demonstrated trapping skills with hands and feet*	• *Throwing directly, very obvious improvement* • *Now he can balance on 1 foot* • *Gained skills like catching* • *He has gone from a modest awkward run to a fast run with arms moving appropriately with his legs* • *He shows more control with his feet and hands* • *He now can balance on one leg without support*
Kindergarten Readiness	• *X is more attentive in a large group* • *Improvement in turn-taking* • *Follow multi-step directions* • *Follows routine more easily* • *Improved on amount of time spent participating in activities*	• *He follows directions better (i.e. playing Simon Says, Red Light/Green Light)* • *Skills are definitely improving in turn taking and learning to follow directions* • *He learned to wait his turn in line and be patient* • *He concentrated more on tasks*
Social and Play Skills	• *Is more interested in engaging in play with their peers* • *There was an increased awareness of playing with another child because of activities such as rolling and trapping* • *Before the start of YA she would sometimes wander around the play area and was difficult to engage in activities. She now plays* • *There is an increased interest and confidence in ball play on playground*	• *He is more confident in playing sports* • *He learned new games that he enjoys* • *He learned new ways to play instead of running around* • *He wants to do these things on his own because he now enjoys it. I think the group school activities increased his enjoyment.* • *Play time is now more fun and enjoyable for both parents and kids* • *When we went to a new playground, my daughter went and climbed on things. Before she was too scared to do that.*

Discussion

Several important implications can be drawn from the results of this study. The results suggest that young children with developmental delays can improve motor skills in a relatively short period of time. These motor skill improvements occurred over a short period of time (8 weeks) during which children made significant gains. The YA intervention was implemented with high fidelity and was well attended by children in the intervention group. This fidelity data suggest that motor interventions such as YA can fit into the preschool day as teachers implemented it approximately 90% of the time. In addition, given the significant gains made in a short period of time implies that intensity matters. Follow-up analysis indicated no differences in motor gains as a function of primary diagnosis suggesting that children with *varying* disabilities (DD, ASD, ID) can make significant motor gains on the three key sub-domains: stationary, locomotion and object manipulation skills. These

findings suggest that the YA intervention corresponds well to all three sub-domains of motor development and that the intervention was robust enough to improve motor skills in children with varying disabilities. Finally, the results on the standardized tests were consistent with observations of motor gains reported parents and teachers on the post survey. This triangulation of data sources was useful in confirming results through multiple measures; providing different types of data to illuminate specific skills gains. For example, both parents and teachers observed gains in coordination, balance and throwing which were also consistent with gains noted on the PDMS and VTRF. Taken collectively, these findings imply that the scope of the YA intervention includes a wide range of motor skills that correspond to the "mountain of motor development" that occurs during the preschool years (Clark, 1994; Clark, 2005) and that when implemented with fidelity and intensity, the YA intervention can make a significant and positive impact on motor development.

These findings are consistent with previous research such as Goodway and Branta (2003) who examined the motor gains of at-risk preschoolers who participated in a motor program and, Apache (2005) who examined the effectiveness of an activity-based intervention (ABI) on the motor development of preschool children with disabilities. Results from both of these studies found that children who participated in the motor interventions made significant improvements in locomotion and object control skills. However, unlike these and other studies (Goodway & Amui, 2007; Amui, 2006), the current study found motor gains in object manipulation, locomotion *and* stationary motor skills. The additional assessment of stationary skills has particular relevance because children with autism and other developmental disabilities often have inadequate proprioception, sense of their body's position as they move (Redlich, 2010). These limitations, if not adequately addressed, can negatively impact balance, postural control, limb movement and coordination.

This study also addresses several concerns raised by the Riethmuller, Jones, and Okely (2009) meta-analysis on motor interventions. In particular, the authors raised concerns when assessing the value of preschool motor interventions regarding adequate research design and methodology, adequacy of intervention components, consistency with professional guidelines and theoretical underpinnings of the intervention. First, with regard to the rigor of the research design, in this study, a randomized assignment to treatment design was employed and training was provided to the teachers who led the YA

intervention. Both teachers and teacher assistants were included in training to maximize the potential for fidelity and increase competence of all involved. Also, because both teachers and their assistants would implement the program, it could have enhanced the participation level of children as they already had a relationship with their students (Dowda, et al., 2004). Comprehensive scripted lessons were developed and utilized during the intervention, adding to the fidelity of implementation. The observational and teacher logs indicated that teachers implemented the intervention with high fidelity in both the number of activities covered in the 8 week intervention and the amount of time spent in YA. With regard to methodologic quality, participants from the YA intervention group and the control group were carefully selected using a two step process, and were compared at baseline on key child characteristics (e.g., gender, primary diagnosis, severity of disability, therapeutic services received). The majority of the classes represented inclusive community based schools and validate measures of motor skill were utilized along with parent observations and teacher logs to confirm results. While follow-up assessment of children did not occur within this study, it is currently underway to determine if obtained gains were sustained 5 and 10 months after the intervention.

Second, several concerns regarding the adequacy of the intervention components (Riethmuller et al., 2009) were addressed in the current study as well. These included the intensity of the intervention, the description of the components and, the use of teacher assistants and parents in implementation of the intervention. The intervention structure was consistent with recommendations that motor intervention should occur at least 3 times a week, for a minimum of hour per week (Riethmuller, 2009). The YA intervention was structured to occur 3 times a week, for 30 minutes each day (90 minutes per week). The intervention components were thoroughly explained to teachers and their assistants during a pre-intervention training and research staff were present on a weekly basis to observe implementation and answer questions that might arise. In addition, parents of participants in the YA intervention were given an opportunity each week to implement the YA intervention at home.

Finally, with regard to concerns about the theoretical underpinnings of motor programs *and* links to professional guidelines (Riethmuller, et al., 2009), the YA motor intervention (Favazza, et al., 2011) focuses on the eight motor skill units, which corresponds

to *Fundamental Motor Skill Period* of Clark's "mountain of motor development" (Clark, 1994; Clark, 2005; Clark and Metcalfe, 2002). This is in contrast to previous studies which focus on limited motor skills and/or may not have a clear link to theoretical models of motor development (Swabey & Yeo, 1998; Bergen, 2000). In addition, several aspects of the YA intervention are consistent with recommended practice for motor interventions for preschoolers such as the intervention is based on theory, interventionist have training, adaptations are provided as needed, inclusion of home and school components, the focus on valued content learned through active engagement and play, the utilization of intentional teaching using strategies such as guidance, direct instruction and modeling, the inclusion of stakeholders (e.g., parents and teachers) in the evaluation (NAEYC, 2003; NASPE, 2002; DEC, 2007 National Center for Physical Development and Outdoor Play, 2010; CLAS, 2000). For example, the structure of the YA intervetnion (3 days a week, 90 minutes a week) and the utilization of both school and home components is consistent with recommended practice for preschool children. Both the intensity and the inclusion of families in support their child's development is recommended by Riethmuller (2009) and consistent with guidelines for preschool motor interventions. Given the efficacy data, and these programmatic, theoretical and research design attributes, the YA intervention(NAEYC, 2003; NASPE, 2002; DEC, 2007 National Center for Physical Development and Outdoor Play, 2010; CLAS, 2000). would be considered a high quality motor program, according to the Riethmuller, et al., (2009) criteria and the indicators from professional organizations.

While the findings of this study are promising, the results also generate many important questions on topics such as family engagement, the link between motor skill development and physical activity level, the timing of motor programs as it relates to impact on other developmental domains and, sustainability. Each of these will be discussed with implications for practice and/or research.

Given that family involvement is viewed as essential to any programs for young children with developmental delays (Brofenbrenner, 2006), one question that must be addressed is *how do we engage parents*? The inclusion of the home component does not necessarily mean that parents will participate in it. The YA intervention had components for both school and home implementation, consistent with recommended practice from the

National Association for the Education of Young Children (NAEYC) (2003), the National Association for Physical Education (NASPE) (2002) and CEC' s Division of Early Childhood (DEC) (2007). However, less than 50% of parents reported implementation of the YA activities at home. *How do we incentivize parents to use curriculums at home?* To begin to answer this question, perhaps we need to be reminded that the role of parents has particular relevance to motor development. During infancy and the toddler years, parents often engage in early finger play (Patty-Cake, Itsy Bitsy Spider, Peek A Boo) and motor play (e.g., Simon Says, Hide and Seek, Follow the Leader) with their children at home, in the back yard or on a playground. These types of early play opportunities introduce children to foundational motor skills such as visual tacking, motor imitation and other skills such as turn taking and sustained attention. Given the natural context of motor play within families and the importance of family involvement in supporting their child's motor development, we need to find meaningful ways to continue parent involvement during the preschool years to maximize the impact of the program on preschool children's gains in motor skills. Webster-Stratton and Read (2007) suggest that curriculum used in multi-cultural preschool context include a school-based parent training component to support curriculum use at home. This approach could be applied to programs like the YA intervention to increase parent engagement in the home component, to ensure cultural relevance and to determine other supports families may need. For example, an extension of the YA training to include parents could increase their understanding of the importance of parent's *continued* involvement to their child's motor development *and* the connection between motor development and other areas of development. In addition, periodic school-based parent training could be used to demonstrate the YA intervention and to learn from parents how best to support them based on their needs (e.g., collect and distribute everyday household items for use with YA activities at home, exchange ideas about culturally relevant songs from different families, meet and socialize with other families, schedule YA play dates with other families, create a checkout system for YA equipment). Further research on including parents in on-going training and weekly motor play at school with their child would provide valuable information about effective family partnerships which are needed to maximize the effectiveness of interventions, ensuring that parents receive support to continue their involvement in motor skill development with their child.

Another question is *how do we ensure that children develop motor skills while remaining physically active?* Research on motor development indicates that motor programming must be linked to a larger initiative; ensuring that young children not only develop motor skills but they are *also* physically active (Brown et al., 2009b) In other words, motor development alone is not enough unless paired with physical activities that provide opportunities for children to *utilize* the newly acquired motor skills. While we anticipated that children would be more physically active in the YA intervention, this did not consistently occur. Using observational notes and teacher feedback to describe physical activity level of children, both teachers and research staff reported that children were often sedentary, spending a large amount of time sitting during YA lessons while listening to instructions or waiting to demonstrate motor skills. An obvious natural setting to support motor development is in the context of *physical activities that occur during play*. Indeed, much of play during the preschool years involves gross motor behaviors such as running, jumping, throwing (Burdette, et al., 2004; Provost, et al., 2007a,b) where children have opportunities to hone their motor skills as they interact with peers, develop their social skills (Burdette & Whitaker, 2005; Provost, et al., 2007a,b; Bransford, et al., 2000; Sage, 1984), friendships and personal confidence (Calfas & Taylor, 1994; Dykens, et al., 1998). While all of these benefits physical activity are vital to children's success in school (Bredekamp, 2004; Shonkoff & Phillips, 2000), it is not a reality for children with developmental delays without *intentional* planning for physical activity during the preschool day. Intentional planning implies that teachers have regularly scheduled physical activities with focused attention on increasing a child's activity level while using a variety of motor skills. For example Brown et al, (2009a) developed physical activities (i.e., "Dance Party", "Track Team") for preschoolers based on a modified "Plan, Do, Review" process similar to the *High Scope* curriculum (Hohmann, et al., 1979). Using planned activities that correspond to motor skills previously introduced *and* are known to accelerate levels of physical activities would be an example of intentional planning during play.

Clearly, play is an important context for using motor skills and is important for children overall, (e.g. Ginsburg, 2007; Isenberg & Quisenberry, 2002; Zigler, et al., 2004). However, the reality is that nearly half of preschoolers are not sufficiently physically active on a daily basis (Tucker, 2008) and between 20-40% of US schools have eliminated recess

altogether 20-40% (Center on Education Policy, 2008; Elkind, 2007). At the same time, the National Association for the Education of Young Children (NAEYC) (2003) and the National Association for Physical Education (NASPE) (2002) have both recommended substantial daily time for physical activity and play. Given the rising number of preschool children with developmental delays receiving educational services under IDEA (US Department of Education, 2006) in *inclusive* preschool classes and the prevalence of motor skill deficits in these preschoolers, many of whom depend on direct instruction and adult support for motor development (Goodway & Branta, 2003; Halverson & Robertson, 1979), it becomes clear that providing opportunities for physical activities that are aligned to motor skill development is a necessity, not a luxury.

Another question we are left to ponder is *how can we ensure sustainable results and maximize the impact of motor programs?* Motor programs not only need to have sound theoretical underpinnings, links to physical activities, high programmatic qualities and efficacy, they also need to be sustainable (Reithmueller et al., 2009). While we observed significant motor skill gains in students after participating in YA, how do we maintain these gains? To ensure sustainability and maximize the impact of the program several programmatic features could be examined. Riethmuller, et al., (2009) suggest that sustainability is tied to several components, some of which have been previously discussed (e.g., viability of the home component, training of multiple people in classes). In addition, they suggest examining the intensity and duration of the intervention, recommending that preschool motor programs be at least 12 weeks in duration with a minimum of one hour per week, implemented in smaller time slots (e.g., a 90-minute program would be broken up into 3, 30 minute sessions). These recommendations are consistent with teacher reports indicating that the intervention could be expanded to allow more time to focus on specific skills for children with diverse abilities. For example, the program length and adaptability of the lessons may need further study. Not all children in intervention group made gains and some teachers indicated the intervention needed to be longer to support skill acquisition for all children. Teachers provided comments such as "*we needed to spend more than 8 weeks in YA so that each motor skill could be better supported*" or "*some lessons had too many activities for the 30 minute period*" or *" I needed to spend more one-on-one time with some of the children to make sure they could perform the motor skill*." A thoughtful examination of many of these programmatic

features of could be undertaken to maximize the impact of the intervention and to ensure the sustainability of motor interventions like YA.

One final question bears consideration given that motor delays in young children with developmental delays are expected (Emck, et al., 2009; Provost et al., 2007 a, b; Wuang et al., 2008). *When is the best time for intervening, given that motor delays are expected in young children with developmental delay and motor development impacts other areas of development?* Foundational skills such as motor planning, grasp/release and visual-motor integration are the same motor skills that are critical for learning behaviors which are simultaneously developing such as basic coordination, balance, posture needed for self feeding, grasping objects, and writing (Clark, 1994; Provost, et al., 2007a,b). The progression of motor development serves as the foundation for these and many other areas of development. Teachers and parents observed gains in specific motor skills but also observed improvements in other areas of development such as kindergarten readiness skills (e.g. following directions, turn taking, increased attention, following a routine) and social and play skills (e.g., play with others and with equipment on the playground, purposeful play with others and equipment). This is consistent with previous research indicating that other skill areas are enhanced by motor skill acquisition (e.g., play with peers, kindergarten readiness skills) (Brown et al., 2009b; Cahill, 2009; Seymour et al., 2009). While the current study focused on multiple areas of motor skill development, future research could also examine the timing of motor development interventions and impact on other areas of developments (e.g., social skills, kindergarten readiness, inclusion).

In 1989 and again in 2000, Frances Horowitz posed a question for us, "what if we created programs that placed children "at promise" as opposed to responding to them as "at risk"? More recently, in a discussion on future directions for early childhood curriculum, we were reminded of Horowitz's thought provoking perspective and indeed challenged to apply the "at promise" view when creating new programs for young children. "*What if we created early childhood programs from a preventative and proactive stance that maximized children's potential within their own cultural, familial, and individual frame of reference?"* (Siperstein & Favazza, 2007 p. 321) Would that perspective change the components of motor programs or the way we implement them? It seems that to place children at promise would suggest that *all* preschool children have access to motor programs that meet all of the high quality indicators,

including viable family partnerships, adaptations for differences and, ongoing physical activity to maximize motor skill development. To place children at promise is to recognize that limitations in early motor skill development can lead to a broad array of difficulties in other developmental areas that are dependent upon these skills (Brown et al., 2009b; Cahill, 2009; Seymour, et al., 2009). To place children at promise is to recognize that motor programs are a portal for intervening in intentional structured ways to support not only motor development but other areas as well such as family partnerships, social skills development, inclusion, and kindergarten readiness. To place children at promise is to recognize that we can no longer afford to view motor programming in preschool as an "*add on activity"* to the early childhood schedule. It requires us to view early motor interventions such as Young Athletes as integral to overall development, especially for young children with developmental delays.

References

Amui, H. N. (2006). *The effects of two instructional approaches on the object control skill of children considered disadvantages.* Unpublished doctoral dissertation. The Ohio State University, Columbus, OH.

Apache, R. (2005). Activity-based intervention in motor skill development. *Perceptual & Motor Skills*, *100(3),* 1011-1020.

Bailey, D. B. (1993). Reliability of an index of child characteristics. *Developmental medicine and child neurology, 35*(9), 806-815.

Bergen, M. (2000). The effects of motor development program on preschool children's motor skills [doctoral thesis]. Dekalb, IL: University of Northern Illinois.

Bransford, J., Brown, A., & Cocking, R. (2000). How people learn: Brain, mind, experience and school. Washington, DC: National Academy Press.

Bredekamp, S. (2004). Play and school readiness. In E.F. Zigler, D.G. Singer, & S.J. Bishop- Josef, (Eds.), *Children's play: The roots of reading*. Washington, DC: Zero to Three Press.

Brofenbrenner, U. (2006). *The ecology of human development*. Harvard Press: Cambridge.

Brown, W., Googe, H., McIver, K., & Rathel, J. (2009a). Effects of teacher-encouraged physical activity on preschool playgrounds. *Journal of Early Intervention*, *31*(2), 126-145.

Brown, W., Pfeiffer, K., McIver, K., Dowda, M., Addy, C., & Pate, R. (2009b). Social and environmental factors associated with preschoolers' nonsedentary physical activity. *Child Development*, *80*(1), 45-58.

Burchinal, M, & Appelbaum, M. (1991). Estimating individual developmental functions: Methods and their assumptions. *Child Development, 62 (1),* 23-43.

Burdette, H. L., & Whitaker, R. C. (2005). Resurrecting free play in young children: Looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatrics and Adolescent Medicine*, *159*, 46-50.

Burdette, H. L., Whitaker, R. C., & Daniels, S. R. (2004). Parental report of outdoor playtime as a measure of physical activity in preschool-aged children. *Archives of Pediatrics & Adolescent Medicine, 158* (4), 353-357.

Buysse, V. (1993). Consumer validation of an index characterizing the functional abilities of young children with disabilities. *Journal of Early Intervention, 17*(3), 224-238.

Cahill, S. (2009). Where does handwriting fit in? Strategies to support academic achievement. *Intervention in School and Clinic*, *44*(4), 223-228.

Calfas, K. J., & Taylor, W.C. (1994). Effects of physical activity on psychological variables in adolescents. *Pediatric Exercise Science*, *6*(4), 406–423.

Center on Education Policy (2008). *Instructional time in elementary schools: A closer look at changes for specific subjects.* Washington, DC: Author.

Clark, J. E. (1994). Motor development. In V. S. Ramachandran (Ed.), *Encyclopedia of Human Behavior (3rd ed., pp. 245-255)*. New York: Academic Press.

Clark, J.E. (2005). From the beginning: A developmental perspective on movement and mobility. *Quest*, *57*(1), 37-45.

Clark, J.E. & Metcalfe, J.S. (2002). The mountain of motor development: A metaphor. In Clark & Humphrey (Eds.), *Motor development: Research and reviews* (vol. 2, pp. 163 - 190). Reston, VA: National Association of Sport and Physical Education.

Culturally and Linguistically Appropriate Services (CLAS). (2000). *Culturally & Linguistically Sensitive Practices in Motor Skills Intervention for Young Children*. Clinical Report 1. Authors: Y. Baghwanji, R.M. Santos, & S. Fowler's, Technical Report 1. http://clas.uiuc.edu/techreport/tech1.html

DEC (2007). *Promoting positive outcomes for children with disabilities: Recommendations for curriculum, assessment, and program evaluation.* Missoula, MT: Author. http://www.naeyc.org/files/naeyc/file/positions/PrmtgPositiveOutcomes.pdf

Dowda, M., Pate, R. R., Trost, S. G., Almeida, M., & Sirard, J. (2004). Influences of preschool policies and practices on children's physical activity. *Journal of Community Health. 66*(4), 145–150.

Dunlap, G., & Fox, L. (2007). Parent-Professional Partnerships: A valuable context for addressing challenging behaviors. *International Journal of Disability, Development & Education*, *54*(3), 273-285. doi:10.1080/10349120701488723.

Dykens, E. M., Rosner, B. A., & Butterbaugh, G. (1998). Exercise and sports in children and adolescents with developmental disabilities: positive physical and psychosocial effects. *Child and Adolescent Psychiatric Clinics of North America*, 7, 757–771.

Elkind, D. (2007). *The power of play: How spontaneous, imaginative activities lead to happier, healthier children.* Cambridge, MA: Da Capo Press.

Emck, C., Bosscher, R., Beek, P, & Doreleijers, T. (2009). Gross motor performance and self- perceived motor competence in children emotional, behavioral, and pervasive developmental disorders: a review. *Developmental Medicine & Child Neurology, 51*(7), 501-517.

Favazza, P.F. & Zeisel, S. A. (2009). Addendum to the ABILITIES Index. Center for Social Development and Education, University of Massachusetts, Boston.

Favazza, P.C., Zeisel, S., Parker, R., Leboeuf, L. (2011). *Young Athletes Program.* Special Olympics International, Washington, DC.

Fisher, A., Reilly, J., Kelly, L., Montgomery, C., Williamson, A., Paton, J. Y., et al. (2005). Fundamental movement skills and habitual physical activity in young children. *Medicine and Science in Sports and Exercise*, *37*, 684–688.

Folio, M., & Fewell, R. (2000). *Peabody Developmental Motor Scales* (2nd ed.). Austin, TX: Pro Ed.

Gabbard, C. P. (2000). *Lifelong motor development* (3rd ed.). Madison Dubuque, IA: Brown & Benchmark.

Ginsburg, K. (2007). The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds. *Pediatrics*, *119*(1), 182. http://www.aap.org/pressroom/playFINAL.pdf

Goodway, J. D., & Amui, H. (2007). Promoting motor development in disadvantaged preschoolers: To direct or facilitate? *Journal of Sport & Exercise Psychology*, *29*; S30

Goodway, J. D., & Branta, C. F. (2003). Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Research Quarterly for Exercise & Sport, 74*(1), 36-46.

Goodway, J.D., Crowe, H., Ward, P. (2003). Effects of motor skill instruction on fundamental motor skill development. *Adapted Physical Activity Quarterly, 20*(3), 298-314.

Green, D., Charman, T., Pickles, A., Chandler, S., Loucas, T., Simonoff, E. & Baird, G. (2009). Impairment in movement skills of children with autistic spectrum disorders. *Developmental Medicine & Child Neurology, 51*(4), 311-316.

Halverson, L. & Roberton, M. (1979). The effects of instruction on overhand throwing development in children. In G. Roberts & K. Newell (Eds.) *Psychology of motor behavior & sport* (pp. 258-269). Champaign, Ill: Human Kinetics.

Hamilton, M., Goodway, J., & Haubenstricker, J. (1999). Parent-assisted instruction in a motor skill program for at-risk preschool children. *Adapted Physical Activity Quarterly*, *16*(4), 415-426.

Hohmann, M., Banet, B., & Weikart, D. P. (1979). *Young children in action: A manual for preschool educators*. Ypsilanti, MI: High/Scope.

Horowitz, F. D. (1989). *The concept of risk: A re-evaluation*. Invited address at the Biennial Meeting of the Society for Research in Child Development, Kansas City, MO.

Horowitz, F. D. (2000). Child development and the PITS: Simple questions, complex answers, and developmental theory. *Child Development, 71*(1), 1-10.

Isenberg, J. P., & Quisenberry, N. (2002). Play: Essential for all children. *Childhood Education, 79*, 33-39.

Iverson, J. (2010). Developing language in a developing body: The relationship between motor development and language development. *Journal of Child Language*, *37,* 229-261.

Johnson, L. J., & LaMontagne, M. J. (1993). Using content analysis to examine the verbal or written communication of stakeholders within early intervention. *Journal of Early Intervention, 17,* 73-79.

Malina, R. M. (1991). Fitness and performance: Adult health and the culture of youth. In R.J. Park & H.M. Eckert (Eds.), *The Academy Papers: Vol. 24. New possibilities, new paradigms* (pp. 30–38). Champaign, IL: Human Kinetics Publishers.

Manjiviona, J., & Prior, M. (1995). Comparison of asperger syndrome and high-functioning autistic children on a test of motor impairment. *Journal of Autism and Developmental Disorder*, *25*, 23-39.

Marton, K. (2009). Imitation of body postures and hand movements in children with specific language impairment. *Journal of Experimental Child Psychology*, *102*(1), 1-13.

National Association for the Education of Young Children (NAEYC). (2003). *Early Childhood Curriculum, Assessment, and Program Evaluation: Building an Effective, Accountable System in Programs for Children Birth through Age 8.* Position Statement.

National Association for Physical Education (NASPE). (2002). *Active start: A Statement of Physical Activity Guidelines for Children Birth to Five Years*. Oxon Hill, MD: AAHPERD Publications.

National Center for Physical Development and Outdoor Play (2010). From playpen to playground: The importance of physical play for the motor development of young children. Head Start Body Start National Center for Physical Development and Outdoor Play. Author: Jeffrey Trawick-Smith.

Pan, C., Tsai, C., & Chu, C. (2009). Fundamental movement skills in children diagnosed with autism spectrum disorders and attention deficit hyperactivity disorder. *Journal of Autism & Developmental Disorders*, *39*(12), 1694-1705.

Payne, V. G., & Isaacs, L. D. (2002). *Human motor development: A lifespan approach* (5th ed.). Boston: McGraw Hill.

Piek, J., Dawson, L., Smith, L., & Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human Movement Science*, *27*(5), 668-681. doi:10.1016/j.humov.2007.11.002.

Priest, N. (2006). 'Motor Magic': Evaluation of a community capacity-building approach to supporting the development of preschool children. *Australian Occupational Therapy Journal*, *53,* 220–232.

Provost, B., Heirnerl, S., & Lopez, B. (2007a). Levels of Gross and Fine Motor Development in Young Children with Autism Spectrum Disorder. *Physical & Occupational Therapy in Pediatrics*, *27*(3), 21-36.

Provost, B., Lopez, B., & Heimerl, S. (2007b). A comparison of motor delays in young children: autism spectrum disorder, developmental delay, and developmental concerns. *Journal of Autism & Developmental Disorders*, *37*(2), 321-328.

Raudenbush, S. W., & Bryk A. S. (2002). *Hierarchical linear models: Applications and data analysis methods, Second Edition.* Newbury Park, CA: Sage.

Redlich, J. (2005). Physical therapy and autism spectrum disorders: The motor connection. *Autism Spectrum, 2*(1)*,* 9.

Riethmuller, A., Jones, R., & Okely, A. (2009). Efficacy of Interventions to Improve Motor Development in Young Children: A Systematic Review. *Pediatrics*, *124*(4), 1191.

Rutledge, M.D. (1983). *The level of motor skill development of preschool children provided a physical education program and preschool children provided with free play.* [doctoral thesis]. University of Northern Colorado, Greeley, CO.

Sage, G. (1984). *Motor learning and control: A neuropsychological approach*. Dubuque, IA: William C. Brown.

Seymour, H., Reid, G., & Bloom, G. A. (2009). Friendship in inclusive physical education. *Adapted Physical Activity Quarterly, 26*, 201-219.

Shonkoff, J., & Phillips, D. (2000). *From neurons to neighborhoods: The science of early childhood development.* Washington, DC: National Academy Press.

Simeonsson, R. J., & Bailey, D. B. (1988). Essential elements of the assessment process. In T. D. Wachs, & B. Sheehan (Eds.), *Assessment of developmentally disabled infants and preschool children* (pp. 25-41). New York: Plenum Press.

Simeonsson, R.J., Bailey, D., Smith, T., & Buysse, V. (1995). Young children with disabilities: Functional assessment by teachers. *Journal of Developmental and Physical Disabilities*, *7*(4), 267-285.

Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics, 24 (4),* 323-355.

Siperstein, G., & Favazza, P.C. (2007). Placing young children "at promise": Future directions for promoting social competence. In Brown, W. H., Odom, S. L., & McConnell, S. R. (Eds.). *Social Competence of Young Children: Risk, Disability, and Evidence-based Practices* (2nd Ed.). Baltimore: Paul H. Brookes.

Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales:*

Second Edition (Vineland II), Survey Interview Form/Teacher Rating Form. Livonia, MN: Pearson Assessments.

Swabey, K.J., & Yeo, S.M. (1998). The effect of an adapted version of a structured motor program on kindergarten children's perceptual motor skills. *Key into life,* 172-174. Adelaide: Australian Council for Health, Physical Education and Recreation.

Trevlas E, Matsouka O, & Zachopoulou E. (2003). Relationship between playfulness and motor creativity in preschool children. *Early Child Development and Care. 173*(5): 535–543.

Tucker, P. (2008). The physical activity levels of preschool-aged children: A systematic review. *Early Childhood Research Quarterly, 23*(4), 547-558.

Ulrich, D.A. (2000). *Test of Gross Motor Development* (2nd ed). Austin, TX: Pro Ed.

US Department of Education. (2006). *28th Annual Report to Congress on the Implementation of the Individuals with Disabilities Act, 2006 - Volume 1.*

Venetsanou, F., & Kambas, A. (2004). How can a traditional Greek dances program affect the motor proficiency of pre-school children? *Research in Dance Education*, *5*(2), 127-138.

Vicari, S. (2006). Motor development and neuropsychological patterns in persons with down syndrome. *Behavior Genetics, 36*(3), 355-364. doi:10.1007/s10519-006-9057-8

Webster-Stratton, C., & Reid, M.J. (2007). Strengthening social and emotional competence in socio-economically disadvantaged young children: Preschool and kindergarten school based curricula. In Brown, W. H., Odom, S. L., & McConnell, S. R. (Eds.). *Social Competence of Young Children: Risk, Disability, and Evidence-based Practices* (2nd Ed.). Baltimore: Paul H. Brookes.

Williams, H. G., Pfeiffer, K. A., Dowda, M., Jeter, C., Jones, S., & Pate, R. R. (2008). A field- based testing protocol for assessing gross motor skills in preschool children: The children's activity and movement in preschool motor skills protocol. *Measurement in Physical Education and Exercise Science, 13,* 151–165.

Wuang, Y., Wang, C., Huang, M., & Su, C. (2008). Profiles and cognitive predictors of motor functions among early school-age children with mild intellectual disabilities. *Journal of Intellectual Disability Research*, *52*(12), 1048-1060.

Zigler, E., Singer, D., & Bishop-Josef, S. (2004). *Children's play: The roots of reading.* Washington, DC: Zero to Three Press.