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

ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the reading skills of 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 and middle school students who were 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 2005-2006 school year. Student reading ability was evaluated with the Woodcock Reading Mastery Tests (WRMT) before and after Fast ForWord participation. **Results:** On average, students made significant improvements in reading skills following Fast ForWord use, with as much as 19 months gain in grade equivalent scores on the WRMT subtests.

Keywords: New York, elementary school, middle school, rural, observational study, special education, Fast ForWord Language Basics, Fast ForWord Language, Fast ForWord Language to Reading, 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, and Fast ForWord Language to Reading) were used to evaluate the effectiveness of this approach for improving the reading achievement of elementary and middle school students.

METHODS

Participants

Located in 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 was approximately 21,600 students.

During the 2005-2006 school year, CABOCES chose to implement the Fast ForWord software in its schools. A group of 44 students with various disabilities including mental retardation participated in the study reported here. The students were in second through eighth grades with the majority in first through fifth grades. Average grade level was 4.3. Before using the Fast ForWord products, students were assessed

with the Woodcock Reading Mastery Tests (WRMT). They were then evaluated again after product use. School personnel administered the assessment 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, and Fast ForWord Language to Reading, include three 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.

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] and Trog Walkers[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 MacDonald's Flying Farm[2]: 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], Polar Cop[3], and Treasure in the Tomb[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. *Polar Cop* also develops sound-letter correspondence skills. *Treasure in the Tomb* also develops grapheme recognition.

Phonic Match[2] and Bug Out[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 *Bug Out!* exercise develops skill with sound-letter correspondences as well as working memory.

Phonic Words[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.

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[1] Exercise from the Fast ForWord Basics product.

[2] Exercise from the Fast ForWord Language product.
[3] Exercise from the Fast ForWord Language to Reading product.

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.

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

Assessments
Students were assessed with the Woodcock Reading Mastery Tests (WRMT) in January of 2006 before Fast ForWord participation and again in June, 2006, after product use.

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 subtests.

Analysis
Scores were reported in terms of grade equivalents.

For student with all four subtest scores reported, data were analyzed using a multivariate analysis of variance (MANOVA). Paired t-tests were used for post hoc analyses. 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 2005-2006 school year, the Cattaraugus-Allegany-Erie-Wyoming BOCES chose to use the 50-minute protocol for the Fast ForWord products. Most students began product use in February, 2006. Students participated in the Fast ForWord products for 50 minutes a day for approximately 16 weeks. Due to the nature of the data reported, it was not possible to disaggregate product usage information for the study participants. Table 1 shows detailed product use for all students in CABOCES who used Fast ForWord products during the 2005-2006 school year. Total values reflect the total number of days that students used products, and the average completion, participation, and attendance on each product.

Figures 1 through 3 show the average daily progress through the Fast ForWord Language Basics, Fast ForWord Language, and Fast ForWord Language to Reading product exercises. 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	43	9	24	98%	84%	69%
Fast ForWord Language	71	37	87	65%	95%	62%
Fast ForWord Language to Reading	28	32	89	59%	97%	58%
Total	77	55	137	74%	92%	63%

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 total number of days that students used products, and the average completion, participation, and attendance on each product.

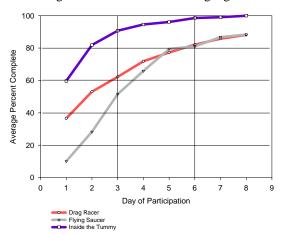Learning Curve: Fast ForWord Language Basics

Figure 1. Average daily progress through the Fast ForWord Language Basics product exercises. Results from 43 students are shown.

Learning Curve: Fast ForWord Language

Figure 2. Average daily progress through the Fast ForWord Language product exercises. Results from 71 students are shown.

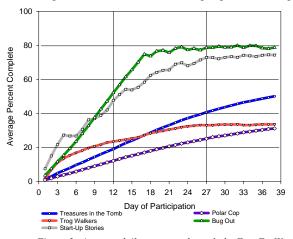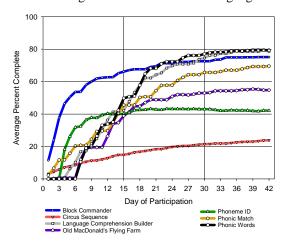Learning Curve: Fast ForWord Language to Reading

Figure 3. Average daily progress through the Fast ForWord Language to Reading product exercises. Results from 28 students are shown.

Assessment Results

Woodcock Reading Mastery Tests (WRMT): Scores were reported in terms of grade equivalents for four subtests of the WRMT: Visual-Auditory Learning, Word-Attack, Word Identification, and Passage Comprehension. Two of those subtests (Word Identification and Passage Comprehension) can be combined to give a score for the Total Reading Cluster.

Twenty-four students at an average grade level of 4.1 had tests available from all four subtests. A

MANOVA using these students' results indicated that, overall, there was a main effect of time, and a significant test x time interaction (Table 2).

	df	F-Statistic
Time	21	0.42
Test	23	25.4*
Test x Time	21	4.1*

Table 2: There was a main effect of Time and a Test x Time interaction when the four subtests were analyzed using a MANOVA. $* p < 0.05$.

Following up on the test x time interaction, post hoc analyses were performed on data from all students. T-tests on the individual subtests indicated that students improved the most on Visual-Auditory Learning and Passage Comprehension, with gains of 19 and 7 months, respectively (Figure 4; Table 3).

	n	Before		After		t-statistic
		Mean	SE	Mean	SE	
Visual-Auditory	29	1.5	0.34	3.1	0.66	3.22*
Word Attack	35	2.2	0.27	2.5	0.25	2.28*
Word Identification	40	2.3	0.12	2.6	0.14	4.05*
Passage Comprehension	40	2.0	0.15	2.6	0.21	5.03*
Total Reading	44	2.2	0.13	2.6	0.15	7.46*

Table 3. Students, on average, made significant improvements on the WRMT subtests after Fast ForWord use. Total Reading is a combination of the Word Identification and Passage Comprehension subtests. $*p<0.05$.
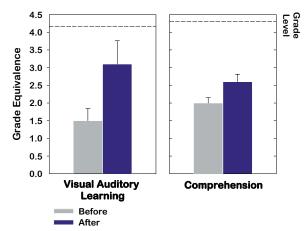
Figure 4. On average, after using Fast ForWord products, students improved their Visual Auditory Learning by 19 months and their Comprehension by 7 months.

DISCUSSION

A group of elementary and middle school students attending schools in the Cattaraugus-Allegany-Erie-Wyoming BOCES used Fast ForWord products during the 2005-2006 school year and achieved significant improvements in reading skills. Student reading ability was evaluated with the Woodcock Reading Mastery Tests (WRMT) in January and June of 2006, before and after Fast ForWord product use. On average, students made between four and nineteen months improvement in the different skill areas tested. For students who were more than two years below grade level, and who previously were not making one year's gain in one school year's time, four to nineteen months improvement in the various skills areas during the five months between evaluations is remarkable.

In addition to improvements in reading skills, teachers reported distinctive changes in their students' ability to stay on task for longer lengths of time as well as improvement in classroom behavior. 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 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 skills. 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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