

# **The Relationship Between Attention Deficit Hyperactivity Disorder (ADHD) and Language Learning Impairment (LLI)**

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## **Introduction**

An estimated 3-5% of all school-age children are diagnosed with attention deficit hyperactivity disorder (ADHD) (Cantwell, 1996). Furthermore, estimates of the prevalence of language learning impairment (LLI) range from 6-15% of all children. The high comorbidity between the two disorders has been well documented, with estimates ranging from 10-33% (Cantwell & Baker, 1987; Riccio et al., 1994). Understanding the relationship between ADHD and LLI may lead to better assessment and more effective treatment strategies for both disorders.

Investigations of the relationship between ADHD and language disorders have provided varying results. Some reports have indicated that children with ADHD have difficulties with expressive rather than receptive language, particularly when language output is required to be organized (Barkley, 1990; Munir et al., 1987). Some studies have shown that language disorders in general are associated with children suffering from the inattentive subtype of ADHD rather than the hyperactive subtype (Shaywitz et al., 1994). Whereas others have suggested that deficits in working memory (Witton et al., 1998) and executive functions (Barkley, 1997; Purvis & Tannock, 1997) negatively impact language abilities. Despite the disagreement over the relationship of language disorders to ADHD, clinicians, teachers, and parents agree that many children with ADHD seem to have language difficulties.

The primary goal of this study was to address whether or not there is an underlying factor in common between subtypes of ADHD and certain forms of LLI or whether these are two distinct syndromes that co-occur in some children. This was accomplished by comparing performance on a language measure to performance on a behavioral rating scale before and after computerized training for receptive language problems in a randomized control treatment study of children "at-risk" for academic failure.

## **Methods**

**Subjects.** 449 children who were "at-risk" for academic failure were identified at 9 elementary schools to undergo Fast ForWord Language® training. After stratified sampling by grade and gender, children were randomly assigned to either a control or experimental group. Roughly two thirds of the subjects were placed in the experimental condition. From this group, 237 children (Controls n=68; Experimental n=169) were selected for analyses based on having been administered the Conners' Teacher Rating Scale-Revised Short Form (CTRS-R:S) as part of a pre-training assessment battery. As recommended by Conners (1997), children were designated as being "at-risk" for ADHD hyperactive type by scoring > 61 on the hyperactivity subscale or designated being "at-

risk" for ADHD inattentive type by scoring  $> 61$  on the ADHD subscale. Teachers, who rated their students on the CTRS-R:S, were not aware (blind) whether or not the child was placed in the control or experimental condition.

**Measures.** The Test of Auditory Comprehension of Language-Revised (TACL-R), a measure of language comprehension, was used to assess receptive language skills. The Conners' Teacher Rating Scale-Revised Short Form (CTRS-R:S) is a 28 item behavioral measure and was used to assess risk for ADHD. It consists of 4 subscales: Oppositional, Cognitive Problems, Hyperactivity, and an ADHD index.

**Intervention.** Fast ForWord Language is an adaptive training program that is designed to modify subject's temporal and spectral processing of acoustic stimuli through using computer modified speech and tones (Miller et al., 1999). This has been shown to improve phonological analysis and language-processing skills of language impaired children. Fast ForWord Language is comprised of seven exercises designed to appear as games.

Both experimental and control groups received the same battery of pre- and post-training measures and questionnaires. Once the groups were designated, teachers were given the behavioral rating scales, and the children received a battery of tests of language comprehension and phonological awareness including the TACL-R. Subjects in the experimental condition were trained on the Fast ForWord Language program for 1 hour and 40 minutes each day, for five days a week for approximately six weeks. Subjects in the control condition received tutoring in language skills as designated by each school. After the training period was over, subjects were administered the post-test battery.

## Results

1. Subjects having trained with Fast ForWord Language demonstrated significant improvement on the total TACL-R scores,  $F(1, 221) = 5.63, p=.019$ .
2. CTRS-R:S scores at pre-training did not significantly predict performance on the TACL-R. Gender was analyzed and was found not to significantly interact with any dependent measures.
3. Significant improvement in language performance did not interact with either the behavioral ratings as measured by the CTRS-R:S or risk status.
4. Subjects "at-risk" for ADHD hyperactive or inattentive type did not demonstrate significantly lower scores compared to a control group or any CTRS-R:S subscales after having trained with Fast ForWord Language.

## Conclusions

The results suggest that children with poor language performance benefited from intensive computerized training regardless of co-occurring behavioral disorders such as ADHD. Prior to training there was no support for the notion that underlying processing difficulties found in certain types of language impairments were related to symptoms of ADHD as measured by the CTRS-R:S. Children benefited from training on Fast ForWord

Language regardless of risk status for ADHD. This suggests that when children have difficulties in both areas, the language impairments appear to be independent of features associated with ADHD. In addition, the CTRS-R:S provided a reliable measure of ADHD symptoms in the children across measures. Despite anecdotal reports provided by parents and teachers indicating that improvements in a child's ability to focus, scores on the CTRS-R:S did not reflect these observations. It will be important to systematically explore the relationship between language difficulties and subtypes of ADHD on additional measures in future studies.

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