

# Enhancing the Cognitive and Motor Abilities of Very Young Children: A Pilot Study of the Efficacy of the PlayWisely Approach.

Craig Leth-Steensen<sup>a</sup>, Elena Gallitto<sup>b</sup>

<sup>a</sup>Carleton University, <sup>b</sup>University of Ottawa

Note: Craig and Elena run “Young Minds of Canada” which offers the PlayWisely program in the Ottawa area.

## Acknowledgements

The authors would like to profusely thank both **Tracy Hanstein** (Director of Kinderville Daycare, 1644 Bank St, Ottawa, ON) for agreeing to let us run this pilot study at Kinderville and **John Osborne** (former Dean of the Faculty of Arts and Social Sciences at Carleton University) for making some funds available in 2014 and 2016 for small research projects like this one. We would also like to thank **Alan Hay** and **Alina Raza** for their fantastic work as M-P-R examiners.

# Learning Objectives

- (i) As a result of attending this presentation, the participant will become motivated to provide more intensive perceptual and cognitive learning experiences to young children at very early ages.
  
- (ii) As a result of attending this presentation, the participant will be able to design their own randomized-controlled intervention trial within an early educational setting.
  
- (iii) As a result of attending this presentation, participants will be able to recommend a novel program for very early learning for which some evidence of positive effects has been demonstrated scientifically.

“One of the most fundamental truths about learning:

Learning changes what is subsequently easy to learn.”

(Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002, Object name learning provides on-the-job training for attention. *Psychological Science*; p. 18)

- Early experiences shape the child's brain architecture and provide a foundation for all future learning.
- Given the malleability of young brains and their potential for change, educational programs that offer targeted training at an early age can provide great advantages with respect to improving both future mental and physical performance.

Bonnier, C. (2008). Evaluation of early stimulation programs for enhancing brain development. *Acta Paediatrica*, 97, 853-858.

Bornstein, M. H., Hahn, C-S., & Wolke, D. (2013). Systems and cascades in cognitive development and academic achievement. *Child Development*, 84, 154-162.

Heckman, J. L. (2008). Schools, skills, and synapses. *Economic Inquiry*, 46, 289-324.

- Most organizations, educators, and researchers whose focus is on child development (e.g., National Scientific Council on the Developing Child; see also the Special Section “Laying the Foundation for Lifetime Learning” in *Science*, 2011, pp. 951-983) now recognize the vast potential that very early childhood education has with respect to enhancing developmental outcomes throughout the lifespan.
- However, the presence of actual programs to realize enhanced cognitive and motor development through psycho-educational training at very young ages is severely lacking.
- In this vein, a pilot study was conducted to gauge the potential efficacy of a novel approach to early learning called PlayWisely.

# PlayWisely

- PlayWisely sessions take place once a week for 30 minutes and can be administered by a single trained instructor, with either parents or a daycare worker also present, to a group of 1 - 4 children aged anywhere from 6 months to 3 years old.
- PlayWisely involves both cognitive and physical/motor skills components. For the cognitive component, a card system is used that is specifically designed to stimulate the development of key cognitive processing abilities and knowledge structures.

- The cognitive skills targeted by different sets of cards in this system include visual perception and attention (e.g., signal detection, acuity, visual-spatial tracking, and speed of processing), discrimination of key physical-based attributes (i.e., shape, colour, shading, size, and part-whole relationships), concept acquisition (i.e., classification and object recognition), and multi-sensory information integration (i.e., across the auditory and visual modalities).
- They are also designed to develop foundational cognitive abilities associated with future numerical and literacy skills (e.g., subitizing, counting, digit and alphabet learning, phonemic awareness, and visual word recognition), helping to ensure high levels of school readiness.

- The physical/motor component of each PlayWisely session involves training on 3-5 exercises within one of eight targeted skill domains: catching and throwing, balance, kicking, strength, fine motor, body translations, striking, and body rotations.
- The corresponding exercise sets are designed to enhance children's awareness of how their body interacts with the physical environment and to enable a high level of brain-body confidence.

# Method

## *Participants.*

- Seventeen children took part in this pilot study (6 females and 11 males). All of them were recruited from the Kinderville Early Learning Centre in Ottawa, ON.
- After an initial round of pre-testing, the children were randomly assigned to either an immediate intervention group (4 females and 6 males,  $M = 18.70$  months of age) or a wait-list control group (2 females and 5 males,  $M = 20.85$  months of age).

## *Procedure.*

- In the immediate intervention condition, children participated in PlayWisely sessions once a week for 16 weeks.
- The wait-list control condition involved waiting until the immediate intervention group had finished before starting their 16 weeks of PlayWisely sessions.

The PlayWisely system itself involves eight different versions of the cards sets and eight different sets of physical/motor exercises. Hence, 16 weeks represents two full cycles through the PlayWisely materials.

- Participants were tested on the Merrill-Palmer-Revised (M-P-R) Scales of Development (Roid & Sampers, 2004) at the start (pre-test), after the first 16 weeks of PlayWisely sessions with the immediate intervention group (post-test), and finally once more after the second 16 weeks of PlayWisely sessions with the wait-list group (follow-up).

PlayWisely for  
Immediate Group

Pre-test

Post-test

Follow-up test

PlayWisely for  
Waitlist Group

16 weeks →

16 weeks →

- This resulted in a study length of 10 months after taking the additional time to perform each round of testing into account.
- Tests of cognitive and gross motor abilities were administered by examiners who were blind to the respective conditions assigned to each of the children being tested.

# Results

- The dependent measures for each of the following analyses were the age-equivalent scores (in months) derived from the M-P-R Cognitive and Gross Motor ability scales.
- Each set of scores was subjected to a 3 (Test Period: pre-test, post-test, and follow-up)  $\times$  2 (Group: immediate intervention, wait-list control) ANOVA in SPSS (with test period and group as repeated measures and independent groups factors, respectively).

- Given that scores were necessarily expected to increase linearly over the testing period (i.e., with age), the key effect of interest was difference in this linear trend across the immediate intervention and wait-list groups.
- That is, the interaction of group with the linear trend of the Test Period effect (from the Polynomial contrast results in SPSS).

*Table 1. Mean Age-equivalent Scores (With SDs in Parentheses) for the Cognitive and Gross Motor Ability Scales of the M-P-R.*

Group:	<u>Test-Period</u>		
	<u>Pre-test</u>	<u>Post-test</u>	<u>Follow-up</u>
		Cognitive ( $p = .100$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	18.94 (1.83)	24.31 (1.43)	31.22 (1.83)
Wait-list Control	20.03 (2.18)	23.74 (1.71)	30.00 (2.19)
		Gross Motor ( $p = .731$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	23.73 (2.77)	33.20 (2.76)	44.90 (2.71)
Wait-list Control	23.29 (3.31)	32.86 (3.30)	43.00 (3.24)

*Table 1. Mean Age-equivalent Scores (With SDs in Parentheses) for the Cognitive and Gross Motor Ability Scales of the M-P-R.*

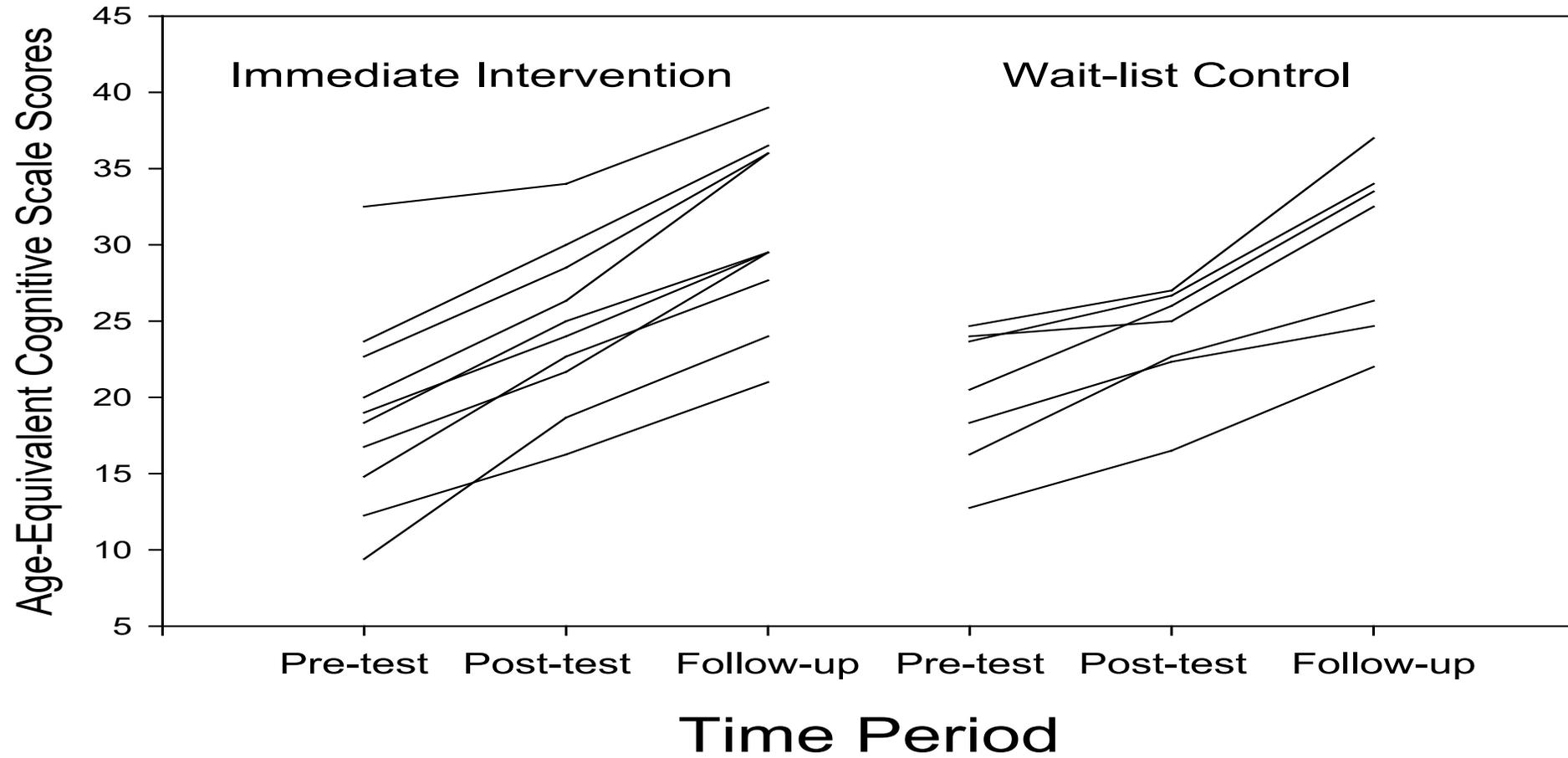
Group:	<u>Test-Period</u>		
	<u>Pre-test</u>	<u>Post-test</u>	<u>Follow-up</u>
M-P-R Cognitive Subscales:			
		Fine Motor ( $p = .002$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	20.35 (2.28)	27.38 (2.03)	38.23 (2.76)
Wait-list Control	21.65 (2.72)	27.36 (2.43)	33.86 (3.30)
		Visual Motor ( $p = .046$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	21.22 (2.01)	28.30 (1.61)	36.18 (2.34)
Wait-list Control	23.30 (2.41)	28.07 (1.92)	33.57 (2.80)
		Processing Speed ( $p = .054$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	23.91 (2.16)	30.83 (2.27)	40.10 (2.94)
Wait-list Control	24.01 (2.59)	30.52 (2.71)	34.54 (3.52)

*Table 1. Mean Age-equivalent Scores (With SDs in Parentheses) for the Cognitive and Gross Motor Ability Scales of the M-P-R.*

Group:	<u>Test-Period</u>		
	<u>Pre-test</u>	<u>Post-test</u>	<u>Follow-up</u>
M-P-R Cognitive Subscales:			
		Reasoning ( $p = .503$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	21.06 (2.04)	26.92 (1.52)	34.56 (2.32)
Wait-list Control	21.83 (2.44)	25.69 (1.81)	33.93 (2.77)
		Receptive Language ( $p = .921$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	18.58 (1.87)	23.27 (1.80)	31.02 (2.31)
Wait-list Control	19.06 (2.23)	22.50 (2.15)	31.21 (2.77)
		Memory ( $p = .837$ for Interaction <sub>Linear trend</sub> )	
Immediate Intervention	20.27 (1.90)	25.93 (1.90)	34.70 (2.77)
Wait-list Control	21.01 (2.28)	21.81 (2.28)	32.81 (3.31)

# Discussion

- The results of this pilot study provide some preliminary evidence for a larger increase in age-equivalent total scale scores for overall cognitive ability over the testing period for the children who were administered PlayWisely immediately as opposed to 4 - 5 months later.
- Indeed, the increase for the immediate intervention group of 12.28 months was about 20% larger than would be expected given the actual time difference of 10 months between the pre-and follow-up tests.



*Fig. 1. Individual overall cognitive ability results across the test period for each group separately.*

- The fact that reliably significant differential increases in fine motor ( $p < .05$ ), visual motor ( $p < .05$ ), and processing speed ( $p < .10$ ) were present certainly suggests that PlayWisely does indeed seem to be targeting these three abilities in particular.
- Importantly, all three could be regarded as being key to the development of higher cognitive functioning.

## Future Studies

- Change the scale used to measure Gross Motor skills.
- Recruit more participants (i.e., offer parents an incentive).
- Improve control group (i.e., drop wait-list).
- Longitudinal work (i.e., to examine the possibility of enhanced literacy and numeracy skills in early elementary school).