

Young children show improved verbal IQ

After 20 days of exposure to music-based, cognitive training 'cartoons'

Toronto, Canada – Canadian scientists who specialize in learning, memory and language in children have found exciting evidence that pre-schoolers can improve their verbal intelligence after only 20 days of classroom instruction using interactive, music-based cognitive training cartoons.

The study – conducted at York University by Dr. Sylvain Moreno, who is now with Baycrest's Rotman Research Institute (RRI) – is posted online today in *Psychological Science* (a journal of the Association for Psychological Science), ahead of print publication in the October issue of the journal.

The cognitive benefit was striking and consistent in 90% of the children who took the four-week learning program and was additionally confirmed by brain imaging data that indicated brain changes had taken place related to the training.

"Our data have confirmed a rapid transfer of cognitive benefits in young children after only 20 days of training on an interactive, music-based cognitive training program. The strength of this effect in almost all of the children was remarkable," said Dr. Moreno, a world expert on neuroeducation. He is now the Lead Scientist at Baycrest's Centre for Brain Fitness.

The findings have exciting implications for conceptualizing and improving neuroeducation programs for children of all ages, and potentially for older adults.

The scientific team included other prominent researchers in the field of cognitive development – Dr. Ellen Bialystok, York University, and principal collaborator in the study; Dr. Tom Chau, Bloorview Research Institute; and Dr. Glenn Schellenberg, University of Toronto. Artist-educators from The Royal Conservatory's Learning Through the Arts program conducted the experimental training with pre-schoolers, and George Brown College provided assistance in the earliest stages of software development for the training programs.

"These results are dramatic not only because they clearly connect cognitive improvement to musical training, but also because the improvements in language and attention are found in completely different domains than the one used for training. This has enormous implications for development and education," said Dr. Bialystok, Distinguished Research Professor of Psychology at York University and Associate Scientist at Baycrest's Rotman Research Institute.

In the study, 48 pre-schoolers four to six years of age participated in computer-based, cognitive training programs that were projected on a large classroom wall and featured colorful, animated cartoon characters delivering the lessons. The children were divided into two groups. One group received music-based, cognitive training that involved a combination of motor, perceptual and cognitive tasks, and included training on rhythm, pitch, melody, voice and basic musical concepts. The other group received visual art training that emphasized the development of visuo-spatial skills relating to concepts such as shape, color, line, dimension and perspective.

Each group received two training sessions of one-hour duration each day in classroom, over four weeks, led by instructors at The Royal Conservatory in Toronto.

Researchers tested the children for verbal and spatial intelligence before and after the training using the Wechsler Preschool and Primary Scale of Intelligence (Third Edition). The team also conducted

brain imaging using non-invasive electroencephalography (EEG) which measures the time course of brain activity.

The verbal IQ tests assessed the children's attention, word recall and ability to analyze information and solve problems using language-based reasoning. Brain imaging enabled researchers to detect if functional brain changes had occurred related to the cognitive training.

When the children were re-tested five to 20 days after the end of the training programs, researchers did not find any significant increase in verbal intelligence or brain changes for the children who participated in the visual art training module. However, they found quite a different result in the children who took the music-based, cognitive training. Ninety percent of those children exhibited intelligence improvements – five times larger than the other group – on a measure of vocabulary knowledge, as well as increased accuracy and reaction time. The music group also showed brain changes that co-related to their enhanced cognitive performance.

"The results of this study strongly affirm the resonance between music and child development, and encourage us to think of music not just as a medium or tool through which treatment might be delivered, but as the treatment itself," said Dr. Chau, a Senior Scientist at Bloorview Research Institute and Canada Research Chair in Paediatric Rehabilitation Engineering.

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