Improved Language Skills by Students in Bermuda who used Fast ForWord® Products through BerCon Ltd.

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ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the language and reading skills of students with language or learning difficulties in Bermuda. **Study Design:** The design of this study was a case study using nationally normed assessments. **Participants:** Study participants were age 8-16 years, and used Fast ForWord products at schools and educational centers they attended at various locations in Bermuda. **Materials & Implementation:** The Fast ForWord products were implemented at schools and educational centers in Bermuda by BerCon Ltd. Following staff training on the Fast ForWord program, students at several locations throughout Bermuda used one or more of the Fast ForWord products from during the 2006-2007 and the 2007- 2008 school years. Before and after Fast ForWord participation, student language ability was evaluated with the Clinical Evaluation of Language Fundamentals-Third Edition (CELF-3). **Results:** After Fast ForWord product use, students significantly improved their early reading skills, with an average improvement from the 13th to the 33rd percentile in expressive language ability and the 27th to the 38th percentile in receptive language ability

Keywords: Bermuda, observational study, Fast ForWord Language, Fast ForWord Literacy, Fast ForWord Literacy Advanced, Fast ForWord Reading Level 2, Clinical Evaluation of Language Fundamentals-Third Edition (CELF-3).

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).

BerCon Ltd., a leading educational consulting firm in Bermuda, was interested in evaluating the effectiveness of the Fast ForWord products on the language skills of students in Bermuda with language and learning difficulties. In this study, commercially available computer-based products (Fast ForWord Language, Fast ForWord Literacy, Fast ForWord

Literacy Advanced, and Fast ForWord Reading Level 2) were used to evaluate the effectiveness of this approach at improving the language and reading skills of students.

METHODS

Participants

BerCon Ltd. is dedicated to providing individualized educational services to struggling students in Bermuda. They value the role of neurodevelopmental research in providing an innovative and effective approach to helping students fulfill their potential.

BerCon Ltd. provided the Fast ForWord products to schools and educational centers throughout Bermuda. Sixteen participants were included in this study. At the start of product use, participants were eight through sixteen years of age (mean of 11.8). They used the Fast ForWord products at their respective schools and afterschool educational centers. All sixteen participants included in this report had pre- and post-Fast ForWord scores from the Clinical Evaluation of Language Fundamentals Third Edition (CELF-3) assessment.

Implementation
The staff at each location 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 BerCon Ltd. (Fast ForWord Language, Fast ForWord Literacy, Fast ForWord Literacy Advanced, and Fast ForWord Reading Level 2) 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 Sequence[1]/Space Racer[2] and Sky Rider[3]: 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 McDonald's Flying Farm[1] and Galaxy Goal[2]: Students hear a single syllable that is repeated several times, and then interrupted by a different syllable. Students must respond when they hear the change in the syllable. This exercise improves auditory processing, develops phoneme discrimination, and increases sustained and focused attention.

Phoneme Identification[1]/Spin Master[2], Meteor Ball[3], and Lunar Leap[3]: 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. *Meteor Ball* also develops sound-letter correspondence skills. *Lunar Leap* also develops grapheme recognition.

Phonic Match[1]/Lunar Tunes[2] and Laser Match[3]: 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 *Laser Match* exercise develops skill with sound-letter correspondences as well as working memory.

Phonic Word[1] and Star Pics[2]: 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.

Stellar Stories[1] and Galaxy Theater[3]: Students listen to stories, then answer multiple-choice questions about them, match pictures to sentences, and follow commands of increasing complexity. As participants integrate information across the sentences of a paragraph, and across the paragraphs of a story, they build listening comprehension skills. These exercises simultaneously develop basic language skills such as auditory word recognition, auditory memory, and basic vocabulary, along with more complex language skills such as attending to word and sentence structure. These exercises provide a comprehensive "cross-training" of oral language skills, to create a solid foundation for reading.

Bear Bags: More Lunch[4]: In this exercise, the participant is asked to help Mama Bear sort words (on pieces of toast) into phoneme-based categories (in lunch bags). It develops phonemic awareness and decoding of single-syllable words. It also develops grapheme/phoneme associations.

Magic Bird[4]: This exercise combines spelling and word-building practice with spelling patterns and word families commonly studied in 2nd grade. The task is designed to emphasize the relationships between

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[1] Exercise from the Fast ForWord Language product.
[2] Exercise from the Fast ForWord Literacy product.
[3] Exercise from the Fast ForWord Literacy Advanced product.

[4] Exercise from the Fast ForWord Reading Level 2 product.

words by showing how one word can be turned into another by simply changing a single letter in any position. Using a click and drag interface, the participant must either select the missing letter to complete a partially spelled word or rearrange scrambled letter tiles to spell a word. This exercise develops spelling and sensitivity to letter-sound correspondences.

Fish Frenzy[4]: In this exercise, a fishing pelican pronounces a word. Then a series of spoken and/or written words (on fish) fly across the pond and the participant clicks on the word when it matches the pronounced word. This exercise develops decoding skills, identification of sight words, and auditory memory.

Leaping Lizards[4]: This exercise uses the "cloze task," in which a written and aurally presented sentence has a word missing. The participant must select the correct word to complete the sentence from four choices. Vocabulary skills and sentence comprehension are developed in this exercise.

Dog Bone[4]: In this exercise, the participant listens to a passage and answers comprehension questions relating to each passage. The questions are aurally presented and written, and the response choices are presented as pictures. Responses are presented as words or short phrases. This exercise develops listening comprehension and working memory skills as measured by performance on multiple choice questions.

Ant Antics[4]: The participant will be presented with a picture and then asked to pick one of the four alternatives that best describes an aspect of that picture. This exercise improves vocabulary skills and sentence comprehension.

Assessments
Before and after Fast ForWord participation, students were evaluated with the Clinical Evaluation of Language Fundamentals-Third Edition (CELF-3).

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. The Institute for the Development of Educational Achievement, in accordance with the Reading First legislation, determined that the CELF subtests listed in Table 1 are appropriate outcome assessments for accurately measuring improvement in the vocabulary skills of children in early elementary school. As defined by the Reading First legislation, vocabulary skills are an essential component of early reading.

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.

CELF Subtest	Description of Subtest
Concepts and Directions	a receptive language assessment that tests the student's ability to interpret and execute commands of increasing complexity
Recalling Sentences	an expressive language assessment that tests the student's ability to remember and reproduce sentences of increasing length and difficulty
Word Classes	a receptive language assessment that tests the student's ability to understand relationships between words and categories
Formulated Sentences	an expressive language assessment that tests the student's ability to formulate a sentence using a specific word or related to a specific picture

Table 1. Receptive and Expressive Language subtests from the CELF are recognized by the Institute for the Development of Educational Achievement as appropriate assessments for measuring early reading skills, specifically vocabulary.

Analysis
Scores were reported in terms of standard scores and/or percentiles. The scores were converted to normal curve equivalents (NCE's) for the analysis. Sixteen students had scores from before and after participation available for analysis. The sixteen available scores were analyzed using repeated measures multivariate analysis of variance (MANOVA). All analyses used a p-value of less than 0.05 as the criterion for identifying statistical significance.

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). Students used the products in 30-, 48- and 50- minute sessions, five days per week. All study participants began participation with either the Fast ForWord Language product or the Fast ForWord Literacy product, and followed up with the Fast ForWord Literacy Advanced or Fast ForWord Reading Level 2 products. On average, students participated for a total of 50 days over the course of approximately 6 months. In addition to the products mentioned above which are the focus of this report, the following products were also used by one or two students: Fast ForWord Language to Reading, Fast ForWord Middle & High School, and Fast ForWord Reading Level 3. Detailed product use is shown in Table 2.

	Number of Students	Days Participated	Calendar Days	Percent Complete	Participation	Attendance
Fast ForWord Language	7	31.3	58.7	79.9%	99.1%	83.9%
Fast ForWord Literacy	8	34.9	173.8	77.0%	84.0%	52.0%
Fast ForWord Literacy Advanced	4	16.5	150.8	15.0%	67.8%	38.8%
Fast ForWord Reading Level 2	7	17.9	45.0	35.4%	74.7%	61.1%
Total	16	50.2	162.4			

Table 2. Usage data showing the number of students who used each Fast ForWord product, along with group averages for the number of days participated, and the percentage of product completed. Due to the low number of students who participated in the Fast ForWord Language to Reading, Fast ForWord Middle & High School and Fast ForWord Reading Level 3 products, usage data for these products are not shown. Note: Many students used multiple products.
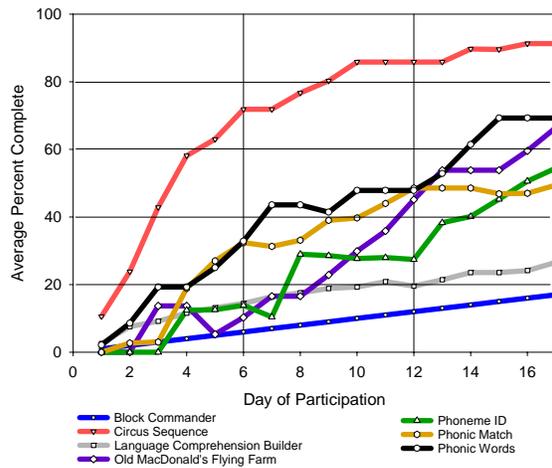

Figure 1. Average daily progress through the Fast ForWord Language product exercises. Results from 7 students are shown.
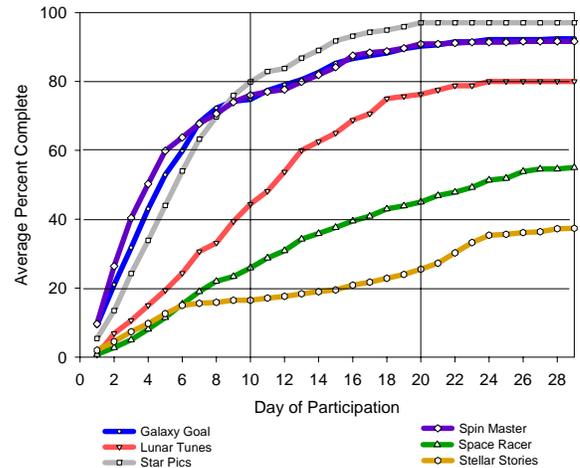

Figure 2. Average daily progress through the Fast ForWord Literacy product exercises. Results from 8 students are shown.

Figures 1 and 2 show the average daily progress through the Fast ForWord Language and Fast ForWord Literacy 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.

Assessment Results
Clinical Evaluation of Language Fundamentals- Third Edition (CELF-3): All 16 students included in this study had Receptive and Expressive Language scores from before and after product use available for analysis. A MANOVA of the two tests showed significant time, test, and time by test effects following use of the Fast ForWord products, indicating that improvements differed between tests (Table 3) and that individual analyses on the Receptive and Expressive composites were appropriate. T-tests revealed significant improvements

on both the Expressive and Receptive Language scores of the CELF-3 assessment, with the former Expressive Language scores showing gains of more than two-thirds of a standard deviation and the latter improving by more than one-fourth of a standard deviation (Figure 3).

On average, student expressive language ability was in the below average range before Fast ForWord use and improved well into the average range after use of Fast ForWord products. Student receptive language skills were in the low average and moved higher into the average range following Fast ForWord product use. Students, on average, improved their expressive language skills by 6.6 points in score and their receptive language skills by 14 points in score after Fast ForWord use (Table 3). This corresponds to movement from the 13th to the 33rd percentile for expressive language skills and from the 27th to the 38th percentile for receptive language ability, as measured by the CELF-3 assessment.

	n	Before		After		t-statistic	MANOVA f		
		Mean	SE	Mean	SE		test	time	test x time
Receptive	16	37.1	5.51	43.7	5.69	3.13*			
Expressive	16	26.8	5.46	40.9	5.99	4.97*			
							10.4*	31.4*	4.80*

*Table 3. After Fast ForWord use, students, on average, improved in measures of their receptive and expressive language skills. *p<0.05.*
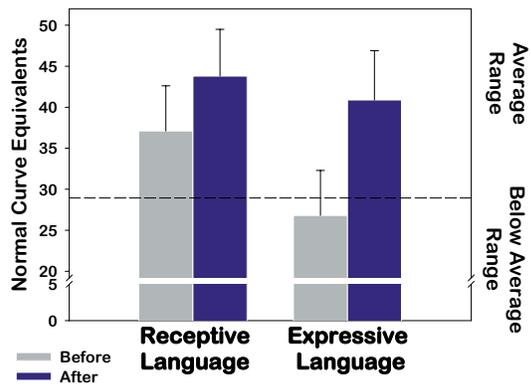

Figure 3. Students, overall, made significant improvements in total language ability following Fast ForWord product use. Results from 16 students are shown.

DISCUSSION

A group of 16 students receiving services from BerCon Ltd. in Bermuda used Fast ForWord products and participated in the study reported here. Despite the language and reading challenges the students had faced in the past, on average, they made significant gains in their early reading skills after Fast ForWord product use. These findings demonstrate that, in Bermuda, an optimal learning environment coupled with a focus on cognitive and language skills can help students attain a higher level of achievement in their language and early reading skills.

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 in Bermuda made significant gains in their language skills with the group moving from the 13th to the 33rd percentile in expressive language ability and the 27th to the 38th percentile in receptive language ability. This study supports other studies demonstrating that using the Fast ForWord products strengthens students' foundational skills, allowing them to benefit more from classroom curriculum.

Notes:
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