Fast ForWord Language Training Program For Children with Language & Learning Problems: Results from a National Field Study by 35 Independent Facilities

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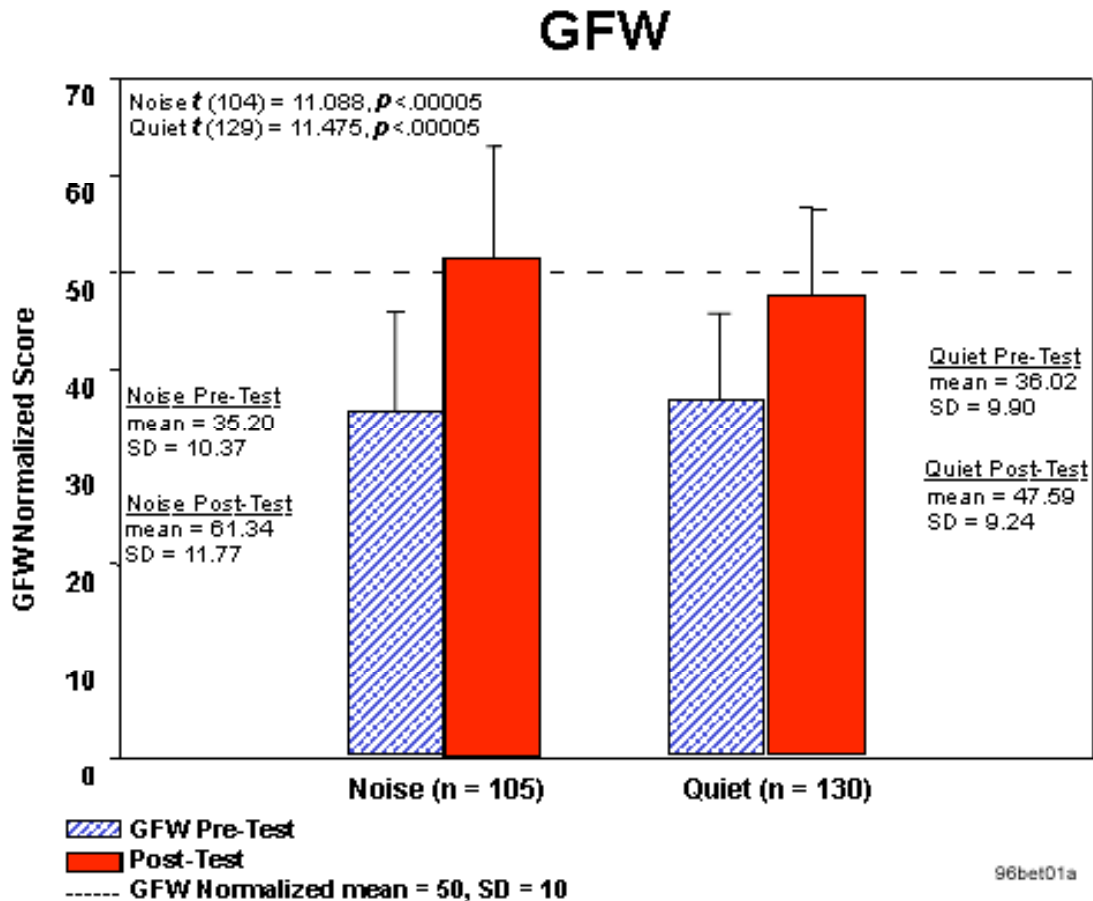
Figure 1
GFW Normalized Scores

Figure 1 shows pre- vs post-Fast ForWord Language training results for the Goldman Fristoe Woodcock (GFW) test of auditory discrimination. The test is normed for presentation either in quiet or in noise. The group of children in this study assessed with the GFW demonstrated mean test scores approximately 1.5 standard deviations below the mean at pre-test. Post-test scores demonstrated a significant improvement in both the quiet and noise conditions (p<.00005) after training, with average scores approaching or exceeding the mean.
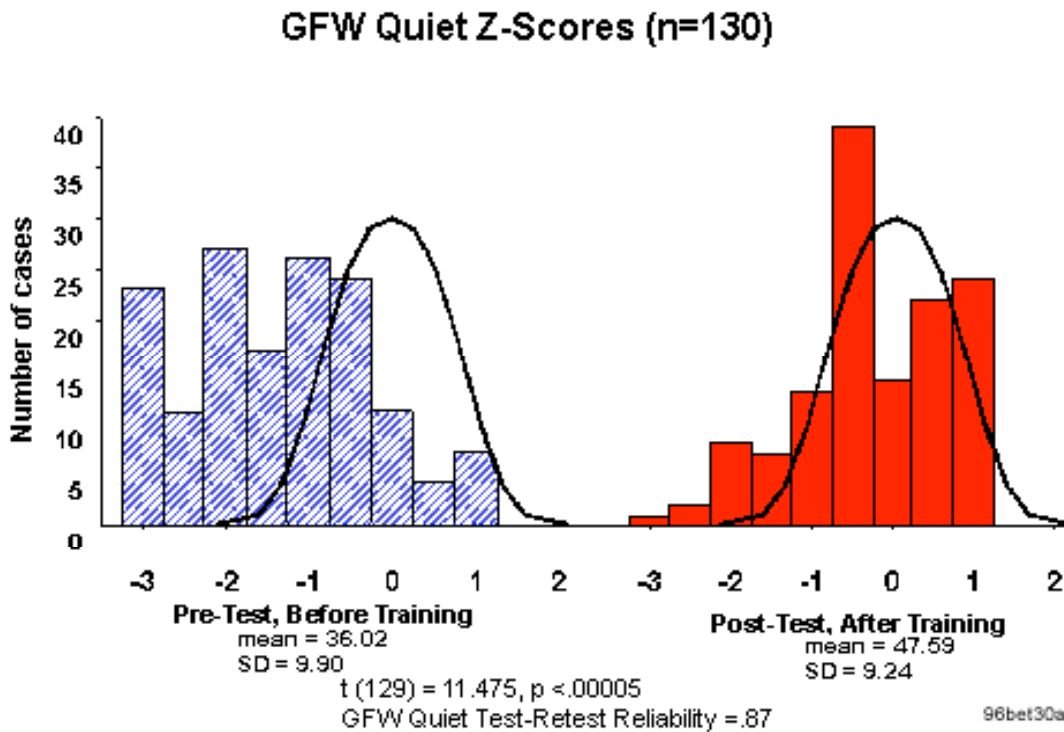
Figure 2
GFW Quiet Z–Scores (n=130)

Figure 2 shows pre– vs post–Fast ForWord Language training results for the Goldman Fristoe Woodcock (GFW) test of auditory discrimination presented in quiet in terms of z scores. A z score of 0 is equal to the population mean, with a z score of –1 equaling 1SD below the mean and a z score of +1 equaling 1SD above the mean. The normal distribution for the GFW test is shown as a black bell shaped curve. The number of individual cases scoring in each z score bin are plotted before and after training. Before training 86 subjects (66%) scored 1 or more SD below the mean and 9 (7%) scored at or above the mean on this test. After training only 25 (19%) scored 1 or more SD below the mean while 51 (39%) scored at or above the mean.
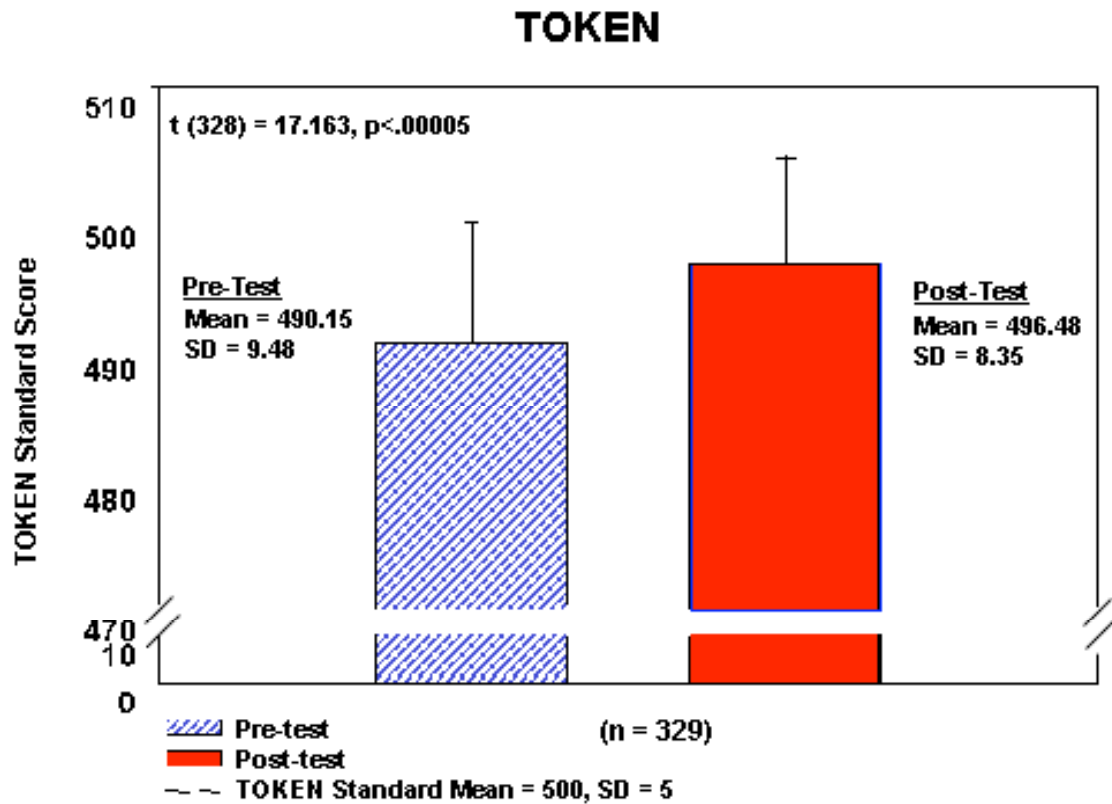
Figure 3
Token Standard Score

Figure 3 shows pre– vs post–Fast ForWord Language training results for the Token Test. Before training the group of children assessed with the Token test (N=329) scored approximately 2 standard deviations (SD) below the population mean on this test. The group improved by more than 1 SD post training, with 45% of children scoring at or above the normal mean after training.

Figure 4
Token Z-Scores (n=329)

TOKEN Z-Scores (n=329)

Pre-Test Z-Scores
Before Training
mean = 490.15
SD = 9.48

Post-Test Z-Scores
After Training
mean = 496.48
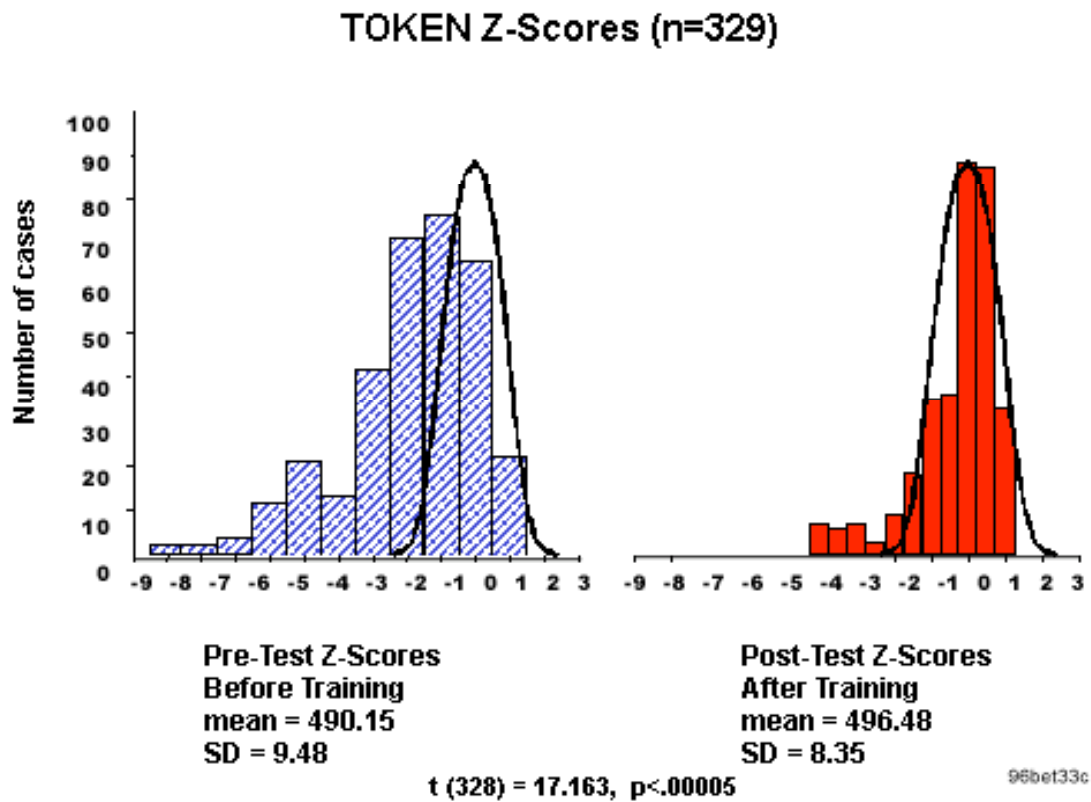SD = 8.35

$t(328) = 17.163, \ p<.00005$

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Figure 4 shows pre- vs post-training for the Token Test in terms of z scores. The normal distribution for the Token Test is shown as a black bell shaped curve. The number of individual cases scoring in each z score bin are plotted before and after training. Before training 221 children (67%) scored 1 or more SD below the mean and 45 (13%) scored at or above the mean on this test. After training 105 children (32%) scored 1 or more SD below the mean while 150 children (45%) scored at or above the mean.

Figure 5
CELF Receptive and Expressive Quotients

CELF Receptive & Expressive Quotients
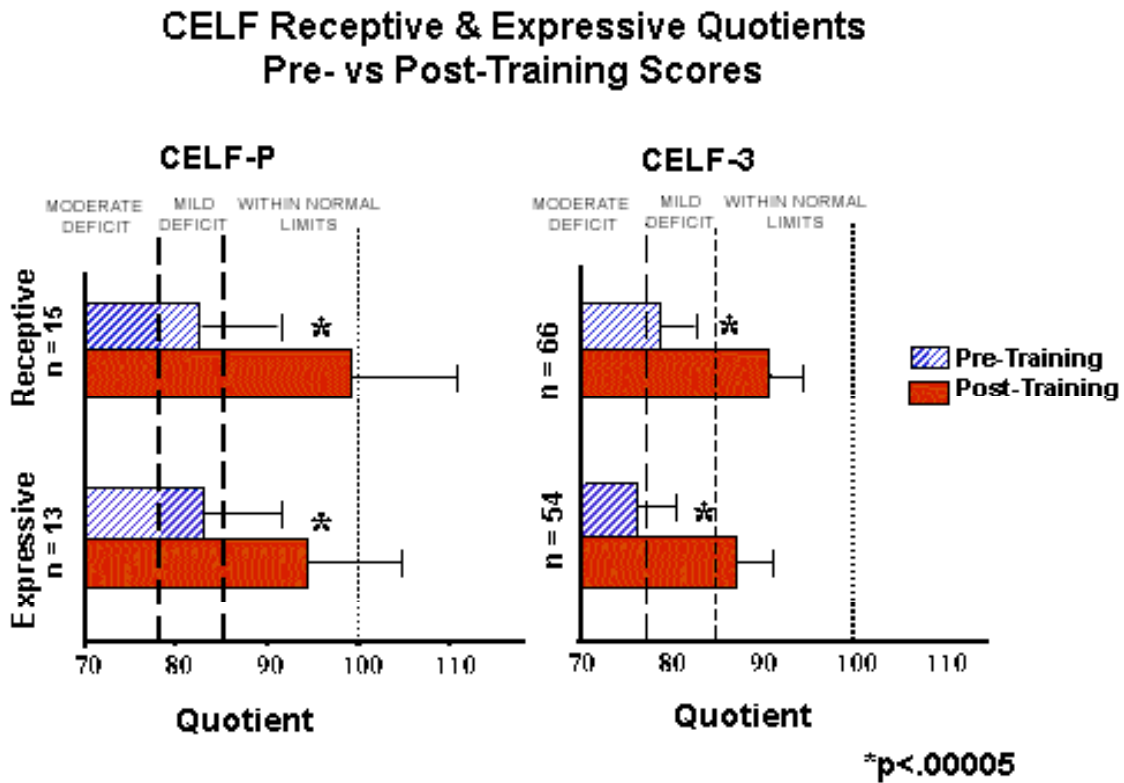### Pre- vs Post-Training Scores

Figure 5 shows pre- and post-Fast ForWord Language training results for two versions of the Clinical Evaluation of Language Fundamentals (CELF) battery (CELF-P and CELF-3). Receptive and Expressive Language abilities can be evaluated separately. The group of children with language impairments participating in this study who were assessed with the CELF tests demonstrated mean receptive and expressive language scores more than 1 SD below the mean at pre-test, placing them in a range this test describes as "mild" to "moderate deficit." Post-training test scores demonstrated a significant improvement in both receptive and expressive language function (p<.0005) with the average group score entering the range this test describes as "within normal limits."

Figure 6
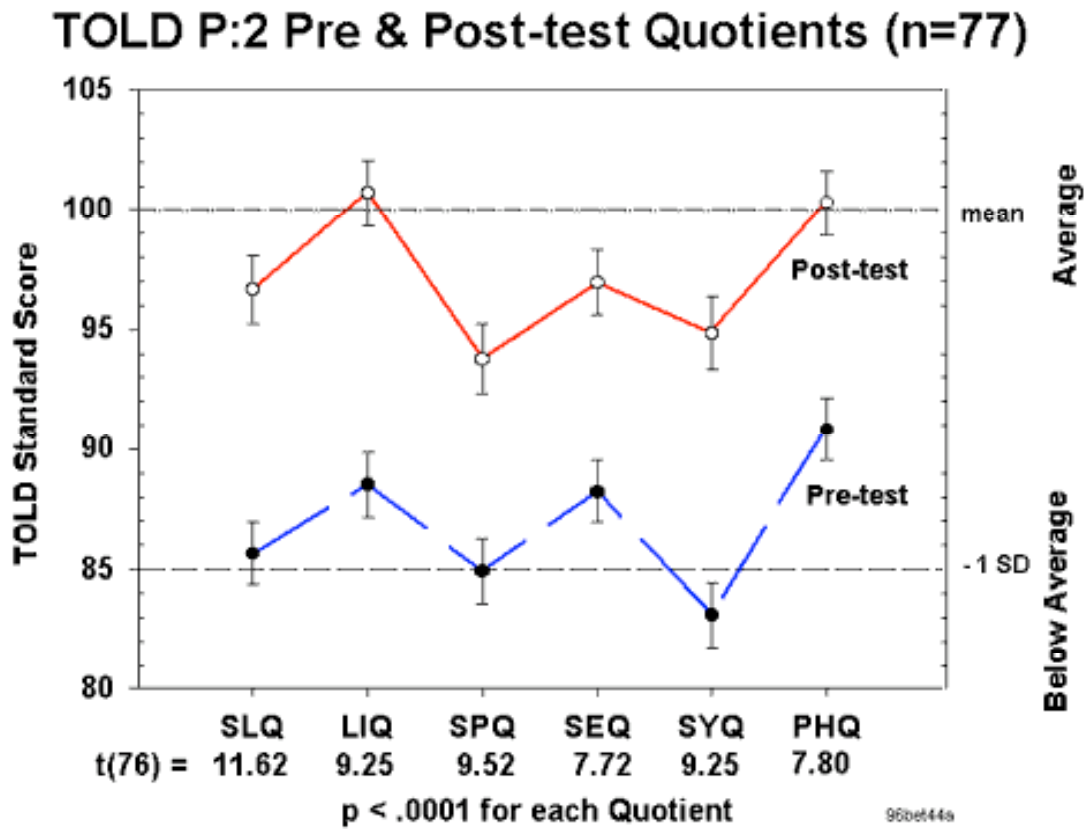**TOLD P:2 Pre- and Post-Test Quotients (n=77)**

Figure 6 shows pre- and post-training test scores for the children assessed using the Test of Language Development (TOLD) Primary: 2. Significant improvement (p<.0001) was demonstrated for the composite language quotient as well as for the Listening quotient (LIQ), speaking quotient (SPQ), semantics quotient (SEQ), syntax quotient (SYQ) and phonological quotient (PHQ). At pre-test these children as a group were scoring approximately 1 standard deviation (SD) below the mean on the composite language quotient (SLQ). Post-training results showed significant improvement across all quotients, with scores approaching or exceeding the normal mean at post-test.

Figure 7
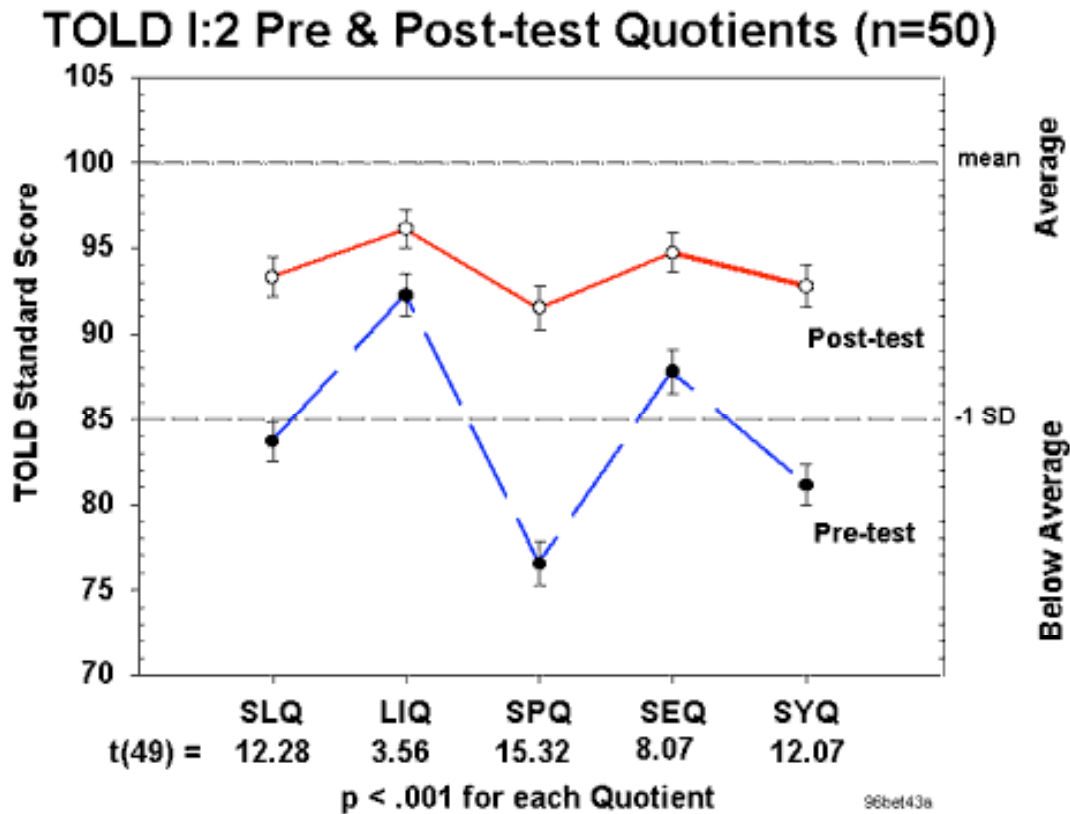**TOLD I:2 Pre- and Post-Test Quotients (n=50)**

Figure 7 shows pre- and post-test language quotients for the children assessed using the Test of Language Development (TOLD) Intermediate:2. The TOLD 1:2 allows individual listening, speaking, semantics and syntax quotients to be derived (LI0, SPQ, SEQ, SYQ, respectively) as well as a composite language quotients (SLQ). At pre-test the group of children were scoring approximately one standard deviation (SD) below the mean on the composite SLQ. Post- Fast ForWord Language training results showed significant improvement across all quotients (P<.0001) with scores approaching the normal mean at post-test.

Figure 8
TOLD I:2 and P:2 Combined Z-Scores

TOLD I:2 & P:2 Combined Z-Scores
Spoken Language Quotient (n = 129)

Pre-Test, Before Training
mean = 84.89
SD = 13.37

Post-Test, After Training
mean = 95.35
SD = 14.96

t(128) = 15.968, p <.00005
TOLD I:2 SLQ Test-retest reliability = .95
TOLD P:2 SLQ Test-retest reliability = .94

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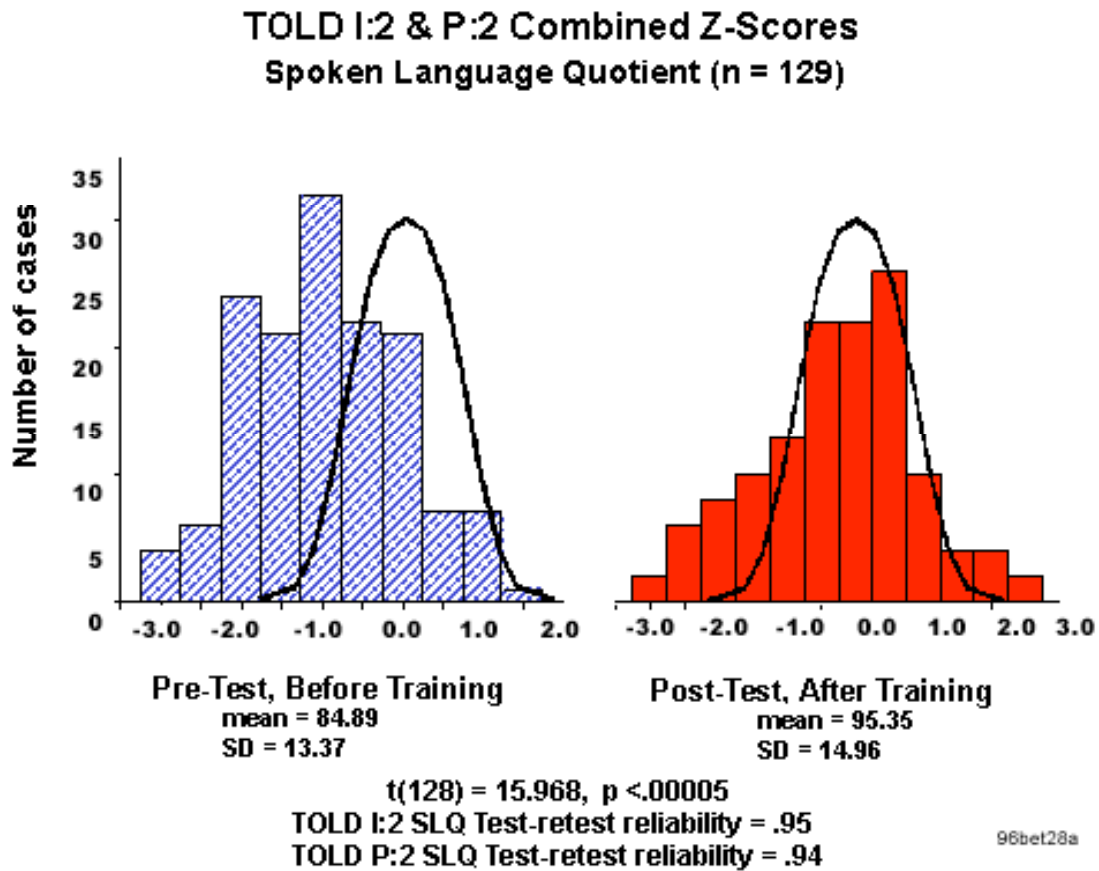Figure 8 shows pre-and post–Fast ForWord Language training for the TOLD 1:2 and P:2 combined in terms of z scores. The normal distribution for the TOLD is shown as a black bell shaped curve. The number of individual cases scoring in each z score bin are plotted before the after training. Before training 70 children (54%) scored –1 or more SD below the mean and 19 scored at or above the mean on this test. After training only 33 (26%) scored 1 or more SD below the mean while 54 (42%) scored at or above the mean.

Figure 9
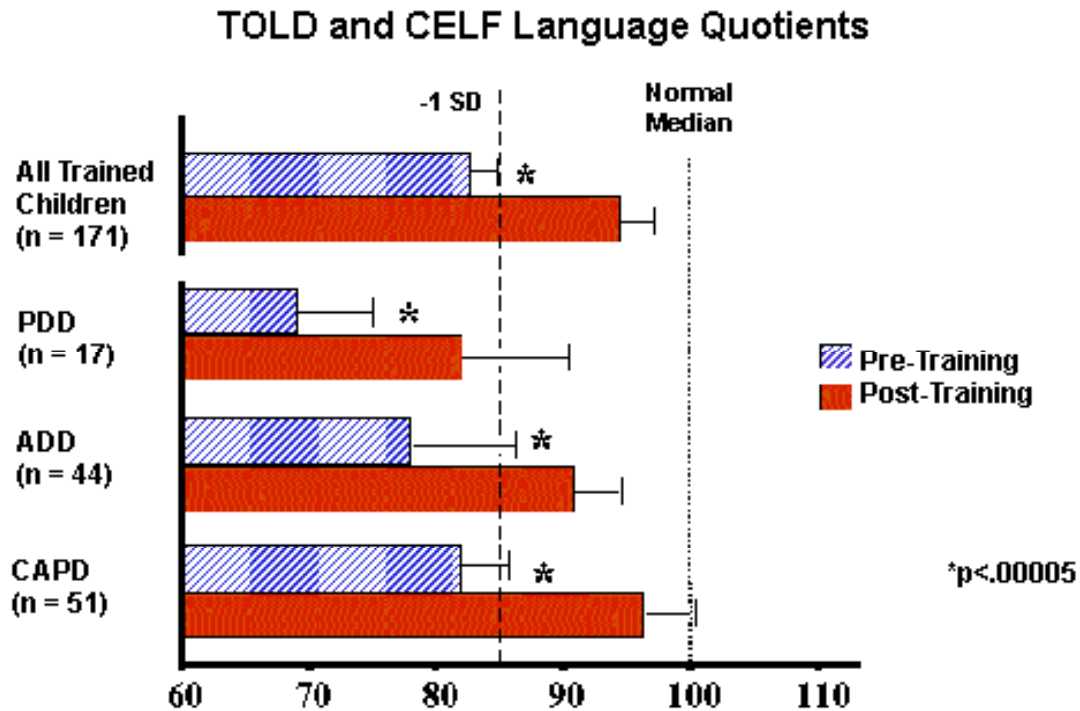**TOLD and CELF Language Quotients**

Figure 9 shows TOLD and CELF Language Quotients for all children assessed with these test batteries at pre–test as well as post–Fast ForWord Language training. Scores are shown for all children with language impairments (LI) combined; as well as for LI children diagnosed as having pervasive developmental disorder (PDD), or with co–morbid diagnoses of attention deficit disorder (ADD), or central auditory processing disorder (CAPD). Although the degree of language deficit differed at pre–test among these groups of children (with children diagnosed as PDD having the most severe language disorder and CAPD having the least severe), there were no significant differences in the magnitude of improvement across groups achieved with training. All groups were 1 or more SD below the mean at pre–test and showed significant improvement (p<.0001) from pre– to post–testing. Although the PDD group improved significantly following training, they still remained more than 1 SD below the mean following training, based on these test batteries. The children with language impairments co–morbid for ADD or CAPD entered the study with pre–test scores more than 1

SD below the mean, while their average post-test scores approached the normal median.

Figure 10
Longitudinal Follow-up of Rutgers Controlled Study

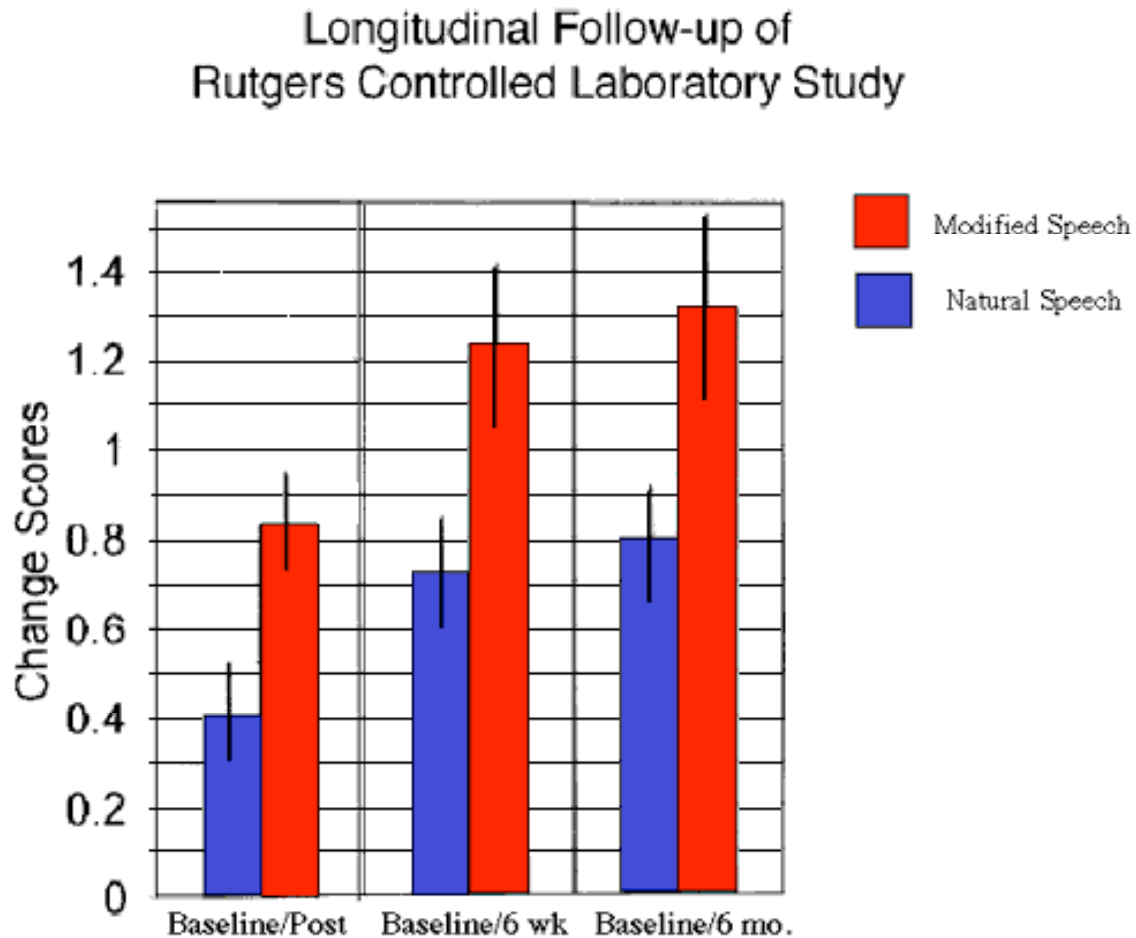Longitudinal Follow-up of
Rutgers Controlled Laboratory Study

Figure 10 shows longitudinal follow-up data of change scores from baseline: immediately after 4 weeks of training (post-test); 6 weeks after training was completed and 6 months after training. Change scores are shown for children receiving language training using modified speech and adaptive computer games compared to a matched control group of children who received the same language training, but with natural speech and non-adaptive computer games. The results immediately following training (post-test) have been published previously in Science (Tallal et al., 1996).

The modified speech group showed significantly greater improvement than the natural speech group (p < .015). Follow-up testing 6 weeks and 6 months after training show that both groups continue to improve, with the difference between the groups continuing to be significant. These results address one of the most frequently asked questions about this new training procedure–do the gains last? These results demonstrate that not only do they last, but children receiving training continue to improve even after training is completed. Furthermore, the additional significant benefit of providing the training using the modified speech and adaptive temporal training is maintained over 6 months following training. Other frequently asked questions pertaining to the effects of both test–retest reliability over short periods, as well as the effects of regression toward the mean, on the interpretation of these data can also be addressed by these longitudinal follow-up data. As groups were initially matched on degree of receptive language deficit, performance IQ and age, and both groups received the same longitudinal testing schedule, significant group differences in change scores at three different testing points demonstrate that these results cannot be attributed to these other factors.