



# The Impact of a Child-Centered, Mastery Movement Program on Physical Activity Levels, Motor Skill Development and Cognitive Function in Young Children.

J. Anderson and D.P. Coe

Department of Kinesiology, Recreation, & Sport Studies. The University of Tennessee, Knoxville TN



## Abstract

**Purpose:** To determine the association between physical activity and cognition in preschool children. **Methods:** Participants were 18 young children (3–5 years old) enrolled in a Head Start preschool program. Physical activity was assessed using an Actigraph accelerometer placed on the child’s hip. The device was worn at school for at least three hours on three separate days during the week. Accelerometer data were categorized as sedentary or active (light, moderate, and vigorous intensity). Cognitive function, specifically working memory, was assessed using the Corsi Block-Tapping Test. The number of buttons in the sequence that were correctly pressed (taps correct) was used to determine working memory. Data were analyzed using Pearson correlations. **Results:** Children spent on average 87.4% of their monitored time in sedentary behaviors and 12.6% of the time physically active. The average number of taps correct was 10.1±9.8 during the Corsi test. There was a significant correlation between the amount of physical activity the children engaged in and the number of taps correct ( $r=0.51$ ;  $p>0.05$ ). **Conclusion:** This association suggests that increased physical activity levels at school could lead to improved cognition and performance in the school setting.

## Background

- Physical activity can have tremendous physical and mental benefits, and while these relationships have been thoroughly studied in adult populations, the research regarding children is not as substantial.
- As children progress through early childhood, they slowly develop gross motor skills in their larger muscles, allowing them to do things such as jump, run, or throw. With more developed gross motor skills also comes more complex movement skills and increased physical activity levels.
- In 2008, the North American Association for the Study of Obesity published an article linking childhood motor skill development to their overall physical activity level, stating that more developed skills allowed for more movement and activity (Williams et al.).
- In addition to physical benefits, other studies have shown positive mental effects of physical activity in children. One such study found that aerobic exercise improved children’s cognitive creativity and flexibility more than traditional physical education (Tuckman & Hinkle), while another identified these cognitive functions and others as predictors of academic performance (Gathercole et al.).

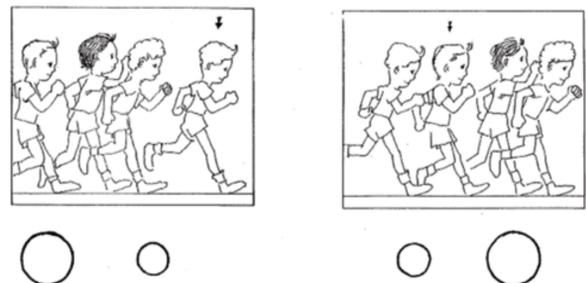


Figure 1 – The Pictorial Scale of Perceived Competence and Acceptance

## Purpose

The purpose of the proposed study is to determine the associations among motor skill development, physical activity level, cognitive function, and perceived motor competence in preschool children.

## Methods

### Sample

Participants were 18 children ages 3-5 years old enrolled in the Knoxville Head Start Preschool program.

### Procedures

Each participant completed the following assessments before the intervention:

- Anthropometric Assessment: Height and weight were measured using a stadiometer and a digital scale.
- Physical Activity Assessment: Physical activity level was measured using the Actigraph GT3X+ accelerometer (Figure 1), which was worn for three consecutive days while at the Head Start (from 9:30am to 12:30pm). Teachers and student research assistants ensured proper placement each morning.
- Motor Skill Assessment: Participants were assessed using the Test of Gross Motor Development – 2<sup>nd</sup> edition, a quantitative assessment of fundamental motor-skill competence in children 3-10 years of age (Figure 2). The TGMD2 assesses both locomotor and object-control skills, and the assessments were recorded for analysis.
- PMC Assessment: Participants completed the Pictorial Scale of Perceived Competence and Acceptance (Figure 3). This self-report uses 2 side-by-side pictures and the child selects the picture that is most like him/her in terms of their physical ability.
- Cognitive Function Assessment: Participants’ working memory was assessed using an iPad version of the Corsi Block tapping test on the app Pathspan (Figure 4). Participants watched a sequence of dots light up and was asked to tap them in the same order.



Figure 2 – The GT3X+ accelerometer



Figure 3 – The Test of Gross Motor Development – 2<sup>nd</sup> edition (TGMD2)

## Statistical Analysis

- Descriptive univariate statistics were conducted.
- Pearson correlations were run to determine the associations among motor skill development, physical activity level, cognitive function, and perceived motor competence in preschool children.

## Results

- Children spent on average 87.4% of their monitored time in sedentary behaviors and 12.6% of the time physically active.
- The average number of taps correct was 10.1 ± 9.8 during the Corsi test.
- There was a significant correlation between the amount of physical activity the children engaged in and the number of taps correct ( $r=0.51$ ;  $p<0.05$ ).
- No significant correlations were found among physical activity, perceived motor competence, and motor skill development.

## Conclusion

- Children engaged in very little total physical activity during the school day.
- There was little variation in perceived motor competence scores, which may have led to a lack of an association between physical activity, perceived motor competence, and motor skill development.
- Prior research has shown that higher levels of vigorous physical activity contributes to increased motor skill development. In the current study, the children spent approximately 2% of their time in vigorous physical activity.
- Therefore, there may be a threshold of physical activity intensity to elicit an improvement in motor skill development.
- This association suggests that increased physical activity levels at school could lead to improved cognition and performance in the school setting.

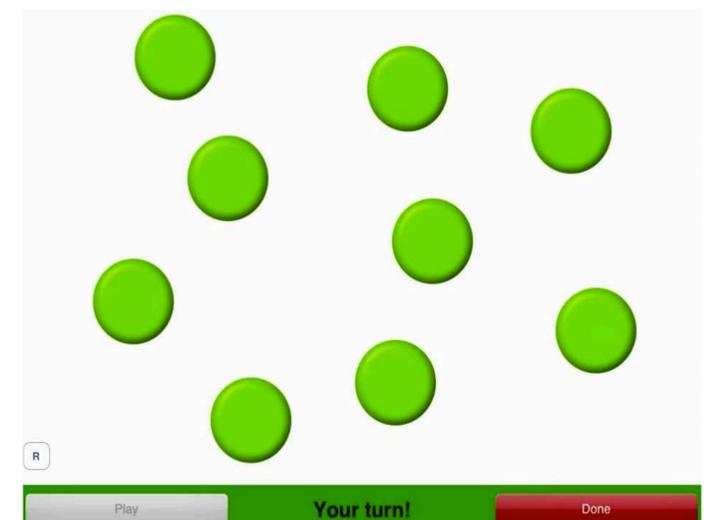


Figure 4 – The Corsi Block tapping test on the iPad app Pathspan