

# Enhancing Working Memory with an At-Risk Population Utilizing Cognitive Training in A School Setting

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## Introduction:

Research has shown that working memory (WM) is correlated with academic success (e.g., performance in math, reading, and language comprehension, as well as, standardized state test scores in reading (3, 4, 8). WM is also related to real world skills such as reasoning, problem solving, inhibition and attention (9). The importance of WM has resulted in researchers looking at the possibility that WM can be enhanced via computerized cognitive training (CCT). There is a general consensus that near transfer effects occur following CCT (i.e., WM is improved following training (1, 5, 6). Most of reported research has focused on training typically functioning populations, as opposed to “at risk” student groups; “at risk” is commonly defined as individuals with exceptionalities such as learning disabilities and autism spectrum disorders (2, 7, 10). Thus, the purpose of the current study was to examine the effectiveness of CCT, implemented during the school day, with at-risk students that do not fit a traditional notion of at-risk. This project worked with students who have been expelled from comprehensive and continuation schools in their respective districts because of behavioral issues such as drug possession, fighting, and/or other criminal activities.

## Methods:

### Participants

Thirty-three students from two community day schools in Southern California participated. The schools serve at-risk youth who exhibit behavioral problems such as drug abuse, truancy, and/or have criminal backgrounds that necessitate an alternative high school setting. Participating students were 13 to 18 years old and came from a wide range of backgrounds and ethnicities.

### Materials

Wide Range Assessment of Memory and Learning 2 (WRAML 2)- The WRAML 2 is a norm-referenced measure of memory capabilities. It is normed for individuals from five to 90 years of age. The Verbal Working Memory (VWM) subscale was utilized in this project. Performance is described in the form of scaled scores ranging from 1-19 with an average of 10 and a standard deviation of 3.

Cognitive Training Activities- Recall and Ultimeyes (UE) are iPad-based training programs that target specific cognitive abilities. Recall is a WM activity while Ultimeyes is a visual processing task.

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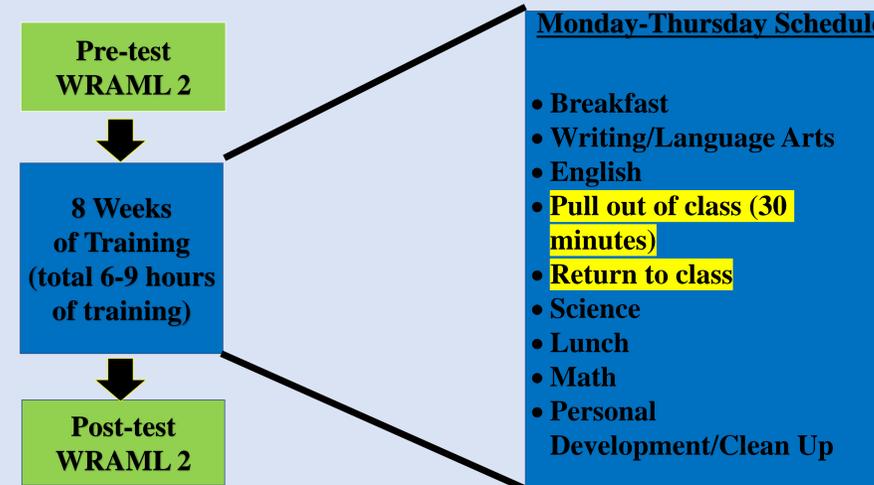
\*\*\*A portion of the current data set was presented at the WPA 2017 conference

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## Procedure



## Results:

Figure 1 shows the students WM scores prior to and following CCT. As seen in the figure, students demonstrated stronger WM in both conditions (Ultimeyes & Recall) following training. Paired sample t-tests were used to determine if pre- to post- test change was significant (See Table 1 below.)

Figure 1:

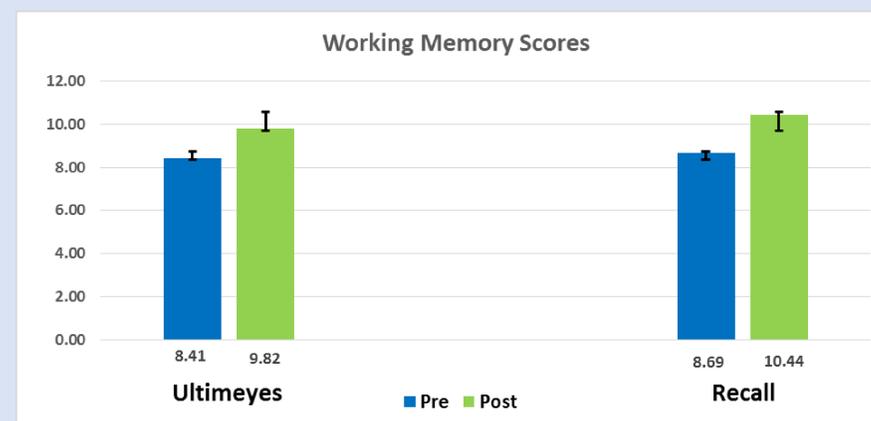


Table 1: Paired t-test and pre- and-post of WM scores. A moderate effect of Cohen's d was seen.

	df	t	p	Cohen's d
Ultimeyes	16	-3.17	0.003	0.56
Recall	15	-2.65	0.009	0.63

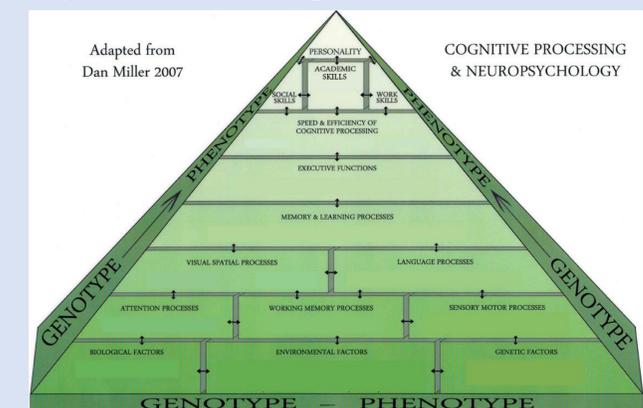
## Discussion:

Pre- to post-training results indicated that there was an improvement in participant's verbal working memory (VWM), for both training programs. These findings support the use of CCT with at-risk youth which aligns with previous research findings that support the use of CCT to improve VWM (1, 2, 3). Furthermore, these results are consistent with a neuropsychological model of academic achievement

Limitations of the current study:

1. Limited number of training hours compared to previously published work
2. Lack of an active control group

The inconsistent attendance that characterized numerous participants in this project resulted in lesser training (on average), for our students relative to participants in other published studies. However, despite the limited training, the current results were statistically and practically significant. Thus, there is evidence that CCT produces an effect on VWM. It was expected that students using the UE training program would serve as an active control group (i.e., these students were not expected to show pre- to post-test improvement in VWM) because they were not playing a working memory game. However, the UE participants demonstrated a post-training improvement in VWM similar to that in the Recall group. Future studies will need to address how an active control group can be established so that the efficacy of CCT can be more clearly demonstrated. Ultimately, this project is unique and meaningful in that it was implemented as part of the school-day and with a population of students who are generally underserved with regard to their educational needs.



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