

Improved Reading Achievement by Students in the Killeen Independent School District who used Fast ForWord® Products

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ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the reading achievement and phonological awareness skills of students who were in the Killeen Independent School District and who used the products within the curriculum in a school setting. **Study Design:** The design of the study was a multiple school case study using nationally-normed tests of reading and a computer-administered phonological awareness test. **Participants:** Study participants were over 1,300 first through ninth graders in the Killeen Independent School District of Killeen, Texas who had their skills evaluated before and after using Fast ForWord products. **Materials & Implementation:** Following staff training on the Fast ForWord products, students in the Killeen Independent School District used Fast ForWord products. Before and after Fast ForWord participation, student performance was evaluated by examining progress on the Gates-MacGinitie Reading Tests and Reading Edge. Dependent t-tests were used to compare how the study participants performed before and after using the Fast ForWord products. **Results:** On average, the students who used Fast ForWord products made significant improvements in reading achievement and phonological awareness skills. At pre-test, the group of students was performing well below grade level in reading achievement. Post-test results revealed that the group attained grade-equivalent scores that brought them above their true grade levels. Significant improvements were present at all levels (elementary, middle, and high) and a subset of students assessed two to three months later indicated that the accelerated learning continued.

Keywords: Texas, elementary schools, middle schools, high schools, urban district, ELL, special education, Fast ForWord Language, Fast ForWord Middle & High School, Fast ForWord Language to Reading, Fast ForWord to Reading 3, Gates-MacGinitie Reading Tests (GMRT), Reading Edge.

INTRODUCTION

Numerous research studies have shown that cognitive and oral language skills are underdeveloped 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 Killeen Independent School District was interested in a learning environment with a focus on early reading and cognitive skills as a way for improving the reading achievement of low-performing students in a school setting. In this study, commercially available computer-based products (Fast ForWord products) were used to evaluate the effectiveness of this approach at improving the reading achievement of students.

METHODS

Participants

The Killeen Independent School District, in Bell County, Texas, is located near Fort Hood, the largest military

installation in the free world. The Killeen Independent School District serves over 32,000 students and employs 5,000 teachers and support personnel to serve the District's 47 campuses. All 27 elementary school campuses were classified as Title I in the 2003 – 2004 school year.

During the 2002 – 2003 school year, the first year of the district wide implementation, over 5,000 students from the district were selected by teachers and school administrators to use Fast ForWord products. Assessment data from over 1,300 of these students were reported and included in this study. Study participants were in grades one through nine, and included students with limited English proficiency (LEP), and students who were receiving special education services, as well as talented and gifted students. Overall, the group of students in the study had reading achievement below the levels expected for their grade levels.

Implementation

Initially, a single elementary school used the Fast ForWord® Language and Fast ForWord Language to Reading products, under the leadership of their principal, Helen Robinson, who now serves the district as Director of Special Education. She was first attracted to the products because of their research-based neuroscience foundation. Success at her school led to a gradual expansion to two other schools the following year, and then to a district-wide implementation in 2002-2003.

In preparation for the district wide implementation, educators in the Killeen Independent School District were trained in current and established findings on the neuroscience of 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 product candidates; 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 the product.

Materials

Fast ForWord products, computer-based products combining an optimal learning environment with a focus on early reading and cognitive skills, were used in conjunction with the school curriculum. The specific products used by the Killeen Independent School District students were Fast ForWord Language, Fast ForWord Language to Reading, Fast ForWord Middle & High School, and Fast ForWord to Reading 3. These products include five to seven exercises designed to build skills that are critical for reading and learning, such as auditory processing, memory, attention, and language comprehension.

*Circus Sequence*¹, *Sweeps*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*¹ and *Streams*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*¹, *IDs*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*¹, *Matches*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*¹ and *Cards*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.

*Language Comprehension Builder*¹: 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*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.

*Stories*² and *Start-Up Stories*³: Students follow increasingly complex commands, match pictures to sentences, and answer multiple-choice questions about stories that are presented aurally.

*Scrap Cat*⁴: 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 develops decoding, vocabulary, and word recognition skills.

*Canine Crew*⁴: 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

¹ Exercise from the Fast ForWord Language product.

² Exercise from the Fast ForWord Middle & High School product.

³ Exercise from the Fast ForWord Language to Reading product.

⁴ Exercise from the Fast ForWord to Reading 3 product.

progresses. This exercise develops vocabulary, decoding, and automatic word recognition.

*Chicken Dog*⁴: 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 develops basic spelling patterns, letter-sound correspondences, and decoding.

*Twisted Pictures*⁴: 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*⁴: 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 among four alternatives. This task develops paragraph comprehension, inferential and cause-and-effect reasoning, working memory, flexible reading, and vocabulary.

*Hog Hat Zone*⁴: 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

To determine the impact of using Fast ForWord products, staff within the Killeen Independent School District conducted testing immediately before and after students used Fast ForWord products. A subset of students was re-tested 8 – 12 weeks later. School personnel administered the assessments and reported the scores to Scientific Learning Corporation. The abilities of the students were evaluated using one or more of the following assessments:

Gates-MacGinitie Reading Tests: There are two parts to the GMRT: a vocabulary test and a comprehension test. These tests are used to assess a child's decoding skills and understanding of words and passages. The scores from the two tests can be combined to give an overall reading score that can be reported in terms of a grade-equivalent score.

Reading Edge: Reading Edge is a software product for evaluating phonological awareness and other early reading skills, including phonological processing, phonological awareness, phonemic decoding, and letter-sound identification. The Reading Edge composite score reflects a student's overall performance on the various phonological and reading tests in Reading Edge taking into account the relative importance of each test in predicting reading ability. The product was normed for children in kindergarten through second grades, sometimes resulting in a ceiling effect when used with older students or students who have improved their abilities greatly.

Scores were reported in terms of grade-equivalents for the Gates-MacGinitie Reading Tests and a Composite Score for Reading Edge.

Analysis

Grade-equivalent and composite scores for the students in the study were compared using dependent t-tests. The analyses used a p-value of 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). The default Fast ForWord protocols used by the district call for students to use the products 90-100 minutes per day, for 5 days a week for four to eight weeks. Alternate protocols were also used, which call for students to use the products between 48-50 minutes per day, 5 days a week, for six to ten weeks.

Over 5,000 students from the Killeen Independent School District used Fast ForWord products during the 2002 – 2003 school year. Overall, there were 6,682 product starts, with many students using multiple products. On average, Fast ForWord products were used for 24 days, and 65% of the content was completed. Detailed usage information for the district is shown in Table 1.

It should be noted that assessment data are available for over 1,300 of these students. Due to the nature of the data provided by the Killeen Independent School District, it was not possible to disaggregate the usage data of the study participants from that of the rest of the district.

Figures 1 to 4 show the average daily progress through the Fast ForWord products for all 2002 – 2003 Killeen Independent School District students. The final day shown on each chart 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.

District	FFWD Product	Number of Students	Average Days Participated	Average Number of Calendar Days	Average Percent Complete	Participation Level
Killeen Independent School District	Fast ForWord Language	2,350	24	46	76%	76%
	Fast ForWord Middle & High School	2,359	26	55	62%	34%*
	Fast ForWord Language to Reading	1,711	21	42	58%	58%
	Fast ForWord to Reading 3	262	20	46	29%	N/A
	Total Product Starts	6,682	24	48	65%	54%

Table 1. Usage information showing the number of students who used the Fast ForWord products. Also shown are group averages for the number of days of product use, calendar days from start and finish, percentage of product completed and participation level. * This low participation reflects, in part, students using an alternate protocol, resulting in fewer minutes of usage per day (see Note 1 at end of report).

Daily Progress in Fast ForWord Language by Killeen Independent School District Students

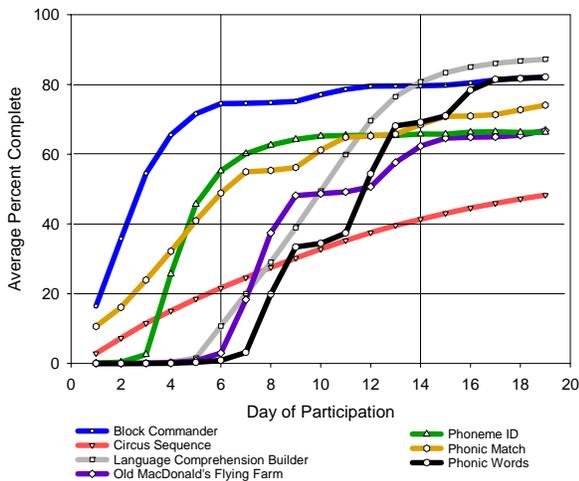


Figure 1. Average daily progress of Killeen Independent School District students using the Fast ForWord Language product. Results from 2,350 students are shown.

Daily Progress in Fast ForWord Middle & High School by Killeen Independent School District Students

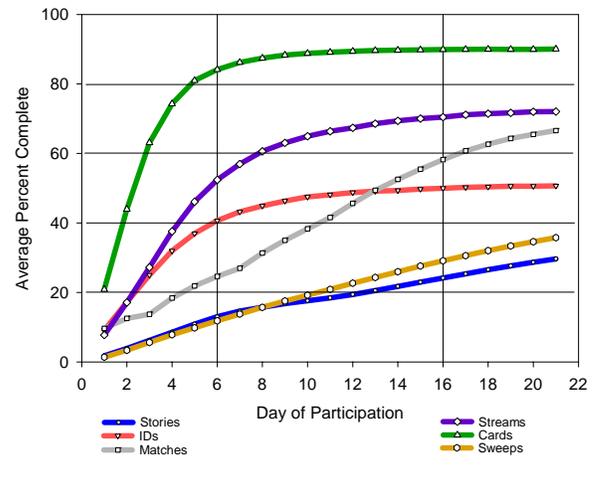


Figure 2. Average daily progress of Killeen Independent School District students using the Fast ForWord Middle & High School product. Results from 2,359 students are shown.

Daily Progress in Fast ForWord Language to Reading by Killeen Independent School District Students

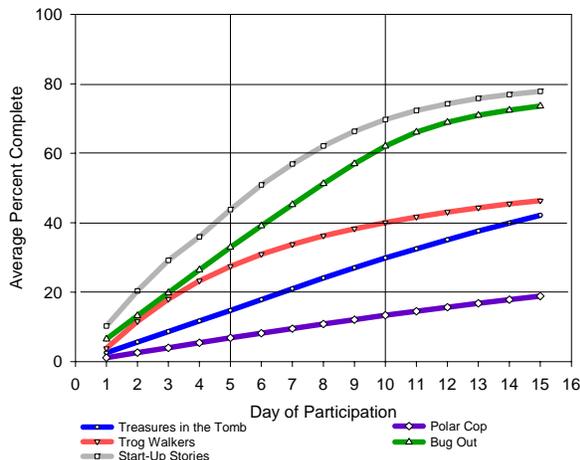


Figure 3. Average daily progress of Killeen Independent School District students using the Fast ForWord Language to Reading product. Results from 1,711 students are shown.

Daily Progress in Fast ForWord to Reading 3 by Killeen Independent School District Students

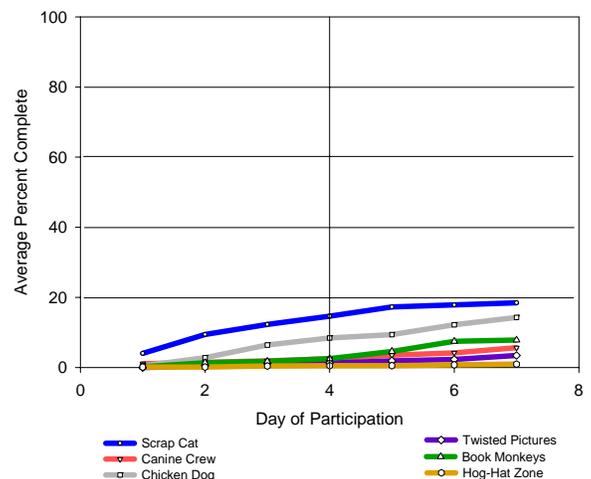


Figure 4. Average daily progress of Killeen Independent School District students using the Fast ForWord to Reading 3 product. Results from 262 students are shown.

Assessment Results

Gates-MacGinitie Reading Tests: Gates-MacGinitie Total reading scores were analyzed for the students who used Fast ForWord products. Before participation, the students had a mean grade level of 5.9, but had a mean reading performance equivalent to a beginning fifth grader. After using Fast ForWord products, the students achieved a grade-appropriate reading level. In addition, a dependent t-test showed that this improvement was statistically significant (Table 2 and Figure 5). This significant improvement was seen across the whole group of Fast ForWord participants from the Killeen Independent School District, as well as for subgroups, including students with Limited English proficiency (LEP) and students who were receiving special education services. See Figures 6 and 7 below for more details about performance within these student populations. Students of different ages also showed significant improvements -- on average, elementary, middle, and high school students showed significant gains in reading achievement, with the reading level of the elementary school students surpassing their true grade level after Fast ForWord use. See Figure 8 for more information on performance split by grade level.

In addition to these pre- and post-test results, follow-up data were reported for a subgroup of students. One hundred forty-four low-functioning students (of whom 40% were receiving special education services) were evaluated before and after Fast ForWord participation and again 8 – 12 weeks later. A repeated measures analysis of

variance showed that, on average, these students achieved statistically significant increases between pre- and post-testing, and then received further benefit, showing additional significant improvements between post- and follow-up-testing (Table 3 and Figure 9). By the third assessment, this group of students, that was originally performing nearly two years behind grade level, had caught up to grade level.

Reading Edge: Reading Edge was used to assess the phonological awareness skills of 1,175 students in grades 1 through 5. Students from the Killeen Independent School District showed statistically significant improvements in their phonological awareness and early reading skills, as measured by Reading Edge. Across all study participants, students moved from the below average range well into the average range (Table 4 and Figure 10). These impressive improvements were not limited to a specific population, but were present across a variety of groups. On average, students with limited English proficiency and students proficient in English made significant gains in their skills. In addition, students receiving special education services as well as students who were not receiving special education services made, on average, statistically significant improvements. See Figures 11 and 12 for more information about the results from these student populations.

	n	Average Grade Level	Mean	SE	Mean	SE	t-value
Grade-Equivalent	1357	5.9	5.0	0.1	6.2	0.1	34.0*

Table 2. Overall, 1357 students who used Fast ForWord products made statistically significant gains in reading achievement, as measured by the GMRT. * $p < 0.05$.

Gates-MacGinitie Total Reading	n	Average Grade Level	Before		After		8-12 Weeks After		df	F-statistic
			Mean	SE	Mean	SE	Mean	SE		
Time									2	96.0*
Grade-Equivalent	144	5.5	3.6	0.1	4.5	0.1	5.7	0.2		

Table 3. One hundred and forty-four students who used Fast ForWord products had three assessment time points. This group of students made statistically significant improvements in reading achievement between each assessment, as measured by the GMRT. * $p < 0.05$.

Reading Edge	n	Average Grade Level	Before		After		t-value
			Mean	SE	Mean	SE	
Composite Score	1175	2.9	48.4	0.9	79.3	0.7	39.9*

Table 4. Overall, 1175 students who used Fast ForWord products made statistically significant gains in phonological awareness and early reading skills, as measured by Reading Edge. * $p < 0.05$.

Gates-MacGinitie Results

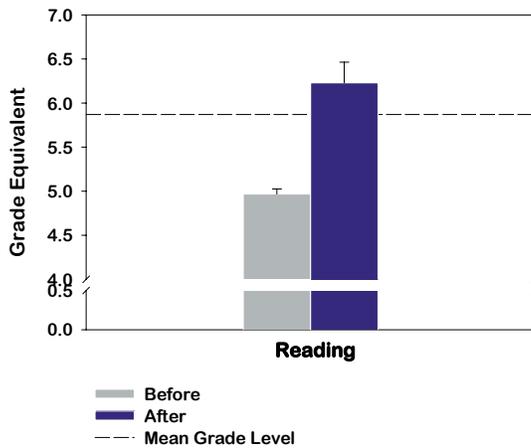


Figure 5. Overall, a group of 1357 students showed significant gains in the GMRT Total reading score, a composite of vocabulary and comprehension scores. The mean grade level of these students was 5.9.

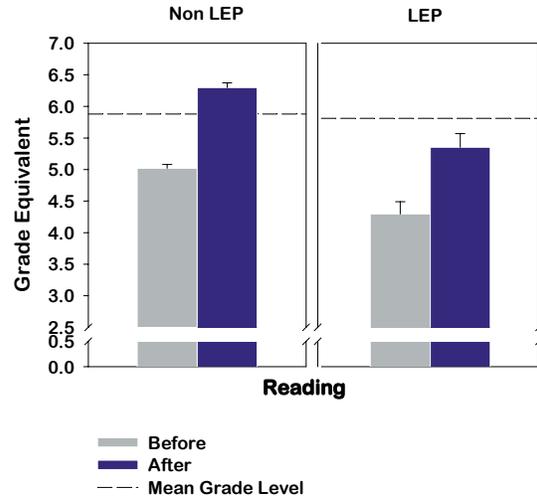


Figure 6. In this study, the vocabulary and comprehension achievement of 1258 non-LEP and 99 LEP students were evaluated. On average, after using Fast ForWord products, both groups of students made significant improvements on the GMRT. The mean grade level of the non-LEP students was 5.9, while the mean grade level of the LEP students was 5.8.

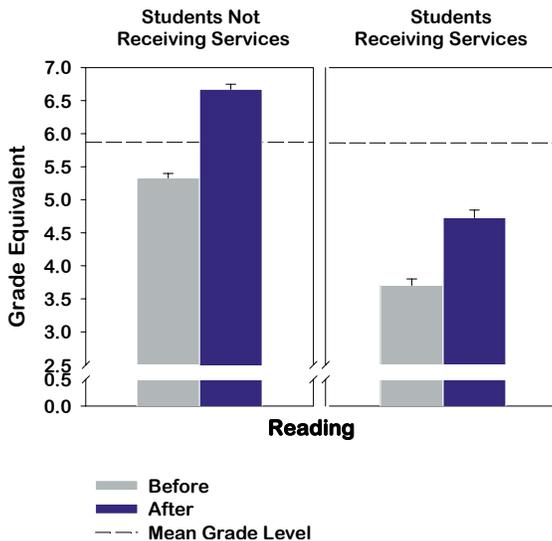


Figure 7. The reading achievement of 1051 students not receiving special education services and 306 students receiving special education services were measured during this study. After using Fast ForWord products, both groups of students showed significant gains in the GMRT Total reading score. The mean grade level of the students not receiving special education services and the mean grade level of the students receiving special education services was 5.9.

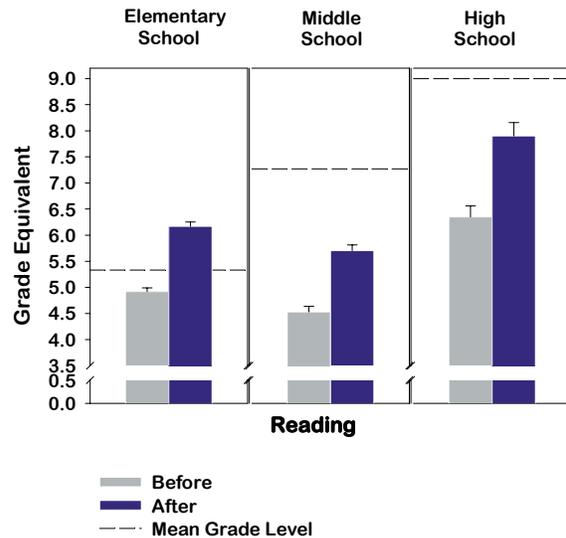


Figure 8. The reading achievement of students of various grade levels is shown above. Elementary school students (n=1065) include students from grades 4 through 6, middle school students (n=193) include students in grades 7 and 8, and high school students (n=99) include ninth graders. After using Fast ForWord products, all three groups of students showed significant gains in the GMRT Total reading score. The mean grade level of the elementary school students was 5.3, the mean grade level of the middle school students was 7.3, and all high school students were ninth graders.

Gates-MacGinitie Results

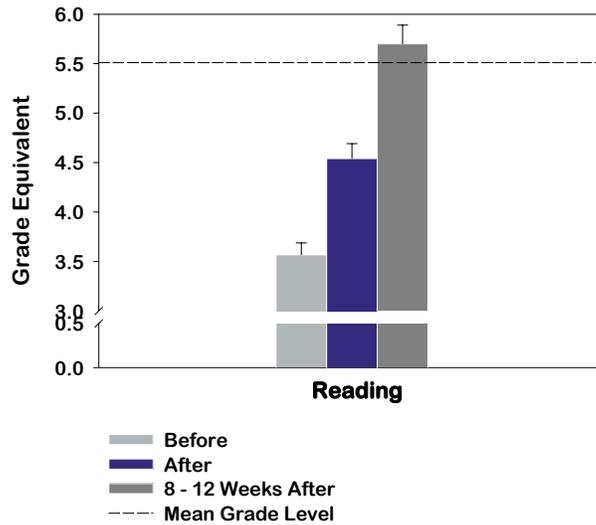


Figure 9. In this study, 144 students had their reading achievement measured at three different time points. On average, after using Fast ForWord products, students made significant improvements, and then made further significant gains eight to twelve weeks after Fast ForWord participation. The mean grade level of these 144 students was 5.5.

Reading Edge Results

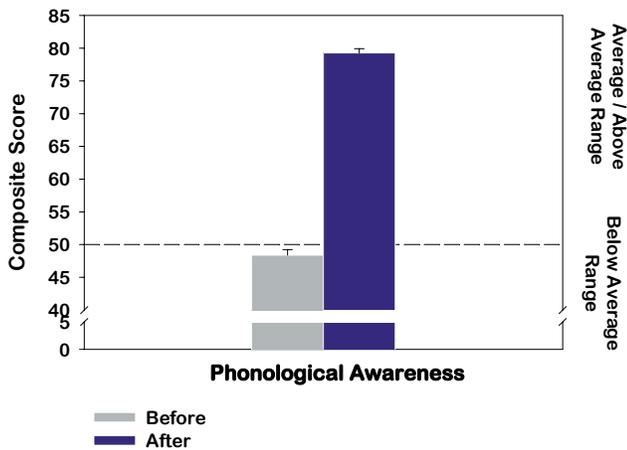


Figure 10. In this study, 1175 students had their phonological and early reading skills assessed with Reading Edge. On average, students showed significant gains in these skills, moving well into the average range. The mean grade level of these students was 2.9, and all students were in elementary school grades (grades ranged from 1 through 5).

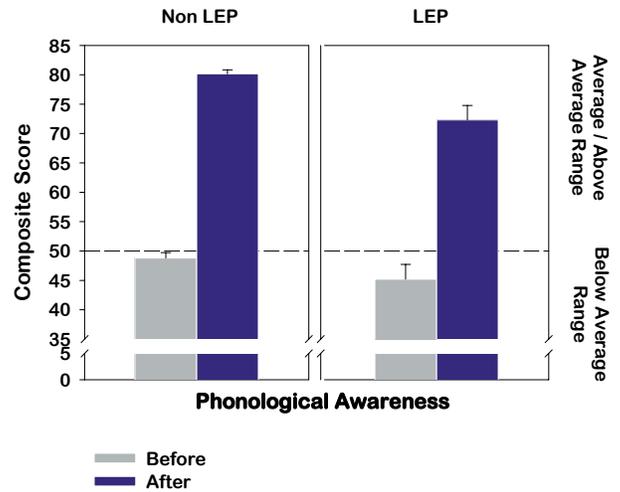


Figure 11. Non-LEP students (n=1038) and LEP students (n=137) had their phonological and early reading skills measured before and after using Fast For Word products. On average, both groups of students showed significant improvements, moving well into the average range. The mean grade level of the non-LEP students was 2.9, while the mean grade level of the LEP students was 3.0, and all students were in elementary school grades (grades ranged from 1 through 5).

Reading Edge Results

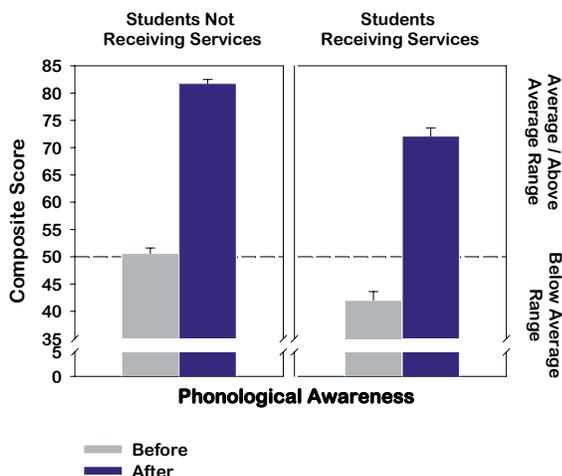


Figure 12. On average, students who were not receiving special education services ($n=871$), as well as students who were receiving special education services ($n=304$) made significant gains in their phonological awareness and early reading skills, as measured by Reading Edge. The mean grade level of the students not receiving special education services was 2.9, while the mean grade level of the students receiving special education services was 3.1, and all students were in elementary school grades (grade ranged from 1 through 5).

DISCUSSION

Over 1,300 students from the Killeen Independent School District used Fast ForWord products during the 2002 – 2003 school year. The students represented a wide variety of populations, including students with limited English proficiency and students receiving special education services. On average, the Killeen students' post-participation mean GMRT scores reflected significant improvements in their total reading achievement, which comprised vocabulary and comprehension skills. Significant improvements were also seen longitudinally, with students showing, on average, that after Fast ForWord participation is completed, benefit can be maintained and built upon with further classroom instruction. In addition to improved reading achievement, on average, students also exhibited significant gains in phonological awareness skills, such as phonemic blending, letter-sound knowledge, and phonemic decoding.

In addition to objective measures of reading improvement across groups of students, the Killeen Independent School District has anecdotes demonstrating the impact of the products on individual students. As one example of Killeen's experience, a ninth-grade male student had been attending Special Education Resources classes but was still almost unable to read. He also had significant attendance issues, and ended up in the principal's office

weekly. After a few weeks working on Fast ForWord products, his attendance improved dramatically, and no disciplinary issues required the principal's attention. Most notable, however, was his reading improvement. Without warning, one day he volunteered to read aloud for the first time ever. Although he struggled, he made it through the passage. The next day, he volunteered again, and made some improvement. The third day, he again volunteered and completed the passage well. At that point, the other students in the class responded by giving him a loud round of applause! Later, he brought a book to class that he had checked out of the library. He told his teacher that this was the first time he had ever checked a book out for himself. The book was *Harry Potter*; he said he wanted to learn what all the excitement was about.

CONCLUSION

Killeen Independent School District has found that careful pre-testing and post-testing can quickly demonstrate how their students are progressing. Part of their success in funding their district wide implementation of Fast ForWord products comes from their ability to show clearly how these products have improved their students' overall reading ability. They can now clearly show that students from various student populations, including students with limited English proficiency and students receiving special education services, showed significantly improved reading and phonological awareness abilities. After using Fast ForWord products, the students had improved their critical early reading and cognitive skills and strengthened their vocabulary, better positioning them to partake in the classroom curriculum.

Notes:

1. In the new Gateway Edition of the Fast ForWord products, the calculation of the Participation Level depends on protocol chosen, so all students should strive for 100%, independent of protocol.
2. To cite this report: Scientific Learning Corporation. (2004). Improved Reading Achievement by Students in the Killeen Independent School District who used Fast ForWord Products, MAPS for Learning: Educator Reports, Vol. 8, No. 23: pp. 1-9.

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