

**Fast ForWord Language Intervention Program:
Four Case Studies**

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Abstract

Children acquire the basic sound units of language through normal development. English has 44 of the units, called phonemes, that occur in different transitions - some fast, some slow. The brain has to distinguish these transitions to discriminate between phonemes. It has been hypothesized that a language-impaired child cannot detect these rapid transitions (Tallal et al., 1993). A new training program, called Fast ForWord Language, is thought to be capable of improving the speech and language comprehension abilities of these children. This program has been implemented at the Callier Center for Communication Disorders.

Approximately 13% of all children have some form of language impairment. Some of the more common causes of developmental language impairments are hearing loss, mental retardation, neurological disorders, motor defects or Pervasive Developmental Disorder. However, 8% of all children display a significant developmental language impairment of unknown origin. Children with Specific Language Impairment (SLI) experience difficulty producing and understanding spoken language and may exhibit significant phonological analysis deficits (Tallal, 1997). For some, these deficits are accompanied by central auditory processing disorders; difficulties in auditory attention and serial memory, including abnormal "detection masking" abilities; abnormal "recognition masking" abilities; abnormal "frequency discrimination" abilities; abnormal signal segmentation and others (Merzenich, 1997). Merzenich, et al (1996) hypothesized that these abnormal processing abilities will remain with a child throughout life and that they are highly correlated with difficulties in reading and spelling.

Recent research has suggested that language impairments may be caused by "an impairment in the rate of neural information processing" (Tallal et al., 1993). In a series of experiments, Tallal and her colleagues demonstrated that children with these problems need longer neural processing time than normally developing children between brief, successive acoustic signals in order to process them (hundreds of milliseconds instead of tens of milliseconds). This slower processing rate causes the child problems when attempting to distinguish speech sounds within the tens of milliseconds window. These findings led Tallal and colleagues to posit a "temporal processing deficit" hypothesis that might arise in early childhood as a result of abnormal perceptual learning that then leads to disordered language learning (Tallal et al., 1993).

Neuroplasticity research has shown that sensory maps in the cortex of the brain can be altered with training. In 1995, while Merzenich and Jenkins were training monkeys to discriminate among subtle differences in rapid sequences of sounds and touches, they found, that as the animals' skills improved, the timing of the responses of neurons in their brains also changed. Further research showed great improvement in the recognition of brief stimuli with practice in adult humans. Thus, researchers began to question if the deficit in the temporal processing capabilities of children could also be altered with practice and training (Merzenich et al., 1996). In 1996, Merzenich and Tallal collaborated in the development of two computer-based audiovisual games with a circus theme that contained highly repetitive learning tasks. These two games were begun with stimuli that SLI children could easily recognize. This program provided each child modified speech input and altered the input based on the subject's response. Then, a computer algorithm was developed that enhanced the acoustic changes within normal speech by altering the speech by 50% and emphasizing rapidly changing speech components, such as short consonant sounds, by making them louder (which made them easier for language-impaired children to comprehend). The children worked these exercises three hours per day, five days a week, for four weeks. The results of that training indicated that this intensive, daily training resulted in meaningful gains in auditory processing rate (Barinaga, 1996).

However, not all speech and language researchers agree with the general auditory hypothesis proposed by Tallal and her colleagues. For example, Dr. Michael Studdert-Kennedy of Hoskins Laboratory proposes that the deficit is in the phonological representation. This "speech specific" hypothesis states that poor speech perception causes "underspecified" lexical and phonological representations and poor verbal short-term memory. This, in turn gives rise to deficits in syntax, listening and reading comprehension. Studdert-Kennedy believes that no experimental study has ever supported the main assumptions of the rapid auditory processing hypothesis, and it is, therefore, scientifically unsound. Similarly, Studdert-Kennedy interprets any improvement that the children in the Tallal studies exhibit to be due to the fact that slowed speech is naturally easier to perceive than normal speech because more time is allowed for the language system to form phonetic representations (Studdert-Kennedy, 1997).

In 1996, Merzenich and Tallal undertook a joint research project with Dr. William Jenkins of the University of California at San Francisco and Dr. Stephen Miller of Rutgers University and formed the Scientific Learning Corporation to develop remediation programs for SLI children. The training program was expanded to include seven computer-based exercises aimed at training temporal integration rate, attention, serial memory, phonological identification and discrimination, language processing and grammatical understanding. This program is called Fast ForWord Language and has been tested on 500 children who required language therapy in the United States and Canada.

The children trained for 1 hour and 40 minutes per day, five days a week, for an average of six to eight weeks. The results of this study agreed with the previous studies; overall, the children improved their auditory processing and speech-language skills on an average by one and one-half years based on pre-training versus post-training standardized test scores (Tallal, 1997). Headquartered in Berkeley, California, Scientific Learning Corporation has a team of over 100 professionals trained in linguistics, neuroscience, psychology, art, and animation, advanced computer technology, business and marketing.

The purpose of this paper is to present four case studies that have completed this innovative language treatment program. These individual cases were selected because they exemplify the criteria for selection, model a variety of abilities and demonstrate a range of responses experienced by participants completing the Fast ForWord Language Program.

Fast ForWord Language Intervention Program: Method

The Callier Center for Communication Disorders / University of Texas at Dallas, began utilizing the Fast ForWord Language program on November 3, 1997. Speech-language pathologists trained and certified by Scientific Learning Corporation (SLC) administer the program. Graduate student assistants are utilized as monitors while the children complete the daily computer exercises. The participants of Fast ForWord Language at the Callier Center are children diagnosed with a language-learning impairment by a certified speech-language pathologist in one of the following: receptive phonology, listening comprehension, or general language abilities. Fast ForWord Language candidates score below the normal range on standardized language test(s). Following are some common measures used to identify these children:

Goldman-Fristoe Test of Auditory Discrimination, a test that measures a child's ability to identify confusable sound parts in words in quiet and in noise.

Test of Auditory Conceptualization of Language (TACL-3), an individualized test designed to measure auditory perception and conceptualization of speech sounds.

Test of Language Development (TOLD-I:3), a comprehensive language battery that measures receptive and expressive syntax, semantics, grammar, and language-based memory.

Clinical Evaluation of Language Fundamentals: 3 (CELF-3) used to identify children K-12 who lack the basic foundations of form and content of mature language: semantics, morphology, syntax, and memory.

Test of Language Comprehension, a tool to assess auditory comprehension of word classes and relations, grammatical morphemes, and elaborated sentences.

Pre-school Language Scale –3 (PLS-3), a developmental scale which assesses auditory comprehension and expressive communication through a variety of stimulus items.

Token Test for Children, a tool designed to assess receptive language function, auditory processing and auditory comprehension in children ages 3 to 12 years.

Test of Auditory Perceptual Skills – Revised (TAPS-R), an assessment tool developed to measure a child's functioning in various areas of auditory perception.

Diagnostic Achievement Battery (DAB), a standardized individual achievement test used to assess children's abilities in listening, speaking, reading, writing and mathematics. Generally, only selected subtests are utilized to determine strengths and weaknesses and supply supplemental information.

Peabody Picture Vocabulary Test – III (PPVT III), a standardized measure of single-word comprehension.

The children in these case studies used Fast ForWord Language for one hour and forty minutes, five days a week at the Callier Center. The program was generally administered for a six to eight-week period, with a minimum required time frame of four weeks. Depending on the student's progress, extending days of play was sometimes necessary.

The Fast ForWord Language training program consists of seven individual training exercises - three sound and four word exercises. The sound exercises present auditory information in a pre-word format using different frequencies, times, deviations and phonemes. The task difficulty is modified so that the child is correct 80% of the time. The sound exercises consist of: Circus Sequence (CS), Old MacDonald's Flying Farm (OMDFF) and Phoneme Identification (PI). A brief description of each exercise excerpted from the Scientific Learning Corporation Training Manual may be found in Appendix A. The four word exercises consist of words in isolation or within sentences. The words and sentences used in these exercises have been acoustically modified to expand and enhance the rapidly changing phonetic elements within natural speech. As a child's performance improves, the degree of speech processing changes from Level 1 to Level 5, which is natural, unmodified speech. The four word exercises consist of: Phonic Word (PW), Phonic Match (PM), Block Commander (BC) and Language Comprehension Builder (LCB). A brief description of each of the word exercises from Scientific Learning Corporation may be found in Appendix B.

The exercises emphasize and dramatize sounds such as "ba" and "da" which allows the brain to grasp the subtle differences between phonemes. Instead of the natural 40

milliseconds between "b" and "ah," the computer generates "ba" with 300, 400, or even 500 milliseconds between "b" and "ah." The computer enhances difficult to hear phonemes, making them longer and louder and more salient to the child's brain. Moreover, the program targets other speech and language skills, including phonics, morphology, syntax and grammar. The order of the training exercises for each day is preset and controlled by the computer and cannot be altered (Scientific Learning Corporation, 1996).

Each child is allowed short breaks between computer exercises. This can include a small snack or trip to the restroom or water fountain. If necessary, the children are given reinforcers for completing the exercises and/or for exhibiting appropriate behavior following a standard token economy system.

After the child completes the daily exercises, the results are uploaded to SLC and downloaded back to the computer used by the child. The data can be viewed in graphic form or text material for various increments of time in order to interpret a child's daily or weekly progress. SLC recommends 90% or greater achievement on five of seven games to discontinue treatment. Once a child reaches criteria for dismissal from Fast ForWord Language, a post-evaluation is completed. During post-testing, a variety of different language and auditory tests are administered. For clinical purposes, the same tests given in the pre-evaluation are not always administered in the post-evaluation. When possible, pre- and post-test standard scores and percentile ranks are considered for comparison. Post-test results are compared to the pre-evaluation tests to determine if the children have improved. After completion of Fast ForWord Language, parents are also interviewed to determine if behavioral changes and improvements experienced in the home or school environment have occurred. After the minimum four-week treatment, if a child has not reached criteria for dismissal and is still demonstrating improvements, the child is allowed to continue playing until dismissal criteria is met.

Fast ForWord Language Intervention Program: Case Studies

Hearing acuity, articulation skills, voice quality and fluency skills were assessed for each of these case studies. These areas were within normal limits for their chronological age ranges unless otherwise specified. Only pertinent background information is noted; otherwise, medical, developmental and family backgrounds were unremarkable.

Case Study #1

Background Information

Child #1, a 6 year 3 month old Caucasian male, was the first child enrolled in the Fast ForWord Language Program at the Callier Center. He was diagnosed with a severe speech-language delay at three years of age. He participated in a small group language therapy program to enhance language facilitation. He also participated in various language intervention programs after that time and was being seen for traditional

language therapy through his school. Child #1 was referred to the Callier Center by his school's speech-language pathologist and parents as a possible candidate for Fast ForWord Language.

Pre-Testing

Child #1's pre-test results on the CELF-R yielded a Total Language Score of 73 which is almost two standard deviations below normal limits for his chronological age range. (The mean for the total language score is 100 with a standard deviation of 15.) The results for Child #1's standard scores and percentile ranks are listed below for each of the receptive and expressive subtests. (Each subtest has a standard score mean of 10 and a standard deviation of 3.)

Receptive Task	Standard Score	Percentile Rank
Linguistic Concepts	6	9
Sentence Structure	6	9
Oral Directions	6	9
Receptive Language Score	74	4
Expressive Task	Standard Score	Percentile Rank
Word Structure	11	57
Formulated Sentences	4	2
Recalling Sentences	4	2
Expressive Language Score	76	5
Total Language Score	73	4

These results suggest that Child #1 exhibited a moderate to severe receptive and expressive language disorder.

Further receptive language testing was administered with the TACL-R which yielded the following results:

Category	Percentile
Word Classes and Relations	52
Grammatical Morphemes	12
Elaborated Sentences	16
Total Test Score	11

These test scores indicate a mild auditory comprehension difficulty. Child #1 appeared to have more difficulty understanding information at the sentence level where a breakdown of metalinguistic abilities can occur.

To assess the secondary language skills (reading/writing) of Child #1, several subtests of the DAB were administered. With a mean standard score of 10 and a standard deviation of 3 on all subtests, his results are as follows:

Subtest	Standard Score	Percentile Rank
Story Comprehension	8	25
Characteristics	8	25
Synonyms	11	63
Grammatical Completion	10	50
Alphabet/Word Knowledge	14	91
Reading Comprehension	13	84

These results were within normal limits or above normal limits for Child #1's chronological age range on each subtest.

Overall, according to the pre-test evaluation, Child #1 showed a moderate to severe disorder in his receptive and expressive language abilities. Recommendations included participation in the Fast ForWord Language Treatment Program and post-testing at the completion of the program.

Fast ForWord Language Performance

Child #1 began the Fast ForWord Language exercises on November 11, and met the criteria for dismissal on December 8, 1997. He completed the three designated games on

his first day with scores of 10% on Block Commander (BC), 12% on Phonic Match (PM), and 3% on Circus Sequence (CS). During the sessions, Child #1 appeared frustrated during difficult items, sometimes banging the counter when he missed an answer. He occasionally commented, "This is too hard," but verbalized pleasure when completing the games and watching the graphics. Giving Child #1 breaks between games seemed to improve his attention during the exercises.

After 13 days of play, Child #1 showed increased scores of 97% on PI, 94% on PM, 60% on CS, 76% on BC, 68% on LCB, 58% on PW and 95% on OMFF. It was at this time that Child #1's mother reported improvements with social interactions. For example, he agreed to talk on the telephone, for the first time on his own initiative, to a family member who had called their house. He was also reportedly speaking with more cohesive, complete sentences. As the weeks continued, improvement was seen in his expressive abilities by the Fast ForWord Language monitors. He was using complete, complex, spontaneous explanations to activities during and between games, instead of asking, "What happened?" or "What was that?" On his final day of play, his scores were 96% on OMFF, 73% on BC, 95% on CS, 94% on PM, 99% on PW, 99% on PI, and 98% on LCB.

Child #1 participated in the Fast ForWord Language Program for almost five weeks. During this time, he spontaneously began demonstrating compensatory skills by repeating stimuli out loud to himself in order to retain information. His mother reported that he made telephone calls for the first time and created invitations to plan a slumber party at his house with his friends. By the last week of play, he used complete, age appropriate sentences to talk about events happening on the computer. Prior to completing Fast ForWord Language, he would generally use sentence fragments or phrases that required a listener to "fill in" missing information. These improvements were also seen by his parents outside the clinical setting.

Post-Testing

During the post-evaluation, the CELF-3 was administered. The mean for the total language score is 100 with a standard deviation of 15. Child #1's results yielded a Total Language Score of 115 which is within the high average range for children of his

chronological age range. Child #1's standard scores and percentile ranks are listed below for each of the receptive and expressive subtests.

Receptive Task	Standard Score	Percentile Rank
Sentence Structure	14	91
Concepts and Directions	10	50
Word Classes	14	91
Receptive Language Score	116	86
Expressive Task	Standard Score	Percentile Rank
Word Structure	14	91
Formulated Sentences	14	91
Recalling Sentences	10	50
Expressive Language Score	114	82
Total Language Score	115	84

These results suggest that Child #1 now exhibited normal or above average receptive and expressive language abilities when compared to other children of his chronological age range.

According to the tests given during post-evaluation, Child #1 showed significant improvement in his receptive and expressive language abilities on the CELF-3 following completion of the Fast ForWord Language Program. Previously, he was found to have a moderate to severe receptive and expressive language disorder. Child #1's parents also reported great communicative improvements at home. However, evidence of an expressive language disorder was still present at the conversational level in the areas of syntax and pragmatics. Child #1's prognosis for continued improvement of his language skills was considered good due to progress noted from previous intervention and parental involvement in his remediation programs. Recommendations were made for Child #1 to continue language therapy through his public school and to complete a language test battery at the end of the school year to document language status.

**Fast ForWord Language Intervention Program:
Case Study #2**

Background Information

Child #2 was an 11 year 11 month old Hispanic male. Immediately prior to completing Fast ForWord Language, he was enrolled in one hour of speech-language therapy on a weekly basis. During the past four and one-half months of therapy, Child #2 showed significant progress in various language areas targeted. His goals targeted comprehension of two-step commands where each command contains a modifier, the ability to label categories, the ability to utilize irregular past tense verb forms when making sentences, the ability to explain semantic absurdities and the ability to express associations between written stimuli. Even with noted progress, his current speech-language pathologist referred Child #2 for participation in the Fast ForWord Language program after consultation with his parents.

Child #2 has a significant medical history. His biological mother is suspected of abusing drugs and/or alcohol during pregnancy and neglect was reported during the first year of life. Child #2 was placed in foster care at one year of age and then adopted. He reportedly had earaches from birth to three years of age, with pressure equalization tubes placed bilaterally and adenoids removed at age two. At 20 months of age, he had surgery for a double hernia. He was diagnosed with Attention - Deficit / Hyperactivity Disorder (ADHD) at age eight and he was taking Dexedrine twice daily to help reduce hyperactive behavior and increase his concentration abilities and awareness of "social boundaries."

During Child #2's early years of elementary school, he was in special education classes. However, he has been home schooled since six years of age, because his adoptive parents felt that his needs could be better met at home and his educational programming could be more individualized by them.

Pre-testing

Child #2's initial test scores from the CELF-3 are as follows:

Receptive Task	Standard Score	Percentile Rank
Concepts and Directions	4	2
Word Classes	3	1
Semantic Relationships	3	1
Receptive Language Score	50	1
Expressive Task	Standard Score	Percentile Rank
Formulated Sentences	3	1
Recalling Sentences	3	1
Sentence Assembly	9	37
Expressive Language Score	65	1
Total Language Score	55	1

Fast ForWord Language Performance

Child #2 began the Fast ForWord Language Program approximately two months after his pre-testing. During the first week of play, Child #2 immediately made progress with high scores on all the games. After about two weeks of play, Child #2 scored 39% on OMFF, 74% on BC, 0% on CS, 72% on PM, 16% on PW, 34% on PI and 15% on LCB. He played all of the games straight through without questions, comments or breaks. Child #2 seemed to have excellent concentration and his mother commented that he was exhausted after running Fast ForWord Language each day. Throughout the next few weeks, he continued to make excellent progress with his scores seeming to dip slightly when the game levels increased.

After approximately four weeks of play, Child #2 was scoring 67% on OMFF, 71% on BC, 91% on PM, 69% on PW, and 16% on LCB. However, two games were obviously more difficult for him than the others; CS and PI were both below 10%. Once Child #2 had completed approximately five weeks, 15 more days were reinstated to see if he could increase his percentages on CS and PI. His percentages were still significantly lower on these two games. On his final day of play, Child #2 scored 100% on OMFF, 96% on BC, 94% on PM, 98% on PW, and 97% on LCB. He did eventually increase his percentages on CS and PI to above 20%.

Child #2 did not require any type of token reinforcement system. He seemed to be very self-motivated. Verbal praise and encouragement appeared to motivate him to continuing playing without tangible reinforcers.

Child #2 met the criteria for dismissal from the Fast ForWord Language Program after almost nine weeks of play. His mother reported that her son continued to have difficulty with conversational discourse throughout this time. However, the speech-language pathologist who had been treating Child #2, prior to Fast ForWord Language, reported a significant improvement in his expressive language and semantic abilities after he had completed the Fast ForWord Language Program.

Post-Testing

Child #2 was given the WORD Test-R and the CELF - 3 during the post-evaluation. The WORD Test-R revealed a dramatic improvement in Child #2's ability to give single definitions and multiple definitions of words. The results from the CELF - 3 given during the post-evaluation are as follows:

Receptive Task	Standard Score	Percentile Rank
Concepts and Directions	4	2
Word Classes	3	1
Semantic Relationships	5	5
Receptive Language Score	53	1
Expressive Task	Standard Score	Percentile Rank
Formulated Sentences	9	37
Recalling Sentences	3	1
Sentence Assembly	9	37
Expressive Language Score	82	12
Total Language Score	65	1

The test results for Child #2 did not show significant improvements in standard scores except for the Formulated Sentences subtest. However, Child #2's Total Language Score increased 10 points from the pre-evaluation and his receptive score improved by 3 points. Therefore, his expressive language score showed significant improvement.

Child #2 still exhibited language and semantic difficulties at a conversational level. It was recommended that he continue language therapy to address his conversational discourse and semantic difficulties.

**Fast ForWord Language Intervention Program:
Case Study #3**

Background Information

Child #3 was a 13 year 3 month old Caucasian male. He was identified as an appropriate candidate for the Fast ForWord Language Program at age 12 and was referred to the Callier Center prior to his thirteenth birthday. He was not currently being seen for language or speech therapy when he began the Fast ForWord Language Program. However, he was previously enrolled in speech-language therapy for six years. Child #3 completed his 6th grade year at a private school for children with special needs such as language-learning disabilities and dyslexia. During that school year, Child #3 had participated in a multi-sensory phonics based reading program, but was still demonstrating significant difficulties in reading.

Pre-Testing

Less than one year prior to beginning the Fast ForWord Language Program, Child #3 was given a speech and language evaluation by an outside agency. The CELF - 3 was administered and the results were as follows:

Receptive Task	Standard Score	Percentile Rank
Concepts and Directions	16	98
Word Classes	11	63
Semantic Relationships	10	50
Receptive Language Score	114	82
Expressive Task	Standard Score	Percentile Rank
Formulated Sentences	7	16
Recalling Sentences	10	50
Sentence Assembly	8	25
Expressive Language Score	90	25
Total Language Score	102	55

Child #3's language scores were within the average to above average range (with the exception of Formulated Sentences). However, these results indicated a 24-point difference between his receptive and expressive language. Admission tests to his private school were also administered, showing below average scores for Child #3 on PPVT III and the Goldman-Fristoe Woodcock Auditory Discrimination Test in both quiet and noise. When testing for academic skills, reading rate, oral and written spelling, handwriting and a spontaneous writing sample were below average.

Fast ForWord Language Performance

Based on these findings, Child #3 immediately began his first day by completing the three designated exercises. By the end of the first week, Child #3 scored 96% on BC, 18% on CS, 54% on PM and 42% on PI. Child #3 began complaining about coming to participate in Fast ForWord Language to his parents after the first day. Child #3 was allowed to bring snacks daily and was given one short snack break per day. A reinforcement system was implemented within the first week allowing Child #3 to pick "prizes" after completing all the games each day. Child #3 also needed frequent redirection from the monitor to stay focused on the games. Many times he would "play" with other things around him such as the computer wires, scratch papers, or food wrappers.

After two weeks of programming, Child #3 had increased his percentages to 47% on OMFF, 97% on BC, 28% on CS, 94% on PM, 36% on PW, 58% on PI, and 41% on LCB. He still needed redirection, but became interested in trying to increase his daily percentages. Child #3 met the criteria for dismissal in four weeks. On his last day, he scored 95% on OMFF, 96% on BC, 47% on CS, 95% on PM, 99% on PW, 74% on PI and 99% on LCB. Child #3 began his post-evaluation two days after completing the Fast ForWord Language Program.

Post-Testing

During post-testing, Child #3 was administered four different tests to determine his abilities in auditory processing, reading, picture vocabulary and expressive and receptive

language. The SCAN A - A Test for Auditory Processing Disorders in Adolescents and Adults, showed Child #3 to fall within normal limits on all subtests except one. The results were as follows:

Subtest	Standard Score	Percentile Rank
Filtered Words	9	37
Auditory Figure Ground	9	37
Competing Words	5	5
Competing Sentences	9	37
Total Test Standard Score	85	

Child #3's Total Test Score falls within the low average range. His results were in the average range on PPVT - III with a standard score of 104. In a comparison of Reading Admission Test Scores completed in September of 1997 to total progress for the 1997-1998 school year, a less than 1.0 percent improvement in all areas for reading were reported by his school. However, on the Woodcock Reading Mastery Test, administered during the post-testing, Child #3 placed within normal limits on all subtests. The standard scores and percentile ranks for the CELF -3 are as follows:

Subtest	Standard Score	Percentile Rank
Receptive Language Score	100	50
Expressive Language Score	106	66
Total Language Score	103	58

These results indicate that Child #3 was within normal limits for both receptive and expressive language.

According to the post-testing information, Child #3 improved in his auditory processing from below normal limits on the Goldman -Fristoe Woodcock Auditory Discrimination Test to within normal limits on the SCAN-A. Scores on the PPVT-III increased from below normal limits into the high average range. Reading skills were also found to be within normal limits during the post-testing. At this time, Child #3 was not found to have an expressive or receptive language disorder. Two recommendations were made.

First it was recommended that the parents of Child #3 pursue tutorial reading services to help their son with academic success. (At this time, the Fast ForWord Language Two program, which specifically targets reading difficulties, had not been released.) Second, Child #3's parents were to pursue an evaluation with a child psychiatrist to rule out ADHD, discuss medication and other adolescent issues.

Fast ForWord Language Intervention Program: Case Study #4

Background Information

Child #4 was a 12 year 4 month old Caucasian male. He was referred to the Callier Center, specifically for Fast ForWord Language intervention, by a private school for children with language-learning disabilities, where he had just completed the sixth grade. Child #4's mother described his difficulties as an "inability to communicate clearly with difficulty following directions." He was also reportedly diagnosed with an "attention deficit disorder (ADD)" and "auditory processing problems."

Child #4 weighed 6 pounds 12 ounces at birth and was delivered by Cesarean section. At nine weeks of age, he underwent surgery for hernia repair. As an infant and preschooler, he had five different sets of pressure equalization tubes due to chronic otitis media. At age eight, his mother reported a head injury accident where he hit his head on a diving board. However, there was no reported loss of consciousness.

Child #4's case history indicated that a problem with his speech and language was first noticed by his preschool teacher. In the past, Child #4 received traditional speech-language therapy to improve his speech and language skills. At the time of Fast ForWord Language, Child #4 was taking 10mg of Adderall once a day for ADD.

Pre-Testing

One month prior to beginning the Fast ForWord Language Program, Child #4 was given the TAPS - R by an outside agency. All subtests were within normal limits except Auditory Sentence Memory and Auditory Interpretation of Directions. The results for these two subtests are as follows:

Subtest	Standard Score	Percentile Rank
Auditory Sentence Memory	7	16
Auditory Interpretation of Directions	6	9
Sum of Scaled Scores	79	
Total Percentile		73

Rank

These results suggest that Child #4 is delayed in these two areas, falling significantly below normal limits. The CELF - R and the TOLD-2:I were also administered. The results for the CELF-R are as follows:

Receptive Task	Standard Score	Percentile Rank
Oral Directions	5	5
Word Classes	11	63
Semantic Relationships	9	37
Receptive Language Score	89	23
Expressive Task	Standard Score	Percentile Rank
Formulated Sentences	3	1
Recalling Sentences	8	25
Sentence Assembly	6	9
Expressive Language Score	72	3
Total Language Score	78	7

Child #4 showed severe to profound delays in language fundamentals. Only one area, Word Classes, was within normal limits. This test also revealed a 17 point standard score difference in his receptive and expressive language abilities with the receptive skills showing the higher score. All of the subtests on the TOLD-2:I were significantly below normal limits. The highest percentile rank achieved on the TOLD-2:I was a 25. The lowest scoring area was Word Ordering with a fifth percentile rating.

Fast ForWord Language Performance

Child #4 began the Fast ForWord Language Program approximately one month after the pre-evaluation. On the first day, he scored 16% on BC, 5% on CS and 11% on PM. After six days, Child #4 was showing remarkable gains on all the games scoring 97% on BC, 34% on CS, 53% on PM, 69% on PI, and 8% on LCB. At this time, Child #4 needed one break, usually between games three and four. His mother reported that Child #4 made comments at home about not wanting to complete the games because they were "babyish." Despite his complaints, Child #4 completed each exercise without any questions or comments to the monitor. Although he was diagnosed with ADD, Child #4 appeared to benefit from his medication. No attention-to-task problems were evident during the program.

After 11 days of programming, Child #4 continued to show progress and was increasing his scores dramatically each day. He scored 91% on OMFF, 97% on BC, 57% on CS, 95% on PM, 40% on PW, 82% on PI and 56% on LCB. On the fourteenth day of programming, Child #4 met criteria for dismissal scoring 90% or above on five of the seven games. However, Child #4 continued the program because he was still making gains on the exercises where criteria had not been met.

Child #4 and his parents were curious about the effects of his medication on his concentration abilities while completing the computer exercises. They requested that he complete the exercises on day 17 without his medication to see if there were any changes in his scores. On this day, Child #4 exhibited noticeable behavioral differences. He seemed restless, moved around in his chair and also put his head down several times. After the session, Child #4 commented that the games seemed more difficult without his medication. Only one game, PI, showed a dramatic decrease in score, dropping from 98% to 84%. Child #4 finished the program after four weeks scoring 98% on OMFF, 98% on BC, 91% on CS, 95% on PM, 98% on PW, 97% on PI, and 99% on LCB on his final day.

Post-Testing

Child #4 was given two of the subtests from the CELF-3 and the TOLD:3-I. The two subtests given during the administration of the CELF-3 were Concepts and Directions and Formulated Sentences, both of which were significantly delayed during the pre-testing. The results of those CELF-3 subtests are as follows:

Subtest	Standard Score	Percentile Rank
Concepts and Directions	10	50
Formulated Sentences	12	68

Both subtests are within normal limits. Also, the results of the TOLD:3-I revealed Child #4 to be within normal limits on all subtests except Word Ordering.

Child #4's scores on both language tests administered during the post-testing significantly improved compared to the pre-test information. Subtests that were extremely delayed during the pre-testing were now within normal limits. The parents of Child #4 also reported improvements in their child's listening skills. For example, they noticed Child #4 was now better able to pay attention, execute and retell instructions from his baseball coach. His parents also felt their child had improved in his ability to pay attention to information given verbally and to stay "tuned in" to his surroundings. The recommendations for Child #4 included continuation of traditional language therapy on a diagnostic basis to determine areas of weakness in conversational discourse and to determine if further therapy is warranted. It was also strongly recommended that a re-evaluation be completed in six months to determine continuation of age-appropriate

skills. The prognosis for Child #4's language skills was good due to progress noted from current intervention and parental concern, if recommended services were pursued.

Fast ForWord Language Intervention Program: Discussion

These case studies of children completing the Fast ForWord Language Program at the Callier Center show similar results to those obtained by the Scientific Learning Corporation with their own field experiments and clients. All four of the children demonstrated varied improvement in some area of their language difficulties after completion of the program.

Child #1 increased his CELF-3 pretest score from a 73 Total Language Score to 115 on the posttest which is a significant improvement. He also demonstrated greater communicative skills at home, but continued to exhibit syntax and pragmatic difficulties. Child #2 and Child #3 showed little improvement between their pre- and post- CELF-3 Total Language Score, but the Expressive Language Score for Child #2 exhibited marked improvement. Child #4 increased his scores on the Peabody Picture Vocabulary Test-III from below normal limits to high average. He exhibited difficulties on language tests administered during pre-testing; however, after treatment he scored within normal limits on readministered subtests. He also demonstrated the ability to pay better attention to information given verbally and stay more "tuned in" to his surroundings.

These case studies demonstrate that Fast ForWord Language does not aid each child in the same area or in the same degree. Some children exhibit great improvement after completing Fast ForWord Language, but other children show only minimal improvement. It is important to remember that the success of a child's participation is based on many factors and the selection criteria are extremely important. Fast ForWord Language is an impressive program that offers promise for children with receptive language disorders. Unfortunately, the program is expensive and not appropriate for every SLI child.

The Fast ForWord Language Program, commendably, is continually up-dated and amended by Scientific Learning Corporation when research and clinical trials indicate the need for changes. The Fast ForWord Language Program demands great commitment from everyone involved. The child must be determined to complete each day's exercises and adhere to compliance issues. Parents must be very encouraging to their children, and the professionals and monitors must be enthusiastic about the program and dedicated to seeing that the children comply with the administration protocol.

Language is an important key to academic success. Good language skills are also imperative to every day communication and socialization for all children. Therefore, every avenue must be used to seek ways to help SLI children. The goal of the Fast ForWord Language Program and the goal of professionals who utilize it is not "increased numbers" on tests, but increased language skills for children with receptive language and auditory processing disorders.

Fast ForWord Language is a new technology that must continue to be studied and tested for its long-term reliability. Efficacy studies are needed to validate the claims of the program. It must not be viewed as a "cure" or substitution for language therapy. All of the children in these cases needed to continue with some form of traditional language intervention. However, because of its past and current record of success, the Fast ForWord Language Program appears to be opening a new frontier of intervention for language therapy for children with Specific Language Impairment.

Fast ForWord Language Intervention Program: Acknowledgement and References

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Fast ForWord Language Intervention Program:
Appendix A and B

Appendix A

Circus Sequence (CS)

Circus Sequence is designed to train a child to process nonverbal sounds more quickly and accurately. Taking place inside a circus tent, the game requires the child to reproduce a two-sound sequence by clicking on two buttons, each of which corresponds to a specific sound. The duration and frequency of each sound also varies. The time interval between the two sounds shortens as the child progresses, helping the child to distinguish between two sounds that occur one after the other with increasing ability. Circus Sequence has 45 levels for each of the 18 tone pairs, and each correct response earns two points (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).

Old MacDonald's Flying Farm (OMDFF)

This game requires a child to use the computer mouse to "capture" and hold a flying animal. While holding the mouse button down, the child hears a rapid succession of isolated phonemes. When the child hears a different phoneme in the sequence, he releases the captured farm animal that then flies into a designated hiding place. OMDFF uses both time and frequency cues within the phonemes. As the child progresses, the time within and between each phoneme becomes shorter. There are 18 levels for each of the five phoneme categories, and each correct response earns four points (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).

Phoneme Identification (PI)

Phoneme Identification trains a child to distinguish single phonemes. The game takes place in an olympic stadium in which a turtle presents the child with a specific phoneme (such as /be/). The child then sees two animals side-by-side: one who says the target phoneme(/be/), and another who says a distracter phoneme (such as /de/). The child must decide which animal said the target phoneme. There are 26 levels for each of the five phoneme contrasts and each correct response earns three points. Level 26 requires the child to identify phonemes at rates of acoustic change found in normal speech (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).

Appendix B

Phonic Word (PW)

Phonic Word presents the child with two words that differ only by an initial or final consonant, and asks the child to choose the correct answer. First, the child is given the instructions to "Point to" followed by the word. The child then chooses between the two pictures (such as a "rake" or "lake"). Phonic Word contains 92 card pairs and 5 levels. A

correct response will award the child with 5 points. The speech becomes less and less modified as the child improves and reaches the higher levels (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).

Phonic Match (PM)

Phonic Match contains 4 to 16 tiles of crazy animal creatures in a grid. Each tile has a corresponding single word that the child hears when he selects that tile. The object of the game is to find the other tile in the grid that hides the same word. The two tiles will disappear when the child selects the matching sounds in successive order. Within a grid, the words will vary in initial or final consonants. If the child clears a grid quickly, the number of tiles in the next game increases, adding an auditory memory component to the game. Two points are earned for each correct response. Phonic Match consists of a large number of word sets with 5 levels across 4 categories (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).

Block Commander (BC)

Block Commander consists of familiar colored shapes on a 3-D board game that the child chooses and moves. The game asks the child to follow increasingly complex commands, forcing the child to use his listening comprehension and attention skills to answer correctly. Longer sentences and increased syntactic difficulty are presented as the child moves to higher levels within the game. Throughout the sessions, the amount of speech processing is decreased (1-5), using natural speech at the highest level (5). Block Commander has 58 different commands and 5 levels. Each correct answer giving the child 6 points (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).

Language Comprehension Builder (LCB)

Language Comprehension Builder focuses on a child's phonological, morphological, and grammatical comprehension skills. This is accomplished by presenting the child with pictures depicting actions and complex relational themes. The child earns 6 points when he matches the spoken sentences with the correct picture. There are 200 sentences and 5 levels on Language Comprehension Builder (Copyright Scientific Learning Corporation, 1996 – 1999. Used with permission.).