Improved Language and Math Performance on the California Standards Tests by Students who used Fast ForWord® Products

ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the academic skills of elementary school students who used the products within the curriculum in a school setting.

Results: After Fast ForWord participation, students made statistically significant gains on both the California Standards Test for English Language Arts and the California Standards Test for Mathematics. The percentage of students at or above the proficiency criterion in English Language Arts increased from 15% to 43%. The percentage of students at or above the proficiency criterion in Mathematics increased from 47% to 59%. Study participants also made statistically significant gains on the Reading Progress Indicator assessment – improving their reading skills by 1.2 grade levels, on average.

Study Design & Participants: The design of this study was a single school case study using standardized assessments. Study participants were elementary school students attending a suburban public school in California.

Materials & Implementation: Following staff training on the Fast ForWord products, the students used the Fast ForWord products during the 2007-2008, 2008-2009, and/or 2009-2010 school years. Their English language arts proficiency, mathematics proficiency, and/or reading skills were evaluated before and after Fast ForWord participation with the California Standards Tests (CSTs) and/or Reading Progress Indicator.

Keywords: California, elementary school, suburban district, observational study, Fast ForWord Language, Fast ForWord Language v2, Fast ForWord Language to Reading, Fast ForWord Language to Reading v2, Fast ForWord Reading Level 1, Fast ForWord Reading Level 2, Fast ForWord Reading Level 3, California Standards Tests (CSTs), Reading Progress Indicator.

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 computer software 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).

Further research has demonstrated that the use of an optimal learning environment with a focus on reading and cognitive skills can lead to improvements in reading achievement and other academic skills for a wide range of students.

In this study, commercially available computer-based products (Fast ForWord Language, Fast ForWord Language v2, Fast ForWord Language to Reading, Fast ForWord Language to Reading v2, Fast ForWord Reading Level 1, Fast ForWord

Reading Level 2, and Fast ForWord Reading Level 3) were used to evaluate the effectiveness of this approach for improving the academic achievement of students attending a public elementary school within a suburban district in California.

METHODS
Participants
Over a period of three school years, from the winter of 2008 through the spring of 2010, students at the study site used the Fast ForWord products. This study focuses on 193 Fast ForWord users who completed one or more assessments before and after their Fast ForWord use. Study participants were in second grade through fifth grade. Before and after Fast ForWord participation, students were assessed with the California Standards Test in English-language arts (CST-ELA), the California Standards Test in Mathematics (CST-Math), and/or Reading Progress Indicator (RPI). 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 the 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. Each product includes several exercises designed to build cognitive skills critical for all learning, such as attention and memory. These exercises simultaneously develop academic skills critical for reading, such as English language conventions, phonemic awareness, vocabulary, and comprehension. Some of the primary skills developed by these products are outlined below in Table 1. More detailed descriptions of the exercises and learning modes within each product can be found online at http://www.scientificlearning.com/exercises.

Product Name	Listening Accuracy & Auditory Sequencing	Auditory Word Recognition	English Language Conventions	Following Directions	Listening Comprehension	Phonological Skills / Phonemic Awareness	Phonics / Word Analysis	Fluency	Vocabulary	Reading Comprehension
Fast ForWord Language v2	●	●	●	●		●			●	
Fast ForWord Language to Reading v2	●		●	●	●	●	●		●	
Fast ForWord Reading Level 1					●	●	●	●	●	●
Fast ForWord Reading Level 2					●	●	●	●	●	●
Fast ForWord Reading Level 3						●	●	●	●	●

Table 1: The Fast ForWord products work on numerous cognitive and early reading skills. The primary skills that each product focuses on are noted in the table. Note: Some participants used the original Fast ForWord Language and Fast ForWord Language to Reading products, while others used the newer "v2" versions. Because they cover the same skill domains, only the "v2" products are listed above.

Assessments
Before and after Fast ForWord participation, student skills were assessed with the California Standards Tests for English language arts (CST-ELA) and Mathematics (CST-Math) and/or Reading Progress Indicator (RPI). It should be noted that some students used the Fast ForWord products during more than one school year (77 students had one year of Fast ForWord use, 67 students had two years, and 7 students had 3 years) so the time between the initial and follow-up assessments varied substantially.

California Standards Tests (CSTs): The CSTs are a major component of California's Standardized Testing and Reporting program (STAR). The CSTs are developed by California educators and test developers specifically for California. They are administered to students in grades two through eleven and measure students' progress toward achieving California's state-adopted academic content standards in English–language arts (ELA) and mathematics.

Performance on the CSTs is classified into five performance levels: advanced, proficient, basic, below basic, and far below basic. California schools strive to help all students reach the proficient or advanced levels. At all grades, a scale score of 350 or higher is required to achieve a performance level of proficient or advanced.

Reading Progress Indicator (RPI): Reading Progress Indicator is a computerized assessment designed to rapidly measure the impact of the Fast ForWord products. It assesses a student's early reading skills including phonemic awareness, decoding, vocabulary, and comprehension.

Analysis
Scores were reported in terms of scale scores and performance levels for the CST-ELA and CST-Math, and in terms of scaled scores and percentile scores for RPI. According to the California Department of Education, CST scale scores cannot be compared across grades, which means that they are unsuitable for analyzing the performance gains of individual students. Because of this limitation, the analyses conducted for this study used CST performance level scores, which can be compared across grades. The CST performance level data were analyzed using a Monte Carlo implementation of a Non-Parametric Randomization Test (McNPR test). This statistical analysis looks for an intervention effect by comparing the number of students whose performance level went up to the number whose performance level went down (for more information on the CSTs and the McNPR test, refer to Scientific Learning Corporation, 2010). The RPI data were analyzed using a paired t-test. 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 how a product is used and the benefits of the product. Product use is evaluated in terms of content completed, days of use, and adherence to the chosen protocol (participation and attendance levels). During the study period, the school chose to use the 30-Minute and 40-Minute protocols. These protocols call for students to use the products for 30 or 40 minutes a day, five days per week for nine to sixteen weeks. Detailed product use is shown in Table 2.

Product Use						
	Number of Students	Days Participated	Calendar Days	Percent Complete	Participation Level	Attendance Level
Fast ForWord Language	41	61	122	76	86	72
Fast ForWord Language v2	152	59	118	91	81	82
Fast ForWord Language to Reading	14	23	40	32	91	83
Fast ForWord Language to Reading v2	127	68	160	80	89	78
Fast ForWord Reading Level 1	60	27	61	91	93	77
Fast ForWord Reading Level 2	38	36	86	78	94	72
Fast ForWord Reading Level 3	11	86	223	84	93	72
Total	193	158	379	--	87	78

Table 2. Usage data showing the number of students who used the Fast ForWord products between the winter of 2008 and the spring of 2010 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. Many students in this study used multiple products, often across multiple school years. In some instatnces students were enrolled in the same product twice. Total days participated and calendar days have been adjusted to capture this additional usage.

Assessment Results

California Standards Test in English Language Arts (CST-ELA): One hundred fifty-one Fast ForWord participants took the CST-ELA before and after participation. CST-ELA scores were reported in terms of scale scores and performance levels. Because CST scale scores from different years cannot be compared, pre-post analyses were conducted using student performance levels, as shown in table 3 and figure 1.

	Before	After
Advanced	1	15
Proficient	21	50
Basic	75	52
Below Basic	33	20
Far Below Basic	21	14

Table 3. The number of study participants scoring in each performance level on the California Standards Test for English Language Arts(CST-ELA) before and after using the Fast ForWord products. Data for 151 students is shown.
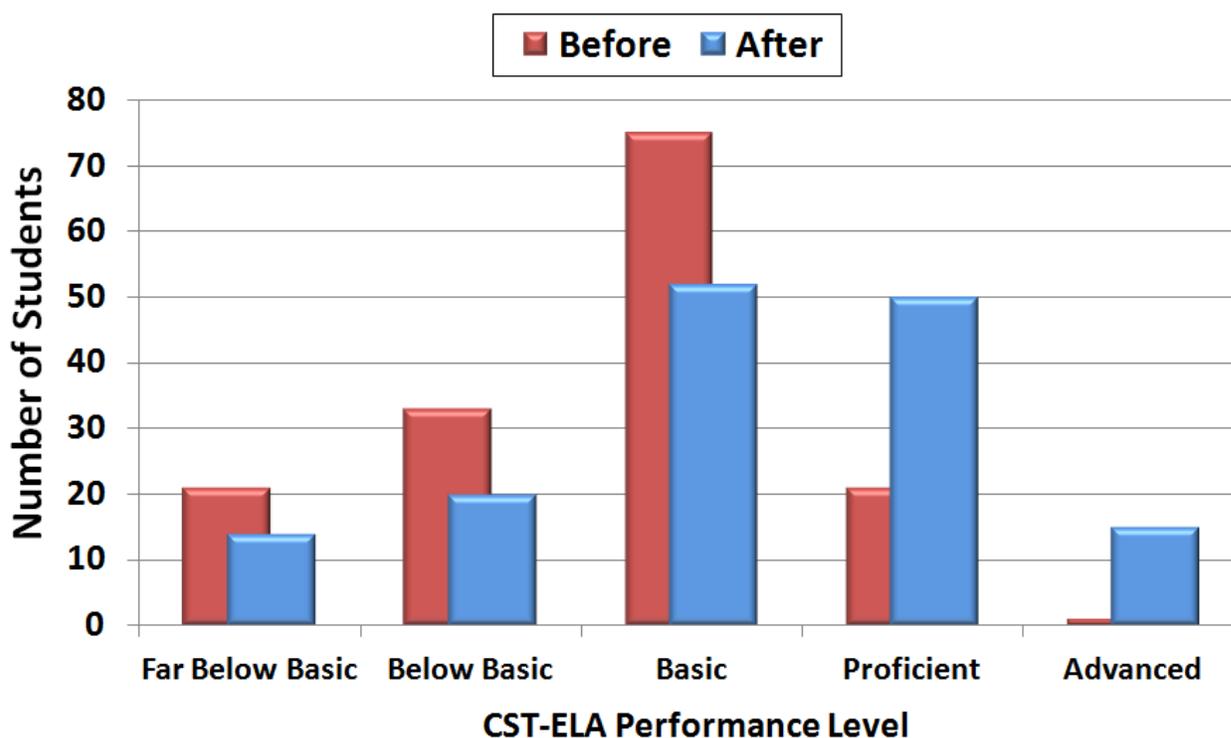

Figure 1: The number of students scoring in each performance level on the California Standards Test for English Language Arts (CST-ELA) before and after using the Fast ForWord products. Data for 151 students is shown.

In the spring prior to using Fast ForWord products, the study participants earned an average CST-ELA scale score of 310. This is well below the minimum score of 350 needed for a performance level of "proficient."

Of the 151 students who had CST-ELA data from before and after using Fast ForWord products, 82 students improved their performance level by one or more levels, 55 stayed at the same level, and 14 moved to a lower level. A McNPR test confirmed that more Fast ForWord users improved their English Language Arts performance level than would be expected by chance ($p < 0.001$).

California Standards Test in Mathematics (CST-Math): One hundred fifty Fast ForWord participants took the CST-Math before and after participation. CST-Math scores were reported in terms of scale scores and performance levels. Because CST scale scores from different years cannot be compared, pre-post analyses were conducted using student performance levels, as shown in table 4 and figure 2.

	Before	After
Advanced	27	54
Proficient	43	34
Basic	34	26
Below Basic	39	23
Far Below Basic	7	13

Table 4. The number of study participants scoring in each performance level on the California Standards Test for Mathematics (CST-Math) before and after using the Fast ForWord products. Data for 150 students is shown.

Of the 150 students who had CST-Math data from before and after using Fast ForWord products, 67 students improved their performance level by one or more levels, 49 stayed at the same level, and 34 moved to a lower level. A McNPR test confirmed that more Fast ForWord users improved their Mathematics performance level than would be expected by chance ($p<0.001$).

Before using Fast ForWord products, 47% of study students were performing at the proficient level or higher in mathematics. After using Fast ForWord products, 59% of study students met or exceeded the proficiency criterion.
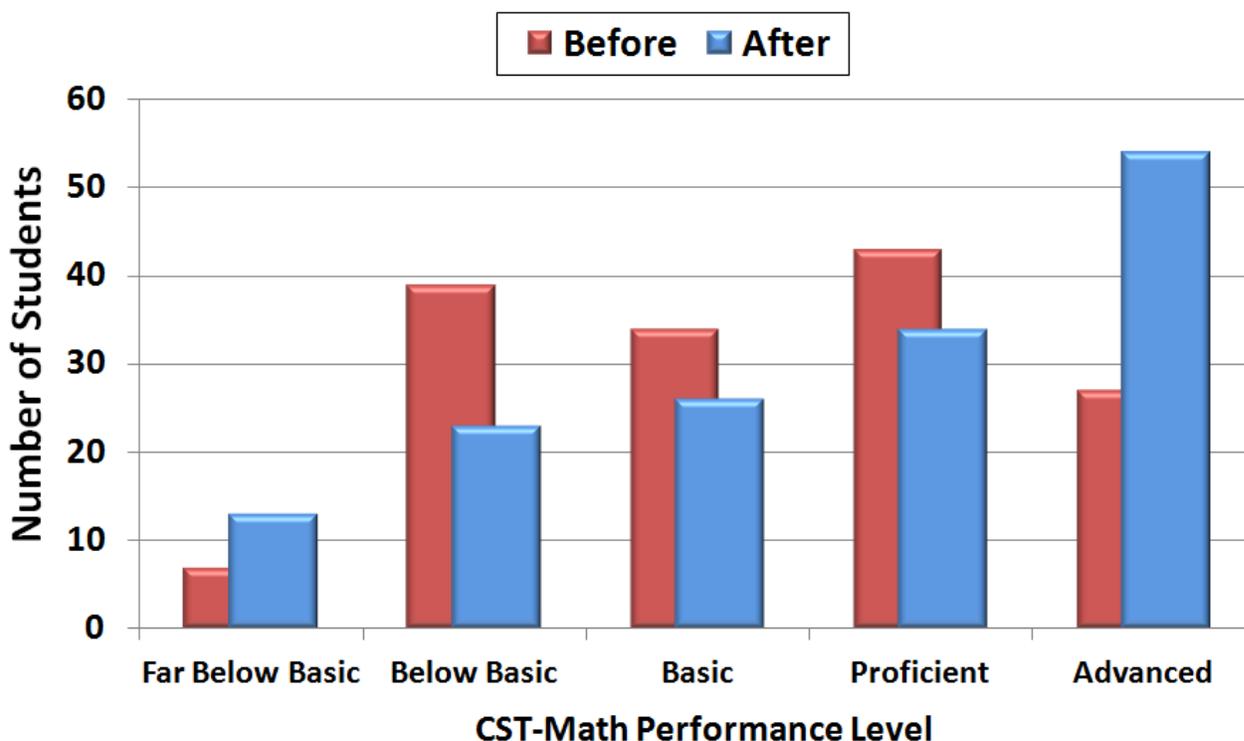

Figure 2: The number of students scoring in each performance level on the California Standards Test for Mathematics (CST-Math) before and after using the Fast ForWord products. Data for 150 students is shown.

Reading Progress Indicator (RPI): In addition to the CST-ELA and CST-Math, RPI was used to evaluate the impact of the Fast ForWord products on the students' reading skills. One hundred seventy Fast ForWord participants took RPI before and after participation. Of these 170 students, 145 (85%) improved their score.

On average, the students' scale scores increased from 471 to 504, which is a statistically significant increase ($t(169)=13.5$, $p< 0.001$). Prior to Fast ForWord use,

the students' average grade-equivalent reading level was 2.6, which was below their average grade level of 3.7. On average, following 165 days of Fast ForWord participation over a 10-month period, the students' grade-equivalent reading level had increased to 3.8, which is an improvement of 1.2 years.

DISCUSSION

On average, between the winter of 2008 and the spring of 2010, the Fast ForWord participants in this study significantly improved their English language arts,

mathematics, and reading skills. Students were evaluated on a variety of assessments including the CST-ELA, the CST-Math, and RPI. Before using Fast ForWord, most of the students were struggling in the areas of English language arts and reading, with scores well below the proficiency criterion or below grade level. The group's initial mathematics performance was stronger, with nearly half of the group scoring above the proficiency criterion.

Study participants showed dramatic improvements on the CSTs, with statistically significant numbers of students moving to higher performance levels in both English language arts and mathematics. The participant group also showed substantial gains in reading skills, with statistically significant improvement on RPI.

These findings demonstrate that an optimal learning environment coupled with a focus on cognitive and early reading skills can help students attain a higher level of language, math, 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 and cognitive skills also provide a critical foundation for academic skills across subjects. After Fast ForWord use, students in this study made significant gains in their English language arts, mathematics, and reading skills. These results replicate other studies and suggest 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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