

Improved Auditory Processing by Students in the United Kingdom who used Fast ForWord® Products

MAPS for Learning: Educator Reports, 10(11): 1-6

ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the language skills of students with language or learning difficulties. **Study Design:** The design of this study was a case study using nationally normed assessments. **Participants:** Study participants were students receiving speech and language services from Innovative Therapies or from other Speech and Language Therapists in the United Kingdom. **Materials & Implementation:** The Fast ForWord products were offered by Innovative Therapies and by local British professionals as part of their range of speech and language services. Before and after Fast ForWord participation, students of Innovative Therapies and of local British Speech and Language Therapists had their auditory processing ability and language skills evaluated with the SCAN-C: Test for Auditory Processing Disorders in Children-Revised and/or the Clinical Evaluation of Language Fundamentals-Preschool Edition (CELF-P) or -Third Edition (CELF-3). Some students were also assessed with the Fisher's Auditory Problems Checklist. **Results:** Students showed significant improvements in the Auditory Figure Ground and Competing Sentences subtests of the SCAN-C assessment. Average gain for Competing Sentences was over one-third of a standard deviation (from the 4th percentile to the 11th); students improved over one standard deviation in the Auditory Figure Ground subtest (from the 5th percentile to the 37th). Although statistical tests were not performed due to the small number of data points, students also demonstrated substantial improvements on their language skills and on a checklist that evaluated areas of concern related to foundational language skills and the auditory system.

Keywords: UK, observational study, Fast ForWord Language, Fast ForWord Language to Reading, Fast ForWord to Reading 3, SCAN-C: Test for Auditory Processing Disorders in Children-Revised, Clinical Evaluation of Language Fundamentals-Preschool (CELF-P), -Third Edition (CELF-3), Fisher's Auditory Problems Checklist.

INTRODUCTION

Numerous research studies have shown that cognitive and oral language skills are under-developed in struggling readers, limiting their academic progress (Lyon, 1996). University-based research studies reported the development of a computer software product that focused on learning and cognitive skills, and provided an optimal learning environment for building the memory, attention, processing and sequencing skills critical for reading success (Merzenich et al., 1996; Tallal et al., 1996). This prototype of the Fast ForWord Language software showed that an optimal learning environment and focus on early reading and cognitive skills resulted in dramatic improvements in the auditory processing and language skills of school children who had specific language impairments (Merzenich et al., 1996; Tallal et al., 1996) or were experiencing academic reading failure (Miller et al., 1999).

Innovative Therapies, under the direction of Speech Language Pathologist Aditi Silverstein, offers specialized therapies aimed at improving speech, language, and listening and reading skills in children.

Ms. Silverstein was interested in evaluating the effectiveness of the Fast ForWord products as part of Innovative Therapies's range of services for students with language and learning difficulties. Under the guidance of Innovative Therapies and of local British professionals trained by Innovative Therapies, students used the Fast ForWord software as part of their therapy sessions. In this study, commercially available computer-based products (Fast ForWord Language, Fast ForWord Language to Reading, and Fast ForWord to Reading 3) were used to evaluate the effectiveness of this approach at improving the auditory processing and language skills of students.

METHODS

Participants

Founded in 1992 by Speech Language Pathologist Aditi Silverstein, Innovative Therapies, PC, provides comprehensive speech, language, auditory and reading therapies for students with language and learning disabilities. Innovative Therapies offers specialized therapies using the latest research-based technology with services available throughout the state of Virginia, the United Kingdom, and Europe.

The Fast ForWord software was implemented by Innovative Therapies and by local British professionals as part of their therapy services to students in the UK. Over 60 students with dyslexia, autism, auditory processing deficits and specific language disorder have participated in the Fast ForWord products through Innovative Therapies and British Speech and Language Therapists and showed significant improvements in speech, language and reading skills.

In the study reported here, a group of students ages 4-11 years used Fast ForWord products as part of their speech and language therapy. Students were assessed with the SCAN-C: Test for Auditory Processing Disorders in Children-Revised, the Clinical Evaluation of Language Fundamentals-Preschool Edition (CELF-P) or -Third Edition (CELF-3), and/or the Fisher's Auditory Problems Checklist. Fifteen participants were included in the study. British Speech and Language Therapists or staff at Innovative Therapies administered the assessments and reported scores for analysis.

Implementation

All professionals involved in this study were trained in current and established neuroscience findings on how phonemic awareness and the acoustic properties of speech impact rapid development of language and reading skills; the scientific background validating the efficacy of the products; methods for assessment of potential candidates for participation; the selection of appropriate measures for testing and evaluation; effective implementation techniques; approaches for using Progress Tracker reports to monitor student performance; and techniques for measuring the gains students have achieved after they have finished using Fast ForWord products.

Materials

The Fast ForWord products are computer-based products that combine an optimal learning environment with a focus on early reading and cognitive skills. The products used by Innovative Therapies, Fast ForWord Language, Fast ForWord Language to Reading, and Fast ForWord to Reading 3 include five to seven exercises designed to build skills critical for reading and learning, such as auditory processing, memory, attention, and language comprehension. While there are variations across products related to the specific skills targeted and the approaches taken, there are several critical skills developed in all of the products, as detailed in the following exercise descriptions.

Circus Sequence¹ and Trog Walkers²: Students hear a series of short, non-verbal tones. Each tone represents a different fragment of the frequency spectrum used in spoken language. Students are asked to differentiate between these tones. The exercises improve working memory, sound processing speed, and sequencing skills.

Old MacDonald's Flying Farm¹: Students hear a single syllable that is repeated several times, and then interrupted by a different syllable. Students must respond when they hear a change in the syllable. This exercise improves auditory processing, develops phoneme discrimination, and increases sustained and focused attention.

Phoneme Identification¹, Polar Cop², and Treasure in the Tomb²: Students hear a target phoneme, and then must identify the identical phoneme when it is presented later. These exercises improve auditory discrimination skills, increase sound processing speed, improve working memory, and help students identify a specific phoneme. *Polar Cop* also develops sound-letter correspondence skills. *Treasure in the Tomb* also develops grapheme recognition.

Phonic Match¹ and Bug Out²: Students choose a square on a grid and hear a sound or word. Each sound or word has a match somewhere within the grid. The goal is to find each square's match and clear the grid. The *Phonic Match* exercise develops auditory word recognition and phoneme discrimination, improves working memory, and increases sound processing speed. The *Bug Out!* exercise develops skill with sound-letter correspondences as well as working memory.

Phonic Words¹: Students see two pictures representing words that differ only by the initial or final consonant (e.g., "face" versus "vase", or "tack" versus "tag"). When students hear one of the words, they must click the picture that matches the word. This exercise increases sound processing speed, improves auditory recognition of phonemes and words, and helps students gain an understanding of word meaning.

Language Comprehension Builder¹: Students listen to a sentence that depicts action and complex relational themes. Students must match a picture representation with the sentence they just heard. This exercise develops oral language and listening comprehension,

¹ Exercise from the Fast ForWord Language product.

² Exercise from the Fast ForWord Language to Reading product.

³ Exercise from the Fast ForWord to Reading 3 product.

improves understanding of syntax and morphology, and improves rate of auditory processing.

*Block Commander*¹: In Block Commander, a three-dimensional board is filled with familiar shapes that students select and manipulate. The students are asked to follow increasingly complex commands. This exercise increases listening comprehension, improves syntax, develops working memory, improves sound processing speed, and increases the ability to follow directions.

*Start-Up Stories*²: Students follow increasingly complex commands, match pictures to sentences, and answer multiple-choice questions about stories that are presented aurally.

*Scrap Cat*³: In Scrap Cat, a series of words is visually presented and participants are asked to sort each word into the correct semantic, phonological, syntactic, or morphological category. For this exercise only, the participant can click a button to hear any word and see it defined. This exercise trains decoding, vocabulary, and word recognition skills.

*Canine Crew*³: In Canine Crew multiple words are presented together in a grid and participants are asked to find pairs that match on the basis of the current criterion. This criterion shifts from words that rhyme, to synonyms, to antonyms, to homophones, as the participant progresses. This exercise trains vocabulary, decoding, and automatic word recognition.

*Chicken Dog*³: Participants hear a word and see it partially spelled. They must complete the word by filling in the missing letter or letter group. Five options are always provided, including options that represent common visual and phonological errors. This exercise trains basic spelling patterns, letter-sound correspondences, and decoding.

*Twisted Pictures*³: Participants are presented with a variety of pictures and asked to select the sentence that most accurately describes each picture from among four alternatives. The descriptive sentences incorporate a wide range of syntactic structures. As the participant progresses, the sentences get longer and more difficult vocabulary is included. This exercise builds sentence comprehension by developing syntax, working memory, logical reasoning, and vocabulary.

*Book Monkeys*³: Participants read narrative and expository passages and answer comprehension questions about each passage. The multiple-choice questions demand that the participant use memory for

literal detail, generation of inferences, or grasp of causal relationships to select the best answer from among four alternatives. This task develops paragraph comprehension, inferential and cause-and-effect reasoning, working memory, flexible reading, and vocabulary.

*Hog Hat Zone*³: In Hog Hat Zone, short passages from classic children's literature are presented, with occasional gaps in the text where words are missing. Participants are asked to fill in each gap with the correct word from among four alternatives. The missing words are morphologically important items such as pronouns, auxiliary verbs, and words with suffixes and prefixes. This task develops paragraph comprehension, complex morphology, flexible reading, and vocabulary.

Assessments

Students' auditory processing ability and language skills were evaluated with the SCAN-C: Test for Auditory Processing Disorders in Children-Revised and/or the Clinical Evaluation of Language Fundamentals-Preschool Edition (CELF-P) or -Third Edition (CELF-3) before and after Fast ForWord participation. A few students also had data from the Fisher's Auditory Problems Checklist available.

SCAN-C: Test for Auditory Processing Disorders in Children-Revised: The SCAN-C is designed for children aged 5-11 years. It measures the perception stage of auditory processing and requires the child to repeat stimulus words or sentences. The child listens to the words from a pre-recorded tape, using headphones. Overall performance on this test is indicated by the Scan Composite Score.

The SCAN-C contains four subtests. The *Filtered Words* subtest requires the child to repeat words that are low-pass filtered and presented, one at a time, in either the right or left ear. The *Auditory Figure Ground* subtest requires the child to repeat words that are presented with background noise of speech babble, in either the right or left ear. The *Competing Words* subtest requires the child to repeat words that are presented in different ears, in rapid succession. The *Competing Sentences* subtest requires the child to repeat a sentence presented in one ear while ignoring stimuli presented to the other ear.

Clinical Evaluation of Language Fundamentals (CELF): The CELF is a comprehensive language test widely used to measure a student's ability to understand words and sentences, follow directions, recall and formulate sentences, and understand relationships between words and categories. Performance on this test can be reported in terms of two subtest scores or composite scores: the *Receptive Language Score*, and the *Expressive Language Score*. An overall score, the *Total Language Score*, can also be reported.

Fisher's Auditory Problems Checklist: This checklist includes 25 items designed to measure whether a student requires evaluation for an auditory processing disorder. Items are checked if it is observed in the student. The student's score is the percentage of unchecked items, with a higher percentage indicating less need for further evaluation. The cut-off for further evaluation is 72%.

Analysis

Scores were reported in terms of standard scores and percentiles for the SCAN-C and CELF assessments. Since the SCAN-C and CELF are both age-normed, improvements due to typical maturation are accounted for. Scores for the Fisher’s were reported in terms of percentages. Fifteen students had pre- and post-Fast ForWord data from at least one of the three assessments reported for analysis. Standard scores are normed and therefore the most appropriate for statistical analyses. Average scores were converted into percentiles for descriptive purposes. SCAN-C standard scores were analyzed using a repeated measures multivariate analysis of variance (MANOVA) and paired t-tests. All analyses used a p-value of less than 0.05 as the criterion for identifying statistical significance. The CELF and Fisher’s assessments had fewer than ten pre- and post-test scores available; no statistical analyses were performed and results are presented for descriptive purposes only.

RESULTS

Participation Level

Research conducted by Scientific Learning shows a relationship between product use and the benefits of the product. Product use is composed of content completed, days of use, and adherence to the chosen protocol (participation level). All students in this study used the products for 90 or 100 minutes a day, five days per week. All study participants began participation with the Fast ForWord Language product and a few continued use with the Fast ForWord Language to Reading or Fast ForWord to Reading 3 products. Detailed product use is shown in Table 1.

Figures 1 and 2 show the average daily progress through the Fast ForWord Language and Fast ForWord Language to Reading product exercises for students who had scores available for analysis. The final day shown is determined by the maximum number of days that at least two-thirds of the students participated. For students who used the product fewer than the number of days shown, percent complete is maintained at the level achieved on their final day of product use.

	Number of Students	Days Participated	Number of Calendar Days	Percent Complete	Participation Level
Fast ForWord Language	15	39	66	80%	67%
Fast ForWord Language to Reading	5	48	87	80%	50%
Fast ForWord to Reading 3	1	-	-	-	-

Table 1. Usage data showing the number of students who used each Fast ForWord product, along with group averages for the number of days participated, the number of calendar days between start and finish, the percentage of product completed, and the participation level. Due to the low number of students who participated in the Fast ForWord to Reading 3 product, usage data for this product is not shown.

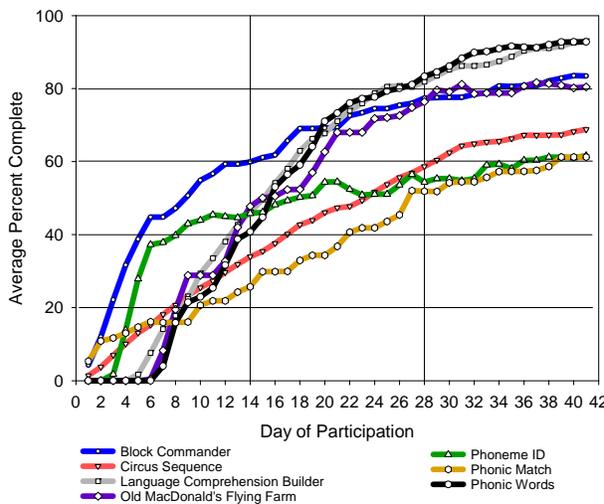


Figure 1. Average daily progress through the Fast ForWord Language product exercises. Results from 15 students are shown.

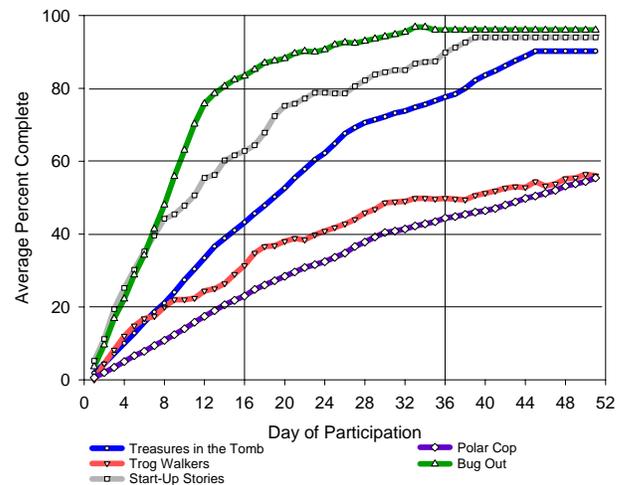


Figure 2. Average daily progress through the Fast ForWord Language to Reading product exercises. Results from 5 students are shown.

Assessment Results

SCAN-C: Test for Auditory Processing Disorders in Children-Revised: Twelve students had SCAN-C scores available for analysis. A MANOVA of the four subtests showed a significant time, test, and time by test effect following use of the Fast ForWord products, indicating that improvements differed between

subtests (Table 2). T-tests revealed significant improvements in the Auditory Figure Ground and the Competing Sentences subtests, with the former subtest showing gains of over one standard deviation and the latter improving by more than one-third of a standard deviation (Figure 3).

	n	Before		After		t-statistic	MANOVA f		
		Mean	SE	Mean	SE		test	time	test x time
Filtered Words	12	7.42	0.66	8.75	0.64	1.77			
Auditory Figure Ground	12	5.17	0.50	9.08	0.43	6.43*			
Competing Words	12	5.67	0.49	6.67	0.43	2.09			
Competing Sentences	12	5.00	0.70	6.33	0.56	3.75*			
							6.20*	39.34*	9.58*

Table 2. After Fast ForWord use, students, on average, improved in measures of their auditory processing skills. *p<0.05.

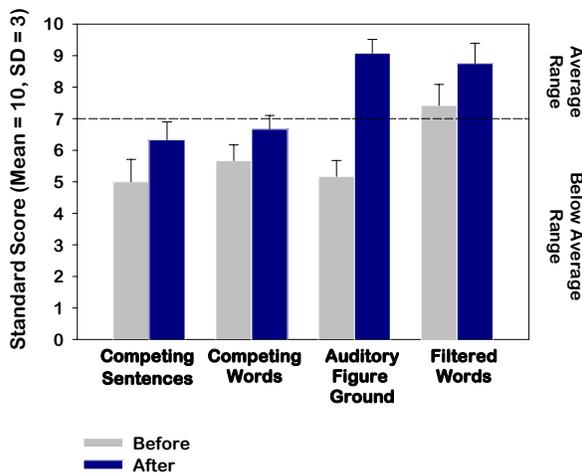


Figure 3. On average, students who used Fast ForWord products had significant gains in the Competing Sentences and Auditory Figure Ground subtests of the SCAN-C. Results from 12 students are shown.

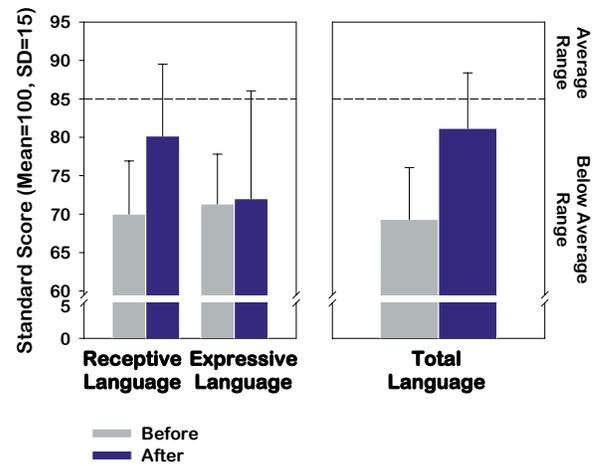


Figure 4. Students, overall, improved in language ability following Fast ForWord product use. Results from 6 students are shown.

Clinical Evaluation of Language Fundamentals

(CELF): Six students had Receptive, Expressive, and Total Language scores from before and after Fast ForWord participation. Because of this small sample size, no statistical analyses were performed. However, for descriptive purposes, Figure 4 shows the gains made by students after Fast ForWord participation. On average, students improved over two-thirds of a standard deviation in overall language ability.

Fisher’s Auditory Problems Checklist: Pre- and post-test scores were available for seven students. As with the CELF scores, no statistical analyses were performed because of the small sample size. Figure 5

shows the percentages of items on the Fisher’s Auditory Problems Checklist that parents listed as not being a concern before and after their child used Fast ForWord products. At pre-test, before product use, all students had a percentage that suggested a need for further evaluation for an auditory disorder. After Fast ForWord participation, the number of items that were of concern decreased such that 40% of the students passed the cut-off and were no longer directed towards further evaluation. The cut-off score for requiring evaluation is 72% and a score of 68% is one standard deviation below the mean; therefore, more than 16% of students are being flagged.

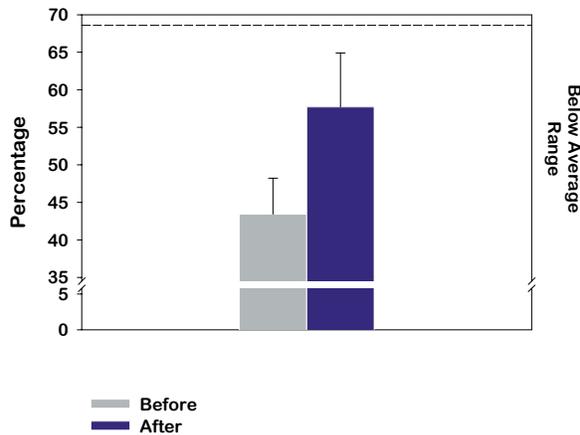


Figure 5. On average, parents reported fewer concerns with their child's auditory abilities following Fast ForWord use. Results from 7 students are shown.

DISCUSSION

Students receiving speech and language services at Innovative Therapies had significant improvements in their auditory processing skills after using Fast ForWord products, with gains greater than one standard deviation. The Auditory Figure Ground gains correspond to improving from the 5th percentile to the 37th percentile while the Competing Sentences subtest corresponds to improvements from the 4th percentile to the 11th percentile. Students also showed improvements in overall language ability and more students were above the cut-off for needing further evaluation for auditory disorders after Fast ForWord participation. These findings demonstrate that an optimal learning environment coupled with a focus on cognitive and early reading skills can help students attain a higher level of reading and language achievement.

CONCLUSION

Language and reading skills are critical for all students, impacting their ability to benefit from instruction, follow directions and participate in class discussions. Strong linguistic skills also provide a critical foundation for building reading and writing skills. After Fast ForWord use, students of Innovative

Therapies and of local Speech and Language Therapists made significant gains in their auditory processing skills, and improved their overall language ability. These results support improvements seen in other studies, and extend the results to a group of students who use British English, demonstrating that the Fast ForWord products strengthen students' foundational skills, allowing them to benefit more from the classroom curriculum, and that accent variation is not a critical component.

Notes:

To cite this report: Scientific Learning Corporation. (2006). Improved Auditory Processing by Students in the United Kingdom who used Fast ForWord® Products, MAPS for Learning: Educator Reports, 10(11): 1-6.

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