Utilizing Cognitive Training to Remediate Working Memory in School-Age Children: Teacher Ratings of Improvement

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Introduction

Considerable research has shown that important predictors of academic success include working memory (WM) and attention skills (Gray et al., 2012). Specifically, research has shown that WM and attention skills impact reading, writing, and mathematics (Rode, Robson, Purviance, Geary, & Mayr, 2014). Moreover, research has found that WM and attention deficits are present in children with learning differences (e.g., ADHD) (Delavarian, Bokharaeian, Towhidkhad & Gharibzadeh, 2015; Kirk, Gray, Riby & Cornish, 2012). Thus, a focus of recent research is on the remediation of attention and WM deficits through the use of game-based computerized cognitive training programs (Gray et al, 2012; Kirk et al., 2015). The results indicate that adaptive WM training can ameliorate low working memory, attention deficits, and other symptoms related to poor learning abilities in children (Holmes, Gathercole, & Dunning, 2009; Kirk et al., 2015). What has been less clear is whether the training produces changes in other academically-related outcomes (e.g., teacher perceptions of classroom behaviors). Thus, the purpose of this study is to examine the efficacy of a school-based computerized cognitive training intervention program in enhancing working memory abilities and improving classroom behaviors (based upon teacher ratings).

Methods

Participants:

-50 students and 10 teachers from a private school serving students with learning differences

-Average age of students was 10.4 years with a range of 7-13 years.

Measures:

Wide Range Assessment of Memory and Learning-2 (WRAML-2)

Used to assess working memory skills; the Symbolic Working Memory, and Verbal Working Memory subtests were used.

Neuropsychological Processing Concerns Checklist

This measure provides classroom teachers a means for rating aspects of functioning related to classroom achievement. The focused attention, sustained attention, cognitive flexibility, working memory, and executive function subscales were utilized. Higher scores indicate greater concerns.

Captain's Log

Captain's Log is a computer-based training program that utilizes adaptive game-like exercises designed to enhance a variety of cognitive skills (e. g., working memory).

Procedures:

Initially, each teacher was asked to complete the checklist for every student in his/her classroom as part of a beginning of the school year baseline index of school-related concerns. Subsequently, the cognitive training program was introduced to parents at the school and they (the parents) were invited to participate. The first 50 respondents were included in this project. Among these students, 25 were randomly assigned to the training group; the remaining 25 did not receive training. All students were pretested on the WRAML-2. Training group students then received 20 hours of cognitive training; only 17 students completed the full training program. Following training all students were administered the WRAML-2 and teachers completed the checklist for each of the 50 students.

Results

Overall, the findings support the hypothesis that remediation of working memory in children with learning differences is possible through computerized-cognitive training. Additionally, teachers reported fewer classroom concerns following training.

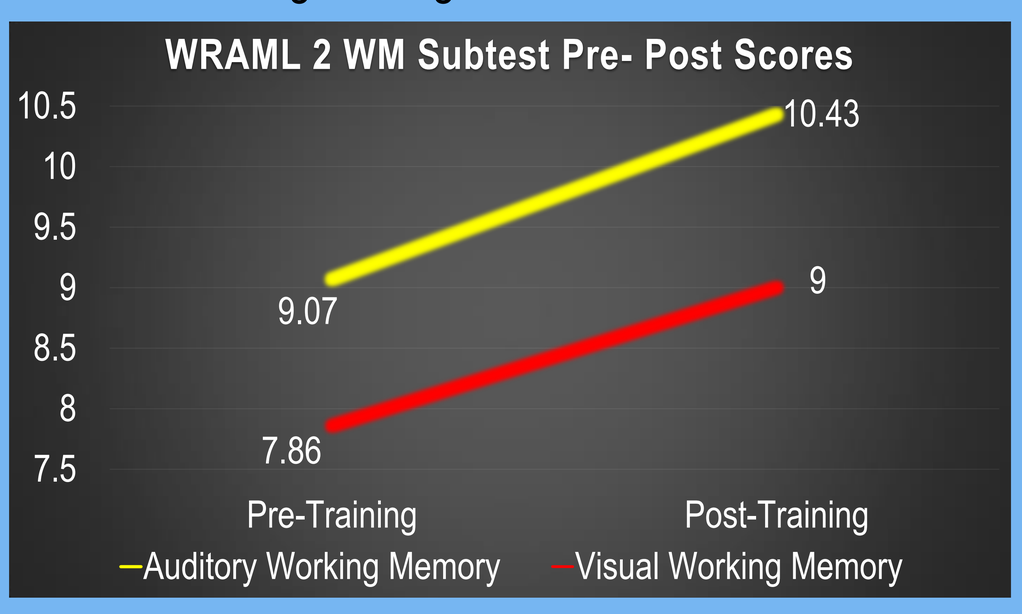

Table 1: Pre- and Post-training differences in teacher ratings for students who received WM training

Training Group	Average	t-test (df)	p-value
Pre-Focused Attention	2.29		
Post-Focused Attention	1.73	4.17 (16)	0.001
Pre-Sustained Attention	2.35		
Post-Sustained Attention	1.80	3.39 (15)	0.004
Pre-Shift Attention	1.67		
Post-Shift Attention	1.20	2.26 (16)	0.038
Pre-Working Memory	1.99		
Post-Working Memory	1.64	2.44 (15)	0.028
Pre-Executive Functioning	1.34		
Post-Executive Functioning	1.11	2.40 (15)	0.03

Table 2: Pre- and Post-training differences in teacher ratings for students who did not received WM training

No Training Group	Average	t-test (df)	p-value
Pre-Focused Attention	1.94		
Post-Focused Attention	1.65	1.80(22)	0.086
Pre-Sustained Attention	1.99		
Post-Sustained Attention	1.73	1.19 (24)	0.247
Pre-Shift Attention	0.93		
Post-Shift Attention	1.04	-.612 (22)	0.547
Pre-Working Memory	1.33		
Post-Working Memory	1.40	-. 54 (24)	0.595
Pre-Executive Functioning	1.11		
Post-Executive Functioning	1.01	.92 (23)	0.365

Discussion

This project provides evidence that computerized cognitive training can be effectively integrated into the daily curriculum of school-age children. Our findings are consistent with previous research demonstrating that game-based training can remediate cognitive skills such as working memory (see Gray et al., 2012; Kirk et al., 2015; Rode et al., 2014). Moreover, this study provides some evidence that the effects of training is noticeable in classroom (as measured by teacher-reported concerns). That is, teachers indicated lesser concerns in neuropsychological function for students who received training than those who did not. Clearly, the teachers were not blind to which students had received training when they completed the checklist for the second time (but they were not aware of which students would receive training when the first checklist was completed). In general, teachers are generally considered to be reasonably accurate reporters. Thus, the significant change from pre-training to post-training perceptions (for the treatment group) are informative.

Presented at the 2015 European Congress of Psychology