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., 2007a, 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

<table>
<thead>
<tr>
<th>Gender total</th>
<th>Age</th>
<th>Primary Diagnosis</th>
<th>Secondary Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mal e</td>
<td>Femal e</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>#</td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>186</td>
<td>80%</td>
<td>47</td>
<td>55</td>
</tr>
<tr>
<td>47</td>
<td>20%</td>
<td></td>
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</tr>
</tbody>
</table>

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 93 children (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 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 those in the control group.

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

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Young Athletes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time 1</td>
<td>Time 2</td>
</tr>
<tr>
<td>PDMS$^1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object Manip.</td>
<td>37.06 (.20)</td>
<td>39.52 (.20)</td>
</tr>
<tr>
<td>Locomotion</td>
<td>36.88 (.39)</td>
<td>40.14 (.40)</td>
</tr>
<tr>
<td>Stationary</td>
<td>34.10 (.72)</td>
<td>38.78 (.73)</td>
</tr>
<tr>
<td>VTRF$^2$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Motor</td>
<td>10.46 (.21)</td>
<td>10.82 (.17)</td>
</tr>
<tr>
<td>Gross Motor</td>
<td>11.85 (.27)</td>
<td>11.58 (.27)</td>
</tr>
</tbody>
</table>

$^1$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 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*

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

Table 4. *Teacher and Parent Post Survey Responses*

<table>
<thead>
<tr>
<th>Teacher Comments</th>
<th>Parent Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor Skill Improvements</td>
<td>Kindergarten Readiness</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>• Most children could not keep feet together and bunny hop, now they can.</td>
<td>• Throwing directly, very obvious improvement</td>
</tr>
<tr>
<td>• Jump over a hurdle and land on 2 feet</td>
<td>• Now he can balance on 1 foot</td>
</tr>
<tr>
<td>• L could not catch, now she can keep eye on ball/bean bag.</td>
<td>• Gained skills like catching</td>
</tr>
<tr>
<td>• Developed his throwing &amp; catching skills with more accuracy</td>
<td>• He has gone from a modest awkward run to a fast run with arms moving appropriately with his legs</td>
</tr>
<tr>
<td>• Improved balance and better trunk control</td>
<td>• He shows more control with his feet and hands</td>
</tr>
<tr>
<td>• Improved hitting skills with racket</td>
<td>• He now can balance on one leg without support</td>
</tr>
<tr>
<td>• Demonstrated trapping skills with hands and feet</td>
<td>• Demonstrated trapping skills with hands and feet</td>
</tr>
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**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 intervention (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 (Brogenbrenner, 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


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.


