Improved Reading Skills by Students at PPEP TEC High School who used Fast ForWord® Products

ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the reading skills of high school students who used the products within the curriculum in a school setting. **Study Design:** The design of this study was a single school case study using nationally normed assessments. **Participants:** Study participants were students attending an alternative high school in Tucson, Arizona. **Materials & Implementation:** Following staff training on the Fast ForWord products, a group of students used the products during the 2005-2006 or 2006-2007 school year and had their reading abilities assessed with subtests from the Woodcock-Johnson III Tests of Achievement or the Brigance Comprehensive Inventory of Basic Skills before and after Fast ForWord participation. **Results:** Students, on average, substantially improved in reading ability after using Fast ForWord products. Average gain on the Passage Comprehension subtest of the Woodcock-Johnson III Tests of Achievement was 2 years and Letter-Word Identification improved by 14 months. Students also improved on the Brigance Comprehensive Inventory of Basic Skills, gaining three and one-half years in reading grade level.

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).

Personnel at PPEP TEC High School were 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 Middle & High School, Fast ForWord to Literacy Advanced, Fast ForWord Language to Reading, Fast ForWord to Reading 1, Fast ForWord to Reading 2, Fast ForWord to Reading 3, Fast ForWord to Reading 4, and Fast ForWord to Reading 5) were used to evaluate the effectiveness of this approach for improving the reading achievement of high school students.

METHODS

Participants

PPEP TEC (Portable Practical Educational Preparation Training for Employment Centers) High School provides quality educational services to students ages fifteen through twenty-one in grades 9 through 12 who are at risk of becoming permanent dropouts of the Arizona public educational system. PPEP TEC High School also provides students with the knowledge and skills necessary to obtain employment or continue their education in post-secondary institutions.

PPEP TEC High School chose to use the Fast ForWord products as part of their educational curriculum during the 2005-2006 and 2006-2007 school years. A group of 17 students used the products and had their reading skills evaluated with subtests from the Woodcock-Johnson III Tests of Achievement or with the Brigance Comprehensive Inventory of Basic Skills before and after Fast ForWord participation. 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 PPEP TEC High School, Fast ForWord Middle & High School, Fast ForWord to Literacy Advanced, Fast ForWord Language to Reading, Fast ForWord to Reading 1, Fast ForWord to Reading 2, Fast ForWord to Reading 3, Fast ForWord to Reading 4, and Fast ForWord to Reading 5, include five to six exercises designed to build skills critical for reading and learning, such as auditory processing, memory, attention, and language comprehension. While there are differences between these products, all help develop certain critical skills as detailed in the following exercise descriptions.

Sweeps[1] and Trog Walkers/Sky Rider[2]: 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.

Streams[1]: 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.

IDs[1], Polar Cop/ Meteor Ball[2], and Treasure in the Tomb/Lunar Leap[2]: 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/Meteor Ball* also develops sound-letter correspondence skills. *Treasure in the Tomb/Lunar Leap* also develops grapheme recognition.

Matches[1] and Bug Out!/Laser Match[2]: 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!/Laser Match* exercise develops skill with sound-letter correspondences as well as working memory.

Cards[1]: 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.

Stories[1] and Start-Up Stories/Galaxy Theater[2]: 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.

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[1] Exercise from the Fast ForWord Middle & High School product.
[2] Exercise from the Fast ForWord Language to Reading/Fast ForWord to Literacy Advanced product.

Bear Bags[3] and Bear Bags: More Lunch[4]: 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[3] and Magic Bird[4]: 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[3] and Fish Frenzy[4]: 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[3]: 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[3] and Leaping Lizards[4]: 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[3] and Dog Bone[4]: 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[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.

Scrap Cat[5]: 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[5]: 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[5]: 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[5]: 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[5]: 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.

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[3] Exercise from Fast ForWord to Reading 1 product.
[4] Exercise from Fast ForWord to Reading 2 product.

[5] Exercise from Fast ForWord to Reading 3 product.

Hog Hat Zone[5]: 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.

Hoof Beat[6]: The participant is presented with a question and four possible answers. The participant must choose the most appropriate answer. The questions relate to semantics, phonology, morphology, orthography, and syntax. The exercise encourages flexibility during reading and automatic access to the various dimensions of vocabulary and is designed to build vocabulary by showing the participant how words function.

Jitterbug Jukebox[6]: The participant hears a word spoken aloud and letters appear on the keys of a jukebox. The participant must spell the word by clicking on the jukebox keys. Jitterbug Jukebox helps participants improve spelling and sensitivity to letter-sound correspondences. This exercise includes many of the 500 most commonly used words in written English including most word families found in 3rd and 4th grade content standards.

Goat Quotes[6]: In Goat Quotes four newspapers paraphrase a headline at the top of a news kiosk. The participant must select the correct paraphrase. The exercise is designed to sample the basic syntactic (i.e., grammatical) structures of spoken English generally mastered in the early elementary grades. The exercise develops logical thinking and working memory skills as well careful reading.

Book Monkeys: Book Two[6]: Participant reads a passage, chart, or schedule and then answers questions related to the material. This exercise develops a participants' ability to read for literal meaning, cause-and-effect relationships, and inferential comprehension. It also develops a participant's working memory as well as vocabulary skills, which are crucial for flexible, fluent reading.

Stinky Bill's Billboard[6]: Participants must select the word that accurately completes a sentence. In this exercise, participants improve sentence

comprehension while practicing the decoding of words in realistic contexts. This exercise also helps build vocabulary and awareness of word structure.

Lulu's Laundry Line[6]: Short passages are presented with occasional gaps where punctuation is missing. The participant must read the words and understand the passage in order to determine the correct punctuation. The exercise develops punctuation skills as well as automaticity for decoding and sentence comprehension.

Wood Works[7]: In Wood Works, the participant sorts written words into sound bins labeled with phonetic (dictionary) symbols. Later the participant sorts spoken words into spelling bins labeled with spelling patterns. In this way, participants build accuracy and fluency in spelling, decoding, and phonemic analysis.

Lana's Lanes[7]: In Lana's Lanes participants build skills in accurate text comprehension and the use of comprehension strategies by reading fiction or nonfiction passages, completing a graphic organizer or summary of each passage, and answering comprehension questions with and without the aid of the graphic organizers/summaries.

Quack Splash[7]: In Quack Splash participants build multiple-paragraph passages and demonstrate comprehension of the passages by correctly identifying missing words, phrases, or sentences; by correctly sequencing sentences and paragraphs; and by answering comprehension questions about the completed passages.

Gator Jam[7]: In Gator Jam, participants complete analogies where one of the 4 terms of the analogy is missing. Later, participants reread the completed analogies, and sort them based on the type of analogical relationship illustrated. In this way, Gator Jam helps participants to build skills in critical thinking and abstract reasoning while improving vocabulary.

Toad Loader[7]: In Toad Loader, participants select sentence segments to correctly build a sentence that describes an illustration. The sentence structures vary in the use of inflections and other grammatical forms. In this way, participants build accuracy and fluency in recognizing and constructing sentence structures.

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[6] Exercise from the Fast ForWord to Reading 4 product

[7] Exercise from the Fast ForWord to Reading 5 product

Assessments

Before and after Fast ForWord participation, student reading skills were assessed with the Letter-Word Identification and Passage Comprehension subtests of the Woodcock-Johnson III Tests of Achievement (WJ III) or the Brigance Comprehensive Inventory of Basic Skills.

Woodcock-Johnson III Tests of Achievement (WJ III): The WJ III is a wide-range, comprehensive set of individually administered tests for measuring cognitive abilities, scholastic aptitudes, and achievement.

The Letter-Word Identification subtest measures the subject's reading identification skills for isolated letters and words.

Passage Comprehension measures the subject's skill in reading a short passage and identifying a missing key word.

Brigance Comprehensive Inventory of Basic Skills (CIBS): The Brigance Comprehensive Inventory of Basic Skills is a criterion-and norm-referenced test designed to measure a student's developmental and academic skills. It is appropriate for students ages 5 through 13, and assesses basic skills including writing, reading, reading comprehension, mathematics, and listening comprehension.

Analysis

Scores were reported in terms of grade equivalents for both the Woodcock-Johnson III Tests of Achievement (WJ III) and the Brigance Comprehensive Inventory of Basic Skills. Data from the WJ III were available for seven students; ten students had scores from the Brigance CIBS available. Because of these small sample sizes, statistical analyses were not performed. Data is reported descriptively.

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 and 2006-2007 school years, the PPEP TEC High School chose to use the 48- and 50-Minute protocols for the Fast ForWord products. These protocols called for students to use the product for 48 or 50 minutes a day, five days per week for eight to twelve weeks. Detailed product use is shown in Table 1. Due to the nature of the data provided, it was not possible to disaggregate the Fast ForWord product usage information of the 17 study participants from that of PPEP TEC High School.

Figure 1 shows the average daily progress through the Fast ForWord Middle & High School 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 to Reading/Fast ForWord to Literacy Advanced, Fast ForWord to Reading 1, Fast ForWord to Reading 2, Fast ForWord to Reading 3, Fast ForWord to Reading 4, and Fast ForWord to Reading 5, 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 Middle & High School	99	20	72	70%	89%	51%
Fast ForWord Language to Reading	10	14	86	41%	82%	45%
Fast ForWord to Literacy Advanced	33	23	81	58%	94%	51%
Fast ForWord to Reading 1	4	-	-	-	-	-
Fast ForWord to Reading 2	4	-	-	-	-	-
Fast ForWord to Reading 3	24	14	62	55%	90%	49%
Fast ForWord to Reading 4	10	21	71	71%	92%	50%
Fast ForWord to Reading 5	3	-	-	-	-	-
Total	142	25	90	-	-	-

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. Usage information for products with fewer than five participants is not shown.
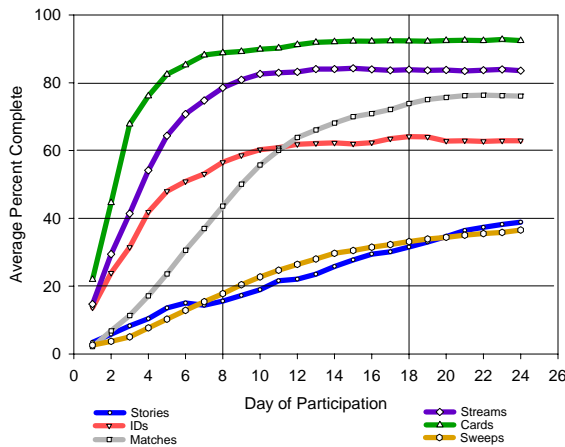
Learning Curve: Fast ForWord Middle & High School

Figure 1. Average daily progress through the Fast ForWord Middle & High School product exercises. Results from 99 students are shown.

Assessment Results

Woodcock-Johnson III Tests of Achievement (WJ III): Data were reported in terms of grade equivalents for seven students. At pre-test, the group of students was performing at a low third grade level on Passage Comprehension and at a fourth grade level on Letter-Word Identification. After Fast ForWord participation, students, on average, gained more than two years on Passage Comprehension and approximately 14 months on Letter-Word Identification (Figure 2).
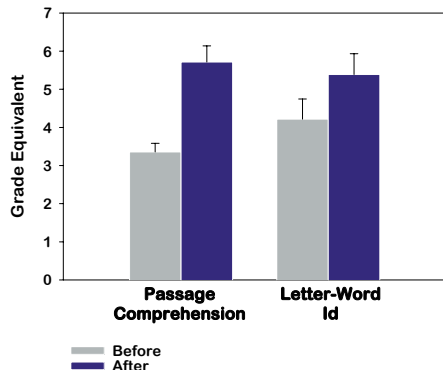

Figure 2. Students who used the Fast ForWord products gained, on average, more than two years in reading skill. Results from 7 students are shown.

Brigance Comprehensive Inventory of Basic Skills (CIBS): Ten students had Brigance CIBS grade equivalents reported. After three months of product use (as reported by PPEP TEC High School), students, on average, improved three and one-half years in basic reading skills (Figure 3).
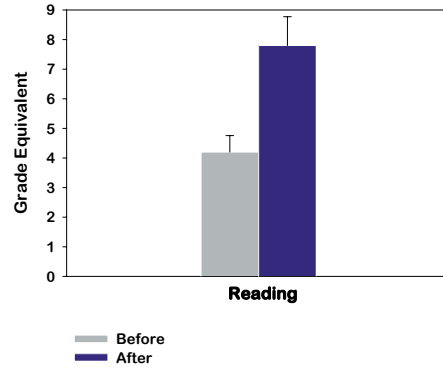

Figure 3. After Fast ForWord participation, students, on average, improved from the low fourth grade level to the high seventh grade level. Results from 10 students are shown.

DISCUSSION

During the 2005-2006 and 2006-2007 school years, high school students attending PPEP TEC High School, an alternative high school for at-risk students, used the Fast ForWord products and participated in the study reported here. The students, who were 15 – 21 years old, were performing at an average grade-equivalent level of third or fourth grade. On average, the students made substantial gains in reading skills following Fast ForWord participation, with improvements of up to 3 ½ years in grade level. These findings demonstrate that, within the PPEP TEC High School, an optimal learning environment coupled with a focus on cognitive and early reading skills can help students attain a higher level of language and 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 PPEP TEC High School 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.

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