

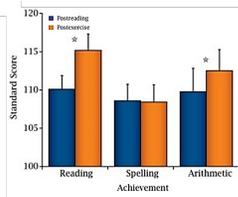
Background

Exercise and the brain:

- Research has shown that physical exercise has cognitive benefits.¹ In spite of this, only 46% of elementary and high-school students are getting the recommended weekly amount of exercise.

The benefits of exercise may start with just *one bout!*

- Scientists have shown that a single bout of exercise improved attention, reading and arithmetic skills in all children (aged 8-10 years).²



- The lab at Sunnybrook has partnered with The Sterling Hall School through The Sterling Institute to extend this field of research by studying the acute effects of exercise on a broad set of cognitive skills.



Questions

- Can single bouts of exercise influence cognitive performance?
- Do high intensity AND moderate intensity exercise have similar effects on cognitive performance?

Methods

Participants: 18 Grade 8 boys (ages 13-14)

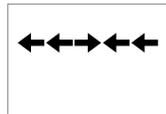
Protocol

- 10-minute cognitive test before and after 20 minutes of exercise
- 2 sessions:
 - Session 1: **HIGH** intensity exercise
 - Session 2: **MODERATE** intensity exercise



Computer-Based Cognitive Testing

Flanker Task



Tests: **Attention**

Students hit the arrow key on the keyboard that corresponded to the middle arrow on the screen.

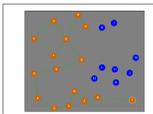
Arithmetic Task



Tests: **Math Skills**

Students solved simple subtraction and multiplication questions.

Trails Making



Tests: **Executive Function**

Students connected dots following the pattern: 1-A-2-B-3-C-4-D etc.

Exercise

Interval Training

- Burpees (1 minute)
- Step-ups on a bench (1 minute)
- Full-gym line touches (2 minutes)
- Push-ups (1 minute)

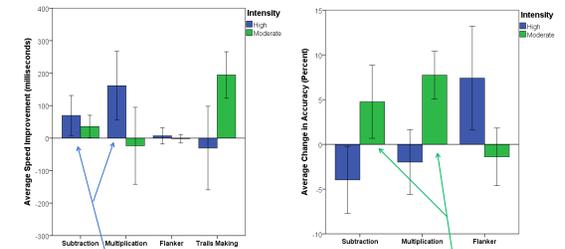


Session 1 (High Intensity) - Participants were instructed to do as many repetitions as they could of each exercise as an index of peak physical fitness performance.

Session 2 (Moderate Intensity) - Participants performed a set number of repetitions that was less than peak physical fitness performance.

Preliminary Findings

Average changes in speed and accuracy AFTER exercise:



After high intensity exercise, students completed the subtraction task 6% faster, and multiplication 7% faster

One bout of moderate intensity exercise significantly improved the students' accuracy in subtraction by 6% and multiplication by 10%

- A single bout of **high intensity exercise** causes students to answer arithmetic questions faster, but with a slight decrease in accuracy. High intensity exercise improved accuracy on the flanker task.
- Moderate intensity exercise** did not affect the students' speed on the arithmetic task, but significantly improved their accuracy.

Implications

- Recess or a short PE class would be beneficial for students before writing tests and exams, as their arithmetic skills, executive functioning and attention would improve.
- A decision as to whether high intensity or moderate intensity exercise is performed would need to be made according to which cognitive abilities are required (e.g. speed vs. accuracy).
- This research is ongoing and will include many more schools in the GTA to continue to explore the effects of single bouts of exercise on various cognitive outcomes.

References

- Colcombe S, Kramer AF. Fitness effects on the cognitive function of older adults: A meta-analytic study. *Psychol Sci* 2003; 14:125-30
- Pontifex MB, Saliba BJ, Raine LB, Picchiotti DL, Hillman CH. Exercise improves behavioural, neurocognitive, and scholastic performance in children with attention-deficit/hyperactivity disorder. *J Pediatr*. 2012;162:543-551

Contact Information

Dr. Bradley MacIntosh
bmac@sri.utoronto.ca
416.480.6100 ex. 7277

The Sterling Institute
sterlinginstitute@sterlinghall.com

David Crane
decrane@gmail.com
Activebrain.ca