

# Young Athletes Program: Impact on Motor Development

**Paddy C. Favazza, Gary N. Siperstein**

University of Massachusetts Boston

**Susan A. Zeisel, Samuel L. Odom, John H. Sideris**

University of North Carolina at Chapel Hill

**Andrew L. Moskowitz**

University of Massachusetts Boston

This study examined the effectiveness of the Young Athletes program to promote motor development in preschool-aged children with disabilities. In the study, 233 children were randomly assigned to a control group or the Young Athletes (YA) intervention group which consisted of 24 motor skill lessons delivered 3 times per week for 8 weeks. Hierarchical Linear Modeling (HLM) showed that children who participated in the YA intervention exhibited mean gains of 7–9 months on the Peabody Developmental Motor Subscales (PDMS) compared with mean gains of 3–5 months for the control group. Children in the YA intervention also exhibited significant gains on the gross motor subscale of the Vineland Teacher Rating Form (VTRF). Teachers and parents reported benefits for children not only in specific motor skills, but also kindergarten readiness skills and social/play skills. The necessity for direct and intentional instruction of motor skills, as well as the challenges of involving families in the YA program, are discussed.

*Keywords:* preschool, children, motor skills

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 backward and sideways, jumping

---

Paddy C. Favazza, Gary N. Siperstein, and Andrew L. Moskowitz are with the University of Massachusetts Boston. Susan A. Zeisel, Samuel L. Odom, and John H. Sideris are with the University of North Carolina at Chapel Hill.

greater distances and heights, and throwing a ball overhand and underhand (Provost, Heimerl, & Lopez, 2007; Provost, Lopez, & Heimerl, 2007).

Compared with their typically developing peers, young children with disabilities often experience deficits in areas such as locomotion and object manipulation (e.g., Emck, Bosscher, Beek, & Doreleijers, 2009; Goodway & Branta, 2003; Provost, Heimerl, et al., 2007; Provost, Lopez, et al., 2007; Wuang, Wang, Huang, & Su, 2008). Development in these motor areas depends on the acquisition of motor skills such as balance and motor planning, as well as multiple opportunities to hone and expand these skills (Gallahue & Ozmun, 1998). Possessing sound fundamental motor skills enables the child to move about in a variety of ways with fluidness, efficiency, and ease. At the same time, it enables children to engage in play with peers and be more physically active. However, research indicates that children with disabilities typically engage less in play with their peers when compared with children who are typically developing (Murphy & Carbone, 2008) and tend to be more sedentary, placing them at higher risk for poor overall health, (Fragala-Pinkham, Haley, Rabin, & Kharasch, 2005) decreased self-esteem, and decreased social acceptance associated with inactivity (Murphy & Carbone, 2008). Thus, fundamental motor skills are essential to provide a foundation for motor development and are important to children's general well-being.

Motor skills have also been linked to other areas of development such as language and social skills (Brown et al., 2009b; Iverson, 2010; Seymour, Reid, & Bloom, 2009). Thus, limitations in early motor skills may lead to difficulties in other skill areas. For a child with a disability who may be delayed in these other areas of development, motor skills interventions may also assist in facilitating language or social skill development. For these reasons, 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, Tsai, & Chu, 2009; Provost, Lopez, et al., 2007).

While early childhood education research has pointed to a general lack of research on preschool motor interventions (Brown, et al., 2009b; Goodway & Branta, 2003; Priest, 2006; Riethmuller, Jones, & Okely, 2009), the results of recent studies indicate that young children who have developmental delays can make significant motor gains in a short period of time (Apache, 2005; Goodway & Branta, 2003). These and other studies that have demonstrated change in motor skills, however, are limited in a number of ways. For example, many studies of motor skill development are limited in scope to specific skills (Venetsanou & Kambas, 2004; Swabey & Yeo, 1998) and do not address the breadth of motor skills which develop in the preschool years (Clark, 2005). Limiting the scope of a motor program to certain skills is particularly problematic when developing motor programs for young children with developmental delays who have a range of difficulties in motor skills. For example, children with autism and related disorders have challenges with proprioception, sense of their body's position and orientation as they move (Redlich, 2005) whereas other children with developmental delays may exhibit challenges related to stationary motor skills such as balance and postural control (Manjiviona & Prior, 1995; Provost, Heimerl, et al., 2007; Provost, Lopez, et al., 2007; Vicari, 2006). As a result, it is important that both the breadth of motor programs and the scope of measurement focus on all aspects of motor development.

Young Athletes is a motor program that addresses many of these concerns. Young Athletes was developed by Special Olympics NJ, in 2004 in consultation with the University of Medicine and Dentistry of NJ, to promote motor skill development of young children (less than 8-years-old) with disabilities through a series of motor play activities. The Young Athletes (YA) program focuses on motor skills such as visual tracking and motor imitation as well as walking and running, balance and jumping, trapping and catching, throwing, striking, and kicking. The skills taught in YA directly correspond to the Fundamental Motor Skill Development Period in Clark's mountain of motor development.

Clark's "mountain of motor development" is a dynamic approach to motor development consistent with Lerner's stage approach to development (Lerner, 1976). Clark's approach to motor development suggests children pass through different periods of motor skill development with each period distinctly different from the previous, with recognition that there are individual differences in children. The skills learned during the Fundamental Motor Skill Period are also referred to as the "building blocks" of motor development, with motor development scaffolding from one period to the next (Gabbard, 2000; Payne & Isaacs, 2002). When provided with opportunities to develop motor skills, preschoolers can move in more complex ways that require underlying skills such as motor planning, grasp/release, and visual-motor integration (Clark, 1994; Provost, Lopez, & Heimerl, 2007; Provost, Heimerl, & Lopez, 2007), which are important for functional skills such as basic coordination, balance, and posture.

While the motor content of the Young Athletes Program is based on Clark's model of motor development, the instructional approach used in YA and the process through which children acquire motor skills is based on the theory put forth by Newell (1984, 1986) which suggests that children acquire motor skills through the interactions between constraints from the task, the organism (child), and the environment. This dynamic systems theory takes into account subsets of interacting factors:

- Aspects of the child (organism) such as disability (i.e., cognitive, motoric, sensory, or communication challenges) or personal temperament (easygoing, rigid).
- Aspects of the environment such as instruction (teacher encouragement and quality of instruction), structure of program (duration and frequency, school and home usage), or the equipment (type and amount, appropriateness of size, and multisensory features).
- Aspects of the task such as motor movement needed for specific motor tasks (balance for hopping, visual tracking, and eye hand coordination for catching) or motor activities that use motor movement (such as sustained strength needed for bridges and tunnels).

Simply put, children acquire new skills through the interaction of factors pertaining to the child, the environment, and the task. For example, successful completion of a YA motor activity (task) such as "tunnels" requires that a child go down on his hands and knees and hold that position while other children crawl under the tunnel (made of several children side-by-side in tunnel position). In addition to these motor movements, the ability to successfully complete this skill involves the interaction of child characteristics (cognitive understanding of knee, kneeling

position, the ability to tolerate children in close proximity) and environmental factors (identification of a carpeted surface comfortable for kneeling, the teacher's knowledge and skill in using child motivators, the teacher's skill in breaking down the task into smaller steps).

YA takes into account the theories of Clark and Lerner regarding the motor content of the program and takes into account the theory of Newell regarding the structure of the program, the instructional strategies used, and the content of the training. Collectively, these theories on motor development and critical elements of motor skill acquisition underlying the YA program combine to optimize the impact of YA.

The purpose of the current study was to examine the benefits and impact of participation in the Young Athletes motor program on the motor skills of preschool children. We anticipated that children participating in the YA motor skill intervention would exhibit significant gains in motor skills specifically in the areas of locomotion, object manipulation, and stationary skills. In addition, we expected both teachers and parents of children participating in YA would report that YA participation was beneficial to children in a variety of ways.

## Method

Approval for this study was granted by a university internal review board and treatment of the participants was in accordance with the standards of the American Psychological Association.

### Participants

**Classes.** Fifty preschool classes from 26 schools in Rhode Island and North Carolina participated in this study. Classes represented a variety of settings: public and private preschool settings as well as child development centers. Thirty-four of the classes (69%) were inclusive classes (included children with and without disabilities) and 15 (31%) were self-contained classes. Within the classes, the ages of the children ranged from 3- to 5-years-old.

**Children.** Participants were 233 children with an intellectual impairment, 122 (52%) from North Carolina and 111 (47%) from Rhode Island, who came from 50 different classrooms. Participants were included in the sample if they had an intellectual disability (including those with a diagnosis of developmental delay), whether or not they had an accompanying diagnosis (e.g., autism spectrum disorder, pervasive developmental delay). Additional inclusion criteria met by all participants were (1) parental consent to participate, (2) the ability to walk independently, (3) the ability to follow simple directions, and (4) the ability to attend to motor tasks during testing. These latter three criteria were intended to facilitate the reliability of the motor skills tests, and were assessed based on information provided by the ABILITIES Index (AI; Simeonsson & Bailey, 1988; Simeonsson, Bailey, Smith, & Buysse, 1995) completed by classroom teachers following receipt of parental permission to participate. The AI is a functional measure of a child's ability 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

Teachers provide a rating for each student on each of the domains, using a scale ranging from 0 (*no impairment*) to 6 (*profound disability*), with higher total scores indicating more significant disability up to the maximum attainable score of 95. The resulting total and domain scores provide a comprehensive profile of a child's abilities and disabilities. The AI has demonstrated adequate test-retest reliability (ICC = 0.70, weighted kappa = 0.77; Bailey, 1993) and validity (Buysse, Smith, Bailey, & Simeonsson, 1993). An addendum to the AI (Favazza & Zeisel, 2009) was developed to gather descriptive information about the types and frequencies of therapies children are receiving (i.e., physical therapy, occupational therapy, speech therapy, language therapy, hippotherapy, behavioral therapy) that could impact motor development outcomes. The characteristics of the sample (i.e., gender, age, disability diagnosis) are shown in Table 1.

**Table 1 Child Characteristics**

<b>Characteristic</b>	<b>Frequency</b>
Gender	
Male	186 (80%)
Female	47 (20%)
Age (in Years)	
3	55 (24%)
4	122 (52%)
5	56 (24%)
Primary Diagnosis	
Developmental disability	169 (72%)
Autism spectrum disorder	47 (20%)
Communication disorder	6 (3%)
Intellectual disability	4 (2%)
Other	7 (3%)

## Design and Procedure

**Design.** Fifty preschool classes were randomly assigned to either the YA intervention group or the control group, resulting in 113 children in the intervention group and 120 children in the control group. Children in classes assigned to the intervention group completed the pretest, YA intervention, and the posttest; children in classes assigned to the control group completed the pretest and post-test only.

The YA program (Favazza, Zeisel, Parker, & Leboeuf, 2011) consists of 24 comprehensive lessons which include motor activities for foundational skills (visual tracking, motor imitation), walking and running, balance and jumping, trapping and catching, throwing, striking, and kicking. Each 30-minute lesson includes an opening motor movement song (4–5 minutes), motor games and activities (approximately 20 minutes), and closing (cool down) motor song (4–5 minutes). A one page lesson summary card with abbreviated lesson components for the entire week is used to enable the teacher to make a quick reference to the key features of the lesson.

The YA intervention took place over a period of 8 weeks; it was 3 days per week (30 minutes a day), consistent with recommendations that preschool motor programs be at least 1 hour per week, implemented in smaller time slots (e.g., a 90-minute program would be broken up into 3 sessions [each 30 minutes]; NASPE, 2002; Trawick-Smith, 2010; Riethmuller et al., 2009). Teachers were provided with two YA kits that included a variety of equipment (balls, scarves, bean bags, cones, beams, etc.) and were asked to use only the equipment provided in the YA kits.

Given the importance of family involvement (Bronfenbrenner, 1979; Dunlap & Fox, 2007) which is espoused by leading professional organizations (DEC, 2007; NAEYC, 2003; NASPE, 2002), a home component was developed to complement the lessons presented by teachers at school. Specifically, before the program began parents were provided with information about the YA program and encouraged to become actively involved. Throughout the program, parents were provided with weekly communications about the YA activities that they could do at home with their child. The weekly communications provided families with pictorial and written descriptions of the YA activities presented that week, suggestions for how to use the YA activities, and a list of equipment used at school with a suggestion of household items that could be used as substitutes. The parents of children from the intervention group were included in data collection in two ways: (1) Each week they were asked to complete a YA Home Record, indicating if they had used YA at home, and (2) They also were asked to complete a postsurvey about their perceptions of the participation benefits in the YA intervention.

**Training.** Teachers and teacher assistants in classes assigned to the intervention group trained for 2 hours before implementation of the YA motor program to maximize the potential for sustainability (Riethmuller, Jones, & Okely, 2009); to enhance participation level; and to increase competence, confidence, and enthusiasm (Dowda et al., 2004). Training consisted of the following:

- background on YA
- an overview of the new expanded YA intervention

- suggestions as to how to structure YA within the class
- how best to use other adults during YA implementation
- how to individualize instruction for children with diverse abilities
- an overview of data collection procedures

Every teacher participated in the training; however, teachers in the control group received training pertaining only to data collection.

While all teachers would be implementing the same lessons 3 times a week for 8 weeks, the lesson could vary within each class to accommodate learning differences (i.e., use of visual prompts with verbal directions), space accommodations, and size of the class. Teachers also were encouraged to adapt the lessons based on the individual needs of their children. For example, if a child was unable to jump over a hurdle, the teacher could encourage a child to step over the hurdle. 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 also were 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).

## Measures

The following measures were used to assess: (1) motor skill development (2) perceived benefits of YA participation, and (3) fidelity of implementation.

**Motor skill development.** Two instruments were used as pretest measures to assess children's motor skills. Research staff administered the Peabody Developmental Motor Scales—Second Edition (PDMS; Folio & Fewell, 2000), and teachers completed the Vineland II, Teacher Rating Form (VTRF; Sparrow, Cicchetti, & Balla, 2005). Each is briefly described below.

The PDMS has been used widely 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 0.89, test-retest all above 0.82, and interrater reliability all above 0.96. Three subscales from the PDMS were used to measure motor skills: locomotion, stationary, and object manipulation. Each child's motor skills were assessed by project staff that had been trained using the PDMS. Motor testing took approximately 20–30 minutes per child.

The VTRF was completed by teachers before the start of the YA intervention and during the corresponding time period for the control classes as well as immediately after the 8-week intervention. Teachers in the control classes completed the VTRF during corresponding periods. 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 assesses children's behaviors in 4 domains: communication, daily living skills, socialization, and motor skills. The coefficient alpha indices for split-half reliability for the domains of the VTRF are all above 0.83, test-retest all above 0.81, and interrater reliability all above 0.62.

## Perceived Benefits

All teachers and parents from the YA classes completed a postintervention survey about their perceptions of benefits derived from their participation in YA. Parents were asked, “*Did your child benefit from his/her involvement in Young Athletes? If so, please give examples of how he/she benefitted.*” Similarly, teachers were asked, “*Did your students benefit from involvement in Young Athletes? If so, please give examples of how they benefitted.*”

**Fidelity of implementation.** Four indicators were used to determine the quantity of exposure to the YA intervention and fidelity of implementation: attendance, Teacher Implementation and Evaluation Log (TIEL), the Fidelity of Implementation Checklist, and the YA Home Record. The first fidelity indicator, *attendance*, was recorded in all classes to ascertain the amount of exposure to the YA motor development program each child received. 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 *TIEL*, in which they indicated which YA activities they completed that week and the amount of time they spent doing YA.

A third indicator of fidelity was provided by weekly observations of the YA sessions made by research staff. Once a week, research staff completed the *Fidelity of Implementation Checklist*, in which they noted which activities were completed, the length of lesson, and provided additional notes regarding strategies used to teach motor activities. Before 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. Research staff used the same instrument during observations of control classes during the motor activities/ physical education to document the nonoccurrence of YA activities, twice during the 8-week time period. Lastly, parents of children who participated in the YA intervention were asked to complete a *YA Home Record* indicating if they used YA activities at home.

**Data analysis.** Descriptive statistics were used to describe the severity of disability and the fidelity of implementation. To assess the motor gains of children in the YA intervention and control groups, data were analyzed in a repeated-measures randomized control trial with classrooms assigned to either YA or control conditions. The model is essentially a 2 (treatment)  $\times$  2 (time point) ANCOVA, with state as a covariate. The repeated measurement (time points) and the inclusion of multiple children resulted in data with a three-level hierarchical structure: time (two time points) nested within child and child nested within class. Random intercept<sup>1</sup> hierarchical linear modeling (HLM) was then used to test group differences in motor skills between YA intervention and control groups with random effects at both the child and classroom levels. HLM incorporates the hierarchical structure

<sup>1</sup> Across all models, the inclusion of random effects for treatment and time resulted in nonpositive definite G matrices. This implies that those effects are zero and that these random effects are not needed in the model.

of the data into the model using the estimation of such random effects (Burchinal & Appelbaum, 1991; Raudenbush & Bryk, 2002; Singer, 1998). The reduced form of the equation for these models is:

$$Y_{tic} = \gamma_{00} + \beta_1(\text{time})_{ic} + \beta_2(\text{treatment})_j + \beta_3(\text{time}_{tic} * \text{treatment})_j + \beta_4(\text{state})_{icj} + e_{00cj} + e_{tic}$$

As noted above, only random intercepts were estimated. The  $\beta$  parameters in the above equation all represent the fixed effects of those variables. Treatment was coded with the control group = 0 and the treatment group = 1; time was centered at posttest so that pretest = -1 and posttest = 0. As such, the main effect for group is tested at post and the main effect for time is tested in the treatment group. The interaction reflects the multiplicative effect of these variables.

A separate model was used for each outcome. These models were estimated under restricted maximum likelihood with an unstructured covariance matrix. The fixed effects in the model included *Time*, *Treatment*, and a *Time by Treatment* interaction with random effects for the intercept. The primary test of the intervention is the time by treatment interaction, which provides an assessment of whether change over time varies across experimental groups. State was included as a covariate in all models.

## Results

### Severity of Disability

We first employed the ABILITIES Index (AI; Simeonsson & Bailey, 1988) to determine the severity of disability of each child. A total of 186 boys and 47 girls from the 50 classes met criteria for data collection. The children from the YA intervention group and control group were similar with regard to gender, age range, and disability diagnosis. The groups also did not differ in severity of disability as measured by the ABILITIES Index. 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 ( $M = 7.11$ ,  $SD = 7.31$ );  $t(227) = .57$ ,  $p = .58$ . 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%). 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 records* were used to determine the percentage of exposure to the YA intervention for the days on which YA occurred. Attendance records indicated that children were present for 21–24 days of the 24 day intervention or 88%–100%.

Teachers completed the *Teacher Implementation and Evaluation Log* (TIEL), 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 TIEL indicate that on average teachers completed 89%–98% of the 187 YA activities. In addition, reports from the TIEL indicate that weekly time spent in the YA intervention was, on average, between 89–92 minutes. For the teachers who did not complete lessons, reasons for not implementing lessons 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 observations of the teachers as they implemented the YA intervention. Using the *Fidelity of Implementation Checklist*, research staff observed and recorded the activities that occurred during a YA lesson, making notes as to how a teacher implemented the lessons as well. Teachers in the intervention condition completed on average, 90% (167/186) of the YA activities. (Interrater reliability, using Delta software, yielded a Kappa of .91 and Delta of .95.) Notes on teacher implementation indicated that teachers used a variety of strategies that reflected Newell's theory of motor skill acquisition by addressing unique aspects motor task, child characteristics, and environment. For example, when leading the YA activity of tunnels, teachers were observed teaching children where theirs are located on their bodies and modeling the kneeling position.

The *YA Home Record* was used to assess parent's weekly implementation of YA activities in the home. Preliminary analysis showed that 46% of the families completed the YA Home Record with YA activities occurring on average 2 times per week. Preliminary analyses showed no discernible effects on motor development as a result of home use of the YA program. For this reason, the YA Home Record data were not included as a variable in other analyses as the data set was not large enough to be considered a representative sample of the participating families and no effects could be attributed to home usage. Moreover, we could not assume that those who failed to complete the YA Home Record did or did not implement YA activities at home as some teachers indicated anecdotally that parents who did not submit the YA Home Record reported that they liked using YA at home.

## Motor Skill Development

To test for group differences in motor skills between the YA intervention and control groups, a fixed effects model including Time, Treatment, and the Time by Treatment interaction was used in explaining motor skill changes assessed by the object manipulation, locomotion, and stationary motor subscales of the PDMS and gross and fine motor subscales of the VTRF. In addition, random intercepts were included to manage the hierarchical structure of the data. Random effects were significant across all outcomes, minimum  $z = 7.40$ ,  $p < .001$ . Intraclass correlation coefficients within children tended to be quite high (from .56 to .91, but tended to be very small within classrooms (.001 to .08). As noted, all were statistically significant and so the random intercepts at both levels were retained. V-scale scores were used when analyzing VTRF data. A V-Score is used to describe the child's level of functioning in the subdomains of the Vineland, relative to others of the same age and is often used with children who are low-functioning. Because a majority of children scored below the threshold for age equivalents, age equivalents could not be computed for a large portion of the sample; thus, V-scale scores were most appropriate. Means and standard errors can be found in 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, object manipulation AE,  $F(1,227) = 92.71$ ,  $p < .001$ ; locomotion AE  $F(1,227) = 166.81$ ,  $p < .001$ ; stationary AE  $F(1,225) = 92.50$ ,  $p < .001$ . There were no main effects on any of the subscales for treatment.

**Table 2 Model-Based Means and Standard Errors on Subscales of Peabody Developmental Motor Scales (PDMS) and Vineland Teacher Rating Form (VTRF) Motor Scales**

	Control		Young Athletes		Interaction F	d
	Time 1	Time 2	Time 1	Time 2		
	PDMS					
Object manipulation	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						
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

*Note.* PDMS subscales use age-equivalent scores; VTRF subscales use V-scale scores

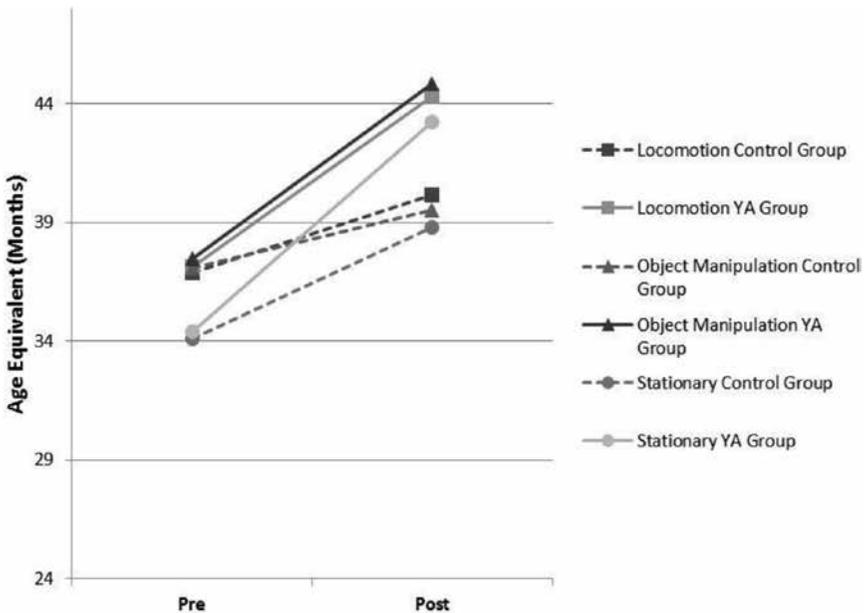
\* $p < .05$  \*\* $p < .01$  \*\*\* $p < .001$

However, the time effects observed in the PDMS subscales were further explained by a time by Treatment interaction.

A significant Time by Treatment interaction emerged for both the object manipulation and locomotion PDMS subscales,  $F(1,227) = 23.09, p < .001, d = .38$ ;  $F(1,227) = 23.33, p < .001, d = .26$ , respectively. Children in the YA intervention group gained, on average, 7 months on the age equivalent scales, compared with 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 children in the control group who did not participate in the intervention. The d-type effect sizes indicated a small to moderate statistical effect for the Time by Treatment interaction for object manipulation and small statistical effect for locomotion.

Results also indicated a significant Time by Treatment interaction in favor of children in the YA intervention group with gains of almost 9 months on the PDMS stationary subscale compared with gains of 5 months for the children in the control group,  $F(1,225) = 8.70, p < .01, d = .21$ . A d-type effect size indicated a small statistical effect for the stationary subscale. See Figure 1.

Teacher ratings on the VTRF fine motor subscale showed no significant effects for Time, nor was there an interaction between Time and Treatment. There was, however, a significant Time by Treatment interaction on the gross motor subscale,  $F(1,229) = 4.82, p < .05, d = .27$ . A d-type effect size indicated a small statistical effect. These findings suggest that not only did motor skills improve based on ratings made by a trained observer (PDMS), but that teachers also saw significant motor improvement in the children (VTRF).



**Figure 1** — Pre- and postintervention Peabody Developmental Motor Scales (PDMS) group mean scores for YA intervention and control groups.

In addition, 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 skills gains between boys and girls nor were there differences as a function of children's primary diagnosis.

### Perceived Benefits

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 skills; 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 interrater reliability. Interrater reliability on the family survey was 85% and 91% agreement in sorting of the parent responses into the identified categories. Interrater reliability on the teacher surveys was 93% and 97% agreement in sorting of the teacher responses into the identified categories.

Parents were given the option to complete their survey by phone or by paper. A total of 89 parents (79%) completed the postintervention survey, providing 84 distinct comments reflecting benefits of participating in the intervention, and 26 teachers provided 150 comments on the benefits of participating in YA. Responses from both teachers and parents were separated into three distinct primary categories: Increased motor skills, increased kindergarten readiness skills, and improved play/social experiences (see Table 3). For instance, teachers noted that children

**Table 3 Parents' and Teachers' Perceptions of the Benefits of the YA Intervention**

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%)

followed routines more easily and some children were more interested in engaging in play with peers. One parent commented that her child could now balance on one foot without support, and another parent noted that her child is now more confident in playing sports.

## Discussion

The findings from this study demonstrate that motor skills in young children with developmental delays and autism can improve over a short period of time with consistent participation in the Young Athletes program. Children in the YA intervention group gained on average 7 months on the PDMS age equivalent scales in a 2 month period, compared with an average gain of 3 months for children in the control group on the object manipulation and locomotion subscales of the PDMS. Simply stated, the motor skills of young children participating in YA improved at twice the rate of children in the control group. In fact, children in the YA intervention group gained almost 9 months on the stationary subscale of the PDMS in addition to their significant improvements in locomotion and object manipulation.

Not only were there significant improvements in motor skills observed on the PDMS but all teachers and most parents (79%) of participating children also reported gains in coordination, balance, and throwing. It is also noteworthy that these significant motor skill gains were evidenced across all children in the YA intervention group regardless of the nature of the disability, suggesting that the YA motor program is robust enough to improve motor skills in children with developmental delays and autism.

The present findings are consistent with previous research by Goodway and Branta (2003) and Apache (2005) who found that children with disabilities who participated in a motor intervention program made significant improvements in locomotion and object control skills. However, this study makes the additional contribution of assessing stationary motor skills and finding that the YA intervention resulted in improvements in this subscale as well. The additional assessment of stationary skills has particular relevance because children with autism and other developmental disabilities often have inadequate proprioception (i.e., their sense of their body's position as they move; Redlich, 2005). This challenge, if not adequately addressed, can negatively impact balance, postural control, limb movement and coordination.

These findings are significant in considering not only a child's motor development, but in consideration of a child's overall development. Motor skills have been linked to other areas of development such as language and social skills (Brown et al., 2009b; Iverson, 2010; Seymour, Reid, & Bloom, 2009) and outcomes such as self-esteem, fitness, and physical activity (Riethmuller et al., 2009). Deficiencies in motor development can result in collateral deficits in other areas of development and the quality of life for children with disabilities. Providing a theoretically sound and consistently implemented motor intervention during the preschool years has the potential to enhance numerous aspects of the child's life. The implementation of the YA motor program with high fidelity suggests that it is a feasible intervention for early childhood settings. As reported by teachers, Young Athletes can easily fit into the preschool day. As well as demonstrating feasibility, the structure of YA (3 times a week, for 30 minutes each day) is consistent with recommendations for

intensity and duration of motor skill interventions (NASPE, 2002; Trawick-Smith, 2010; Riethmuller et al., 2009). Furthermore, the YA program was appropriate and easy to use in both inclusive and self-contained classrooms.

Critical features of the YA program that might have contributed to the dramatic motor skill gains include: motor content addressed (consistent with Lerner's and Clark's theories of motor development), and the structure, instructional approach, and training (based on Newell's theory of motor acquisition). Collectively, the theoretical foundations which informed the content, the instructional approach and components of the structure of Young Athletes may have resulted in significant motor gains and suggest that this program has promising potential for use in a variety of settings among children with a wide range of disabilities.

## Limitations

While the findings of this study are promising, the study has limitations pertaining to our ability to document family participation and the seemingly low participation of parents in completing the weekly YA Home Record. Less than half of the parents (46%) completed the YA Home Record. However, teachers reported that parents who did not submit the YA Home Record regularly made comments about using the YA program at home indicating that this figure may not be a true representation of the use of the program at home. Therefore, we cannot accurately determine the "dose" of the YA program that each child received. Future work could develop better strategies to document home use of YA such as observing families as they implement YA, develop different ways to communicate with parents about the program, and explore strategies to increase parental participation. For example, some parents suggested making YA equipment available to families who want to have YA play dates on the weekends. Families could meet to implement YA in their neighborhoods or on the school playground. Given that family involvement is viewed as essential to any early childhood program (Bronfenbrenner, 1979; NAEYC, 2003; NASPE, 2002; DEC, 2007), it is critical to find ways to engage families and document their involvement.

## Future Research

The findings of this study have several implications for future research. First, while the focus of this study was primarily on motor skill development, studying preschoolers' physical activity level in tandem with studying motor skill development would contribute to our understanding of motor skill development in young children. Recent data show that preschoolers do not spend enough time in play and gross motor physical activity (Brown et al., 2009; Tucker, 2008), which are the primary context for developing motor skills. Given that young children need multiple opportunities to use and hone motor skills, future studies would be strengthened by examining this as well. Future research also might examine the sustainability of motor gains made by children who participated in the YA program. This study found motor gains after 8-week participation in YA when the program was implemented with a high level of fidelity. A subsequent study could involve an examination of what teachers used for motor programming after the study ended and if the motor gains were sustained over time.

Finally, we assessed the general impact of the YA program on children using HLM, the most stringent of analyses. However, it is important to address the differential effects of motor skills interventions on children of different ability levels. Because children with disabilities possess unique characteristics, each individual may not have received the same “boost” from the treatment. As Bouffard (1993) suggests, multilevel modeling provides one way to examine child change, but future research could take advantage of a single-subject design methods to study intraindividual variance within children.

## Implications

In a recent discussion on future directions for early childhood curriculum, we were reminded of the thought-provoking perspective, “What if we created programs that placed children “at promise” as opposed to responding to them as “at risk?” (Horowitz, 1989, 2000). We were 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). 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 child differences, and ongoing physical activity opportunities 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; Seymour et al., 2009). To place children at promise means 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 as integral to development, especially for young children with developmental delays.

Children with disabilities need multiple types of opportunities to develop motor skills including opportunities to explore motor movement through recess, typical music motor activities as well as, thoughtfully planned instructional opportunities that take into account the unique aspects of the child, environment, and task. Given the rising number of children with developmental delays in *inclusive* preschool classes (US Department of Education, 2006) and the prevalence of motor deficits in these preschoolers (Goodway & Branta, 2003; Halverson & Robertson, 1979), it is clear that providing opportunities for motor play that are aligned to motor skill development is a necessity.

## References

- Apache, R.R. (2005). Activity-based intervention in motor skill development. *Perceptual and Motor Skills*, 100(3, Pt 2), 1011–1020. PubMed doi:10.2466/PMS.100.3.1011-1020
- Bailey, D.B. (1993). Reliability of an index of child characteristics. *Developmental Medicine and Child Neurology*, 35(9), 806–815. PubMed doi:10.1111/j.1469-8749.1993.tb11732.x
- Bouffard, M. (1993). The perils of averaging data in adapted physical activity research. *Adapted Physical Activity Quarterly*, 10, 371–391.

- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.
- Brown, W.H., Pfeiffer, K., McIver, K., Dowda, M., Addy, C., & Pate, R. (2009). Social and environmental factors associated with preschoolers' non-sedentary physical activity. *Child Development, 80*(1), 45–58. 10.1111/j.1467-8624.2008.01245.x. [PubMed doi:10.1111/j.1467-8624.2008.01245.x](#)
- Burchinal, M., & Appelbaum, M. (1991). Estimating individual developmental functions: Methods and their assumptions. *Child Development, 62*(1), 23–43. 10.1111/1467-8624.ep9103110597. [doi:10.2307/1130702](#)
- Buysse, V., Smith, T., Bailey, D.B., & Simeonsson, R.J. (1993). Consumer validation of an index characterizing the functional abilities of young children with disabilities. *Journal of Early Intervention, 17*(3), 224–238. [doi:10.1177/105381519301700302](#)
- 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. [doi:10.1080/00336297.2005.10491841](#)
- 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, 29*(3), 183–196. [PubMed doi:10.1023/B:JOHE.0000022025.77294.af](#)
- Dunlap, G., & Fox, L. (2007). Parent-professional partnerships: a valuable context for addressing challenging behaviors. *International Journal of Development, Disability, and Education, 54*(3), 273–285. 10.1080/10349120701488723. [doi:10.1080/10349120701488723](#)
- Emck, C., Bosscher, R., Beek, P., & Doreleijers, T. (2009). Gross motor performance and self-perceived motor competence in children with emotional, behavioral, and pervasive developmental disorders: a review. *Developmental Medicine and Child Neurology, 51*(7), 501–517. 10.1111/j.1469-8749.2009.03337.x. [PubMed doi:10.1111/j.1469-8749.2009.03337.x](#)
- Favazza, P.F., & Zeisel, S.A. (2009). *Addendum to the ABILITIES Index*. Boston: Center for Social Development and Education, University of Massachusetts.
- Favazza, P.C., Zeisel, S., Parker, R., & Leboeuf, L. (2011). *Young Athletes Program*. Washington, DC: Special Olympics International.
- Folio, M., & Fewell, R. (2000). *Peabody Developmental Motor Scales* (2nd ed.). Austin, TX: Pro Ed.
- Fragala-Pinkham, M.A., Haley, S.M., Rabin, J., & Kharasch, V.S. (2005). A fitness program for children with disabilities. *Physical Therapy, 85*(11), 1182–1200. [PubMed](#)
- Gallahue, D., & Ozmun, J. (1998). *Understanding Motor Development: Infants, Children, Adolescents, Adults* (4th ed.). Boston: McGraw-Hill.
- Gabbard, C.P. (2000). *Lifelong motor development* (3rd ed.). Madison Dubuque, IA: Brown & Benchmark.
- 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 and Sport, 74*(1), 36–46. [PubMed doi:10.1080/02701367.2003.10609062](#)
- 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 and Child Neurology, 51*(4), 311–316. 10.1111/j.1469-8749.2008.03242.x. [PubMed doi:10.1111/j.1469-8749.2008.03242.x](#)

- Halverson, L., & Robertson, 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.
- 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. PubMed doi:10.1111/1467-8624.00112
- Iverson, J. (2010). Developing language in a developing body: The relationship between motor development and language development. *Journal of Child Language*, 37, 229–261. doi: 10.1017/S0305000909990432
- 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. doi:10.1177/105381519301700108
- Lerner, R.M. (1976). *Theories of development: An overview in Concepts and Theories of Human Development* (pp. 136–155). Reading, MA: Addison-Wesley.
- 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 Disorders*, 25, 23–39. PubMed doi:10.1007/BF02178165
- 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. doi:10.1016/j.jecp.2008.07.007. PubMed doi:10.1016/j.jecp.2008.07.007
- Murphy, N.A., & Carbone, P., and the Council on Children with Disabilities. (2008). Promoting the participation of children with disabilities in sports, recreation, and physical activities. *Pediatrics*, 121(5), 1057–1061. PubMed doi:10.1542/peds.2008-0566
- 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.
- Newell, K. (1984). Physical constraints to development of motor skills. In J. Thomas (Ed.), *Motor development during preschool and elementary years* (pp. 105–120). Minneapolis, MN: Burgess.
- Newell, K. (1986). Constraints on the development of coordination. In G. Wade & H.T. Whiting (Eds.), *Motor development in children: Aspects of coordination and control* (pp. 341–360). Dordrecht, Netherlands: Nijhoff.
- Pan, C.Y., Tsai, C., & Chu, C. (2009). Fundamental movement skills in children diagnosed with autism spectrum disorders and attention deficit hyperactivity disorder. *Journal of Autism and Developmental Disorders*, 39(12), 1694–1705. doi:10.1007/s10803-009-0813-5. PubMed doi:10.1007/s10803-009-0813-5
- Payne, V.G., & Isaacs, L.D. (2002). *Human motor development: A lifespan approach* (5th ed.). Boston: McGraw Hill.
- 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. doi:10.1111/j.1440-1630.2006.00546.x. doi:10.1111/j.1440-1630.2006.00546.x
- Provost, B., Heimerl, S., & Lopez, B. (2007). Levels of gross and fine motor development in young children with autism spectrum disorder. *Physical & Occupational Therapy in Pediatrics*, 27(3), 21–36. PubMed doi:10.1080/J006v27n03\_03
- Provost, B., Lopez, B., & Heimerl, S. (2007). A comparison of motor delays in young children: autism spectrum disorder, developmental delay, and developmental concerns.

- Journal of Autism and Developmental Disorders*, 37(2), 321–328 10.1007/s10803-006-0170-6. [PubMed doi:10.1007/s10803-006-0170-6](#)
- Raudenbush, S.W., & Bryk, A.S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Newbury Park, CA: Sage.
- Redlich, J. (2005). Physical therapy and autism spectrum disorders: The motor connection. *Autism Spectrum*, 2(1), 9.
- Riethmuller, A.M., Jones, R., & Okely, A. (2009). Efficacy of interventions to improve motor development in young children: A systematic review. *Pediatrics*, 124(4), e782–e792 10.1542/peds.2009-0333. [PubMed doi:10.1542/peds.2009-0333](#)
- Seymour, H., Reid, G., & Bloom, G.A. (2009). Friendship in inclusive physical education. *Adapted Physical Activity Quarterly*, 26, 201–219. [PubMed](#)
- 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 10.1007/BF02578431. [doi:10.1007/BF02578431](#)
- 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 10.2307/1165280.
- Siperstein, G., & Favazza, P.C. (2007). Placing young children “at promise”: Future directions for promoting social competence. In W.H. Brown, S.L. Odom, & S.R. McConnell (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 II: A revision of the vineland adaptive behavior scales: I. Survey/caregiver form* (2nd ed.). Circle Pines, Minnesota: American Guidance Service.
- 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.
- Trawick-Smith, J. (2010). *From playpen to playground: The importance of physical play for the motor development of young children*. Reston, VA: Head Start Body Start National Center for Physical Development and Outdoor Play.
- Tucker, P. (2008). The physical activity levels of preschool-aged children: a systematic review. *Early Childhood Research Quarterly*, 23, 547–558. [doi:10.1016/j.ecresq.2008.08.005](#)
- 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 10.1080/14617890500064019. [doi:10.1080/14617890500064019](#)
- Vicari, S. (2006). Motor development and neuropsychological patterns in persons with Down syndrome. *Behavior Genetics*, 36(3), 355–364 10.1007/s10519-006-9057-8. [PubMed doi:10.1007/s10519-006-9057-8](#)
- Wuang, Y.P., 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 10.1080/10913670903048036. [PubMed doi:10.1111/j.1365-2788.2008.01096.x](#)