Improved Reading Skills by Students in the Cattaraugus-Allegany-Erie-Wyoming BOCES who used Fast ForWord® Products 2006-2007

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ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the reading skills of elementary, middle, and high school students with various disabilities who used the products within the curriculum in a school setting. **Study Design:** The design of this study was a multiple school case study using nationally normed assessments. **Participants:** Study participants were elementary, middle, and high school students who were receiving services for special education and attending schools in the Cattaraugus-Allegany-Erie-Wyoming BOCES (CABOCES) organization. **Materials & Implementation:** Following staff training on the Fast ForWord products, a group of students used the products during the 2006-2007 school year. Reading abilities were assessed with the Woodcock Reading Mastery Tests (WRMT) before and after Fast ForWord participation. **Results:** Student reading ability improved significantly following Fast ForWord participation, overall. Total Reading improved by 7 months and students, on average, improved more than 2 ½ years on the WRMT subtests.

Keywords: New York, elementary, middle, high school, rural, observational study, special education, Fast ForWord Language Basics, Fast ForWord Language, Fast ForWord Middle & High School, Fast ForWord Language to Reading, Fast ForWord to Reading 1, Fast ForWord to Reading 2, Fast ForWord to Reading 3, Woodcock Reading Mastery Tests (WRMT).

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).

The Cattaraugus-Allegany-Erie-Wyoming BOCES was interested in evaluating the effectiveness of an optimal learning environment with a focus on early reading and cognitive skills as a way to improve the reading achievement of students in a school setting. In this study, commercially available computer-based products (Fast ForWord Language Basics, Fast ForWord Language, Fast ForWord Middle & High School, ForWord Language to Reading, Fast ForWord to Reading 1, Fast ForWord to Reading 2, and Fast ForWord to Reading 3) were used to evaluate the effectiveness of this approach for improving the reading achievement of elementary, middle, and high school students.

METHODS

Participants

Covering Cattaraugus, Allegany, Erie, and Wyoming counties in southwestern New York State, CABOCES assists school districts in these areas to meet the educational needs of their students. The districts vary in size from rural to small city districts and in student population from a few hundred to thousands. In 2003, combined public school enrollment in the districts was approximately 21,600 students.

During the 2006-2007 school year, 37 students receiving special education services through the CABOCES organization took part in the study reported here. Study participants were in kindergarten through eleventh grade and had an average grade of

4.8 and had various levels of learning disabilities including moderate cognitive delays.

Before and after Fast ForWord participation student reading ability was assessed with the Woodcock Reading Mastery Tests (WRMT). School personnel administered the assessments and reported scores for analysis.

Implementation
Educators 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 the Cattaraugus-Allegany-Erie-Wyoming BOCES, Fast ForWord Language Basics, Fast ForWord Language, Fast ForWord Middle & High School, ForWord Language to Reading, Fast ForWord to Reading 1, Fast ForWord to Reading 2, 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 and reading comprehension. While there are differences between these products, all help develop certain critical skills as detailed in the following exercise descriptions.

Inside the Tummy[1]*:* Participants click and drag colored shapes into matching shape outlines in pre-defined patterns. This task helps participants improve fine motor skills, hand-eye coordination, and computer mousing skills.

Flying Saucer[1]*:* Participants identify sounds presented in a sequence, then click on graphic icons associated with those sounds to reproduce the sequence. This task builds auditory discrimination ability, auditory working memory, and sequencing skills.

Drag Racer[1]*:* Participants point and click on a (sometimes moving) graphic, then hold the mouse button down to hear a stream of identical sounds. Participants release the mouse button when there is a sound change. This task is designed to improve auditory discrimination and sustained auditory attention. It also develops mousing skills, and the ability to withhold a response until an auditory cue is presented.

Circus Sequence[2]*, Sweeps*[3]*, and Trog Walkers*[4]*:* 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 Farm[2] *and Streams*[3]*:* 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 Identification[2]*, IDs*[3]*, Polar Cop*[4]*, and Treasure in the Tomb*[4]*:* 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 Match[2]*, Matches*[3]*, and Bug Out*[4]*:* 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 Words[2] *and Cards*[3]*:* 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,

[1] Exercise from the Fast ForWord Language Basics product.

[2] Exercise from the Fast ForWord Language product.
[3] Exercise from the Fast ForWord Middle & High School product.
[4] Exercise from the Fast ForWord Language to Reading product.

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 Builder[2]*:* 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, improves understanding of syntax and morphology, and improves rate of auditory processing.

Block Commander[2]*:* 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.

Stories[3] *and Start-Up Stories*[4]: Students follow increasingly complex commands, match pictures to sentences, and answer multiple-choice questions about stories that are presented aurally.

Bear Bags[5] *and Bear Bags: More Lunch*[6]*:* In these exercises, the participant is asked to help Mama Bear sort words (on pieces of toast) into phoneme-based categories (in lunch bags). They develop phonemic awareness and decoding of single- syllable words. Bear Bags also develops understanding of alphabetic principles (phonics) and Bear Bags: More Lunch also develops grapheme/phoneme associations.

Magic Rabbit[5] *and Magic Bird*[6]*:* These exercises combine spelling and word-building practice with spelling patterns and word families commonly studied in 1st grade for *Magic Rabbit* and in 2nd grade for *Magic Bird*. The task is designed to emphasize the relationships between 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. These exercises develop spelling and sensitivity to letter-sound correspondences.

Flying Fish[5] *and Fish Frenzy*[6]*:* In these exercises, 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. These exercises develop decoding skills, identification of sight words, and auditory memory.

Quail Mail[5]*:* In Quail Mail, a squirrel mail carrier pulls words out of a mailbag and the participant sorts them into different categories by clicking on the appropriate mailbox. This exercise encourages flexibility during reading and automatic access to the various dimensions of vocabulary.

Bedtime Beasties[5] *and Leaping Lizards*[6]*:* These exercises use 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 these exercises.

Buzz Fly[5] *and Dog Bone*[6]*:* In these exercises, 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 in *Dog Bone*. These exercises develop listening comprehension and working memory skills as measured by performance on multiple choice questions.

Ant Antics[6]*:* 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.

Scrap Cat[7]*:* 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[7]*:* 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.

[5] Exercise from Fast ForWord to Reading 1 product.
[6] Exercise from Fast ForWord to Reading 2 product.
[7] Exercise from Fast ForWord to Reading 3 product.

Chicken Dog[7]*:* 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[7]*:* 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[7]*:* 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[7]*:* 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

Before and after Fast ForWord participation, student reading skills were assessed with the Woodcock Reading Mastery Tests (WRMT).

Woodcock Reading Mastery Tests (WRMT): The WRMT is a comprehensive battery of tests measuring several important aspects of reading ability. It assesses three major underlying areas of reading including reading readiness, basic skills and comprehension.

Four subtests and the Total Reading composite were used in this study. The subtests were Visual-Auditory Learning, Word Identification, Word Attack, and Passage Comprehension. The Total Reading composite is a measure of overall reading ability and consists of the Word Identification and Passage Comprehension.

Analysis

Scores were reported in terms of grade equivalents which were analyzed using paired t-tests. 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 and attendance levels). During the 2006-2007 school year, the Cattaraugus-Allegany-Erie-Wyoming BOCES chose to use the 30- and 50-Minute protocols for the Fast ForWord products. This protocol called for students to use the product for 30 or 50 minutes a day, five days per week for three to ten weeks. Detailed product use is shown in Table 1.

Figure 1 shows the average daily progress through the Fast ForWord Language product exercises. This graph represents the learning curve of the students as they progress through the product. The other products used in this study, Fast ForWord Language Basics, Fast ForWord Middle & High School, ForWord Language to Reading, Fast ForWord to Reading 1, Fast ForWord to Reading 2, and Fast ForWord to Reading 3, have similar learning curves. 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 products 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	Attendance Level
Fast ForWord Language Basics	12	8	25	97%	99%	68%
Fast ForWord Language	25	38	108	58%	96%	58%
Fast ForWord Middle & High School	6	30	65	47%	82%	66%
Fast ForWord Language to Reading	15	53	114	64%	97%	73%
Fast ForWord to Reading 1	11	18	42	91%	90%	83%
Fast ForWord to Reading 2	10	30	74	75%	90%	75%
Fast ForWord to Reading 3	8	40	124	53%	88%	71%
Total	37	77	203	-	-	-

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, the participation level, and the attendance level. Total values reflect the average total number of days that students used products. Note: Students often use multiple products.

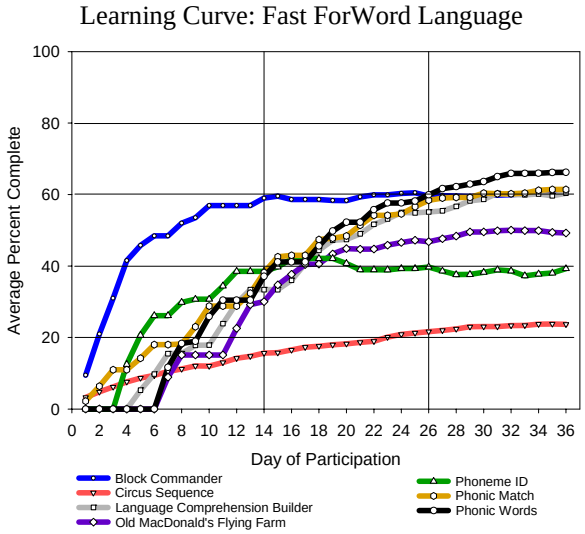

Figure 1. Average daily progress through the Fast ForWord Language product exercises. Results from 25 students are shown.

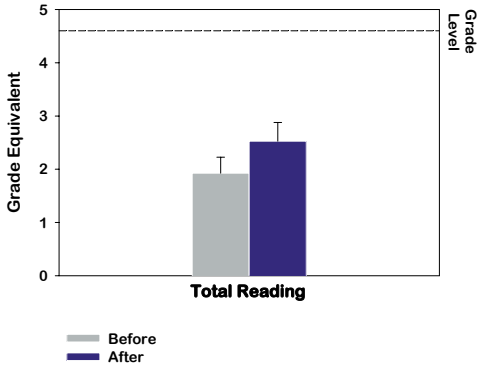

Figure 2. On average, students who used Fast ForWord products significantly improved in Total Reading by 7 months. Results from 35 students are shown.

Assessment Results

Woodcock Reading Mastery Tests (WRMT): Study participants had scores from the Total Reading composite and/or at least one of the following subtests: Visual-Auditory Learning, Word Identification, Word Attack, and Passage Comprehension. Thirty-five students had Total Reading grade equivalents from before and after Fast ForWord participation available for analysis. Before Fast ForWord use, the group of 35 students, who had an average grade level of 4.6, was reading at a 1.9 grade level. After using the Fast ForWord products, students, on average, improved 7 months in Total Reading (Table 3, Figure 2).

	n	Before		After		t-statistic
		Mean	SE	Mean	SE	
Total Reading	35	1.92	0.30	2.52	0.35	6.05*

*Table 3. Following Fast ForWord participation, students overall made significant gains in total reading skills. *p<0.05.*

A multiple analysis of variance (MANOVA) indicated that there was a main effect of time and test, as well as a test by time interaction ($F = 7.093$; $p < 0.005$). Therefore, paired t-tests were used to analyze the results from each subtest. The t-tests indicated that, on average, students also made significant gains on all four of the WRMT subtests (Table 4). Average improvement ranged from 5 months (Word Identification) to more than 2 ½ years (Visual-Auditory Learning).

	n	Before		After		t-statistic
		Mean	SE	Mean	SE	
Word Identification	32	2.00	0.28	2.43	0.35	4.07*
Word Attack	29	1.79	0.47	2.62	0.63	2.97*
Passage Comprehension	33	1.64	0.35	2.24	0.35	4.17*
Visual-Auditory Learning	20	1.51	0.49	4.38	1.0	3.21*

*Table 4. Overall, students showed significant gain in reading ability after Fast ForWord participation. *p<0.05.*

DISCUSSION

During the 2006-2007 school year, students in the Cattaraugus-Allegany-Erie-Wyoming BOCES who used the Fast ForWord products and had their reading skills evaluated with the Woodcock Reading Mastery Tests made significant improvements in reading ability. On average, students gained 7 months in Total Reading, and made as much as 2 ½ years improvement on the WRMT subtests. Overall these students' skills had only reached a high first grade reading level despite the students' being midway through fourth grade. However, after using the Fast ForWord products, these students made significant improvements in their skills with their performance on the Auditory-Visual Learning subtest reaching an age-appropriate level. These findings demonstrate that, within the Cattaraugus-Allegany-Erie-Wyoming BOCES, an optimal learning environment coupled with a focus on cognitive and early reading skills can help students with various disabilities including moderate cognitive delays attain a higher level of reading 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 in the Cattaraugus-Allegany-Erie-Wyoming BOCES made significant gains in their reading ability. This suggests that using the Fast ForWord products strengthened the students' foundational skills and better positioned them to benefit from the classroom curriculum.

Notes:

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REFERENCES

Lyon, G.R. (1996). Learning Disabilities. *The future of children: Special education for students with disabilities.* 6:54-76.

Merzenich MM, Jenkins WM, Johnston P, Schreiner CE, Miller SL, & Tallal P (1996). Temporal processing deficits of language-learning impaired children ameliorated by training. *Science*, 271, 77-80.

Miller, S.L., Merzenich, M.M., Tallal, P., DeVivo, K., Linn, N., Pycha, A., Peterson, B.E., Jenkins, W.M., (1999). Fast ForWord Training in Children with Low Reading Performance, *Nederlandse Vereniging voor Lopopedie en Foniatrie: 1999 Jaarcongres Auditieve Vaardigheden en Spraak-taal*. (Proceedings of the 1999 Dutch National Speech-Language Association Meeting).

Tallal P, Miller SL, Bedi G, Byma G, Wang X, Nagarajan SS, Schreiner C, Jenkins WM, Merzenich MM (1996). Language comprehension in language-learning impaired children improved with acoustically modified speech. *Science* 271:81-84.

Woodcock, R. (1998). *Woodcock Reading Mastery Tests.* Circle Pine, MN: American Guidance Service.