

Improved Reading and Math Achievement by Students in the Hoke County Schools who used Scientific Learning Products: 2011 - 2012

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ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord® program and the Scientific Learning Reading Assistant™ products on the reading and math achievement of students who used the products within the curriculum in a school setting.

Results: Students with moderate implementations of the Fast ForWord and Reading Assistant products (attendance of at least 70% and at least one product completed), made significantly greater than expected growth on the Reading and Math components of the North Carolina End-of-Grade tests. The students' reading skills were initially well below grade level (on average, the students' skills were at a mid-2nd grade level while the students were enrolled at an early-4th grade level). Four months later, the students' skills had improved by one year, to a mid-3rd grade level.

Study Design & Participants: The design of this study was a multi-school quasi-experimental study using high stakes and nationally-normed assessments. Study participants were elementary, middle, and high school students in the Hoke County Schools of Raeford, North Carolina.

Materials & Implementation: Following staff training on Scientific Learning® products, the students used the Fast ForWord and Reading Assistant products during the 2011-2012 school year and had their reading and math abilities evaluated before and after Fast ForWord participation with the North Carolina End-of-Grade Tests (EOG) and/or Reading Progress Indicator.

Keywords: North Carolina, elementary school, middle school, high school, rural district, quasi-experimental study, Fast ForWord Language Basics, Fast ForWord Language Series, Fast ForWord Literacy Series, Fast ForWord Reading Readiness, Fast ForWord Reading Levels 1 - 5, Scientific Learning Reading Assistant, North Carolina End-of-Grade tests (EOG) , Reading Progress Indicator (RPI).

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).

Further research has demonstrated that the use of an optimal learning environment with a focus on reading and cognitive skills not only benefits the auditory processing and language skills of school

children who have specific language impairments, but can benefit the reading achievement of a wide range of students.

The Hoke County Schools 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 and language achievement of their students. In this study, commercially available computer-based products (Fast ForWord Language Basics, Fast ForWord Language Series, Fast ForWord Literacy Series, Fast ForWord Reading Readiness, Fast ForWord Reading Levels 1 – 5, Scientific Learning Reading Assistant) were used to evaluate the effectiveness of this approach for improving the reading and math achievement of elementary, middle, and high school students.

METHODS

Participants

The Hoke County Schools serve nearly 8,000 students. Approximately 29% of the students in the district are Caucasian, 44% are African American, 13% are Hispanic, and 13% are Native American; 62% of the students are eligible for free or reduced-price lunches, 8% are English language learners, and 13% receive services for Special Education.

During the 2011-2012 school year the Fast ForWord and Reading Assistant products were implemented district-wide at Hoke County's 13 elementary, middle, and high schools.

This study focuses on 2,758 students in the Hoke County Schools who used the Fast ForWord and/or Reading Assistant products for 10 or more days during the 2011-2012 school year. Study participants were in Kindergarten through tenth grade. Before and after using the products, students were assessed with a variety of tests including the North Carolina End-of-Grade tests (EOG) and/or Reading Progress Indicator (RPI). School personnel administered the assessments.

District personnel matched the test scores to product use, and reported the data 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 importance of guided oral reading practice for building reading fluency; 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 the online reporting tool, Scientific Learning® Progress Tracker, to monitor student performance; and techniques for measuring the gains students have achieved after Fast ForWord and Reading Assistant participation.

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.

Scientific Learning Reading Assistant is a computer-based tutor for guided oral reading. Combining advanced speech recognition technology with research-based interventions, Reading Assistant helps elementary and secondary students strengthen their reading fluency, vocabulary and comprehension.

Some of the primary skills developed by these products are outlined 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>.

Primary Skills 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 Basics	•									
Fast ForWord Language v2	•	•	•	•		•			•	
Fast ForWord Language to Reading v2	•		•	•	•	•	•		•	
Fast ForWord Literacy	•	•	•	•	•	•			•	
Fast ForWord Literacy Advanced	•		•	•	•	•	•		•	
Fast ForWord Reading Readiness				•		•	•			
Fast ForWord Reading Level 1					•	•	•	•	•	•
Fast ForWord Reading Level 2					•	•	•	•	•	•
Fast ForWord Reading Level 3						•	•	•	•	•
Fast ForWord Reading Level 4						•	•	•	•	•
Fast ForWord Reading Level 5						•	•	•	•	•
Reading Assistant								•	•	•

Table 1: The Fast ForWord and Reading Assistant products work on numerous cognitive and early reading skills. The primary skills focused on by each product are noted in the table.

Assessments

Before and after using the Scientific Learning products, student reading and math achievement were assessed with a variety of tests including the North Carolina End-of-Grade Tests (EOG) and/or Reading Progress Indicator (RPI).

North Carolina End-of-Grade Tests (EOG): End of Grade exams are North Carolina's high stakes assessment. Administered to students in third through eighth grade, they evaluate a student's reading and math achievement. Scores are available in terms of Scaled Scores and Achievement Levels as well as c-scale scores and growth scores that allow comparisons across grades.

Following North Carolina's ABCs Model, scores from the previous one or two years can be used to determine an "expected" score. Students whose scores match their expected score have growth scores of zero. If a student's score exceeds the expected score, the growth score is positive.

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 scaled scores, achievement levels, c-scale scores and growth scores for the EOG, and in terms of normal curve equivalents, scaled scores, grade equivalent scores, and percentile scores for Reading Progress Indicator. The EOG data were analyzed in terms of growth scores while scaled scores and normal curve equivalents were used to analyze Reading Progress Indicator scores. Data were analyzed using analyses of variance (ANOVA) and one-sample t-test (for the EOG data) and paired t-tests (for the RPI data). 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). Recommended Fast ForWord use is an attendance level of at least 80%, participation of at least 95%, and at least two products completed each year. During the 2011 - 2012 school year, the Hoke County Schools' elementary schools chose to use the 30-Minute and

40-Minute protocols while the middle and high schools used the 30-Minute and 50-Minute protocols. These protocols call for students to use the product for 30, 40, or 50 minutes a day, five days per week for six to sixteen weeks. On average, students had an

attendance level of 72% and a participation level of 93%; 51% of the students completed at least one product while 11% of the students completed two or more products. Detailed product use is shown in Tables 2 & 3.

2011 – 2012 Fast ForWord Product Use						
	Number of Students	Days Participated	Number of Calendar Days	Percent Complete	Participation Level	Attendance Level
Fast ForWord Language Basics	282	31	80	96 %	97 %	69 %
Fast ForWord Language v. 2	754	56	132	62 %	96 %	76 %
Fast ForWord Language to Reading v. 2	327	51	126	55 %	95 %	73 %
Fast ForWord Literacy	220	29	71	60 %	75 %	58 %
Fast ForWord Literacy Advanced	102	19	48	35 %	73 %	55 %
Fast ForWord Reading Prep	728	44	106	81 %	95 %	74 %
Fast ForWord Reading Level 1	519	32	76	79 %	93 %	74 %
Fast ForWord Reading Level 2	498	39	90	71 %	94 %	74 %
Fast ForWord Reading Level 3	831	48	108	60 %	93 %	72 %
Fast ForWord Reading Level 4	258	23	55	52 %	88 %	67 %
Fast ForWord Reading Level 5	74	24	59	16 %	79 %	63 %
Total	2758	66	163	--	93%	72%

Table 2. Product use data showing the number of students who used the Fast ForWord products during the 2011 – 2012 school year for 10 or more days, 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; 51% of the students completed at least one product while 11% completed two or more.

2011 – 2012 Reading Assistant Product Use			
Product	N	Days	Calendar Days
Reading Assistant	437	25	121

Table 3. Reading Assistant product use data for students who used the Reading Assistant products during the 2011 – 2012 school year for 10 or more days. All students who used Reading Assistant software also used the Fast ForWord products.

Assessment Results

End-of-Grade Test (EOG):

In an effort to bring students up to proficiency, North Carolina educators work to improve students' performance each year, relative to their performance the prior year. Using a Growth Model, an Academic Change (Growth) score is calculated based on the student's current and prior score(s). The goal is for students to have a positive Academic Change score where:

$$\text{Academic Change (Growth Score)} = (\text{Current C-Scale score}) - (0.90 \times \text{Average of C-Scale scores from past two years})$$

For students who only have EOG scores from the previous year,

$$\text{Academic Change (Growth Score)} = (\text{Current C-Scale score}) - (0.82 \times \text{Previous Year's C-Scale score})$$

C-Scale scores can be calculated using the statewide mean and standard deviation for the student's grade level:

$$\text{C-Scale score} = (\text{Scaled Score} - \text{Mean}) / \text{Std. Deviation}$$

The mean and standard deviation at each grade are supplied by the North Carolina State Board of Education.

Since growth scores depend upon data from prior administrations of the high stakes tests, the Reading and Math growth scores are only available for students in 4th – 8th grade.

The c-scale scores and growth scores were provided by the district. District personnel initially matched product use to district data by electronically merging the Fast ForWord and Reading Assistant Product Use files with the district's student accountability system. A manual search was made for students who did not initially match but should have been in the system

(those in 3rd grade and above). The district was able to match student scores to product use for 1,638 students. Of those students, 583 had “moderate use” (at last 70% attendance and at least one product completed); of the students with moderate use, 417 had Reading growth scores available and 420 had Math growth scores available. Students with moderate use made statistically significant growth on both their Reading and their Math EOGs ($t(416) = 3.17$; $p < 0.005$ for reading and $t(419) = 2.44$; $p < 0.05$ for math) (Figure 1).

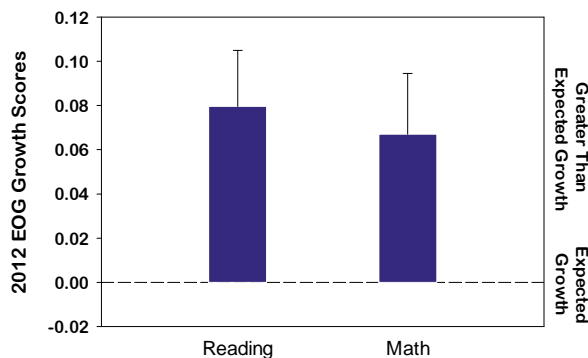


Figure 1. Students with moderate product use made significantly greater than expected growth on both the Reading and Math EOG ($p < 0.05$). A growth score of “0” indicates the student’s 2012 score equaled expectations based upon previous scores. Reading scores represent 417 students; math scores represent 420 students.

An analysis of the relationship between product use and student benefit showed that students who completed more Fast ForWord products received greater benefits with 70% of the students who completed two or more products meeting or exceeding their Reading expected growth scores (Table 4; Figure 2).

	Fast ForWord Products Completed	N	Mean	SE	% Achieving Growth Expectations (Positive Growth)
Reading	1	275	0.045	0.03	54%
	2	125	0.130	0.04	64%
	3+	17	0.275	0.11	81%
Math	1	278	0.053	0.04	55%
	2	125	0.041	0.05	55%
	3+	17	0.24	0.14	65%

Table 4. This table shows the mean growth scores as well as the standard errors for students who had completed 1, 2, or 3 or more Fast ForWord products. On average, students who completed more products had greater growth scores and were more likely to have demonstrated positive growth. In North Carolina, in order to be designated a “High Growth” school, the school must have made its expected growth, and at least 60% of the students must have achieved their growth expectations.

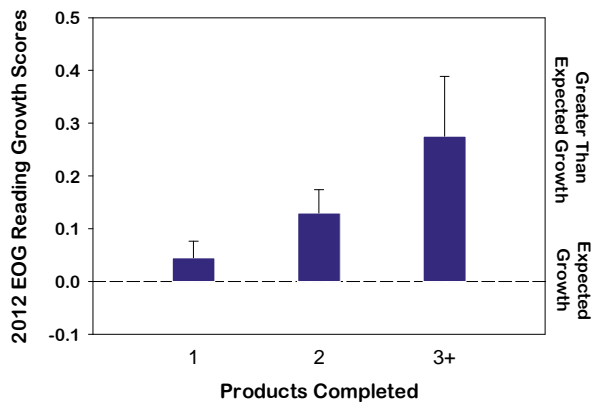


Figure 2. The more Fast ForWord products students completed, the greater the students’ growth. Results represent data from 275 students who completed one product, 125 students who completed two products, and 17 students who completed three or more products.

The positive growth was not limited to students of a specific achievement level. The next analysis investigated the effects of moderate use on students at different initial achievement levels (Table 5).

	n	Mean	SE	t-statistic
Level 1	148	0.092	0.05	1.97†
Level 2	193	0.086	0.03	2.46*
Level 3	74	0.052	0.06	0.93
Level 4	2	NA	NA	NA

Table 5. Positive growth was apparent for students from a variety of different initial achievement levels. (* $p < 0.05$; † $p < 0.10$).

Reading growth scores were available for 1,029 of the 1,638 matched students. A comparison of the 417 students with moderate implementations to the 612 students with weak implementations showed that students with moderate implementations had significantly greater Reading growth ($t(1027) = 3.8$; $p < 0.001$).

Reading Progress Indicator (RPI): In addition to the EOG, RPI was used to evaluate the impact of the Scientific Learning products on students in the Hoke County Schools who used the products during the 2011 – 2012 school year. RPI was administered before and after each Fast ForWord product. Eight hundred ninety students in Kindergarten through 10th grade had pre- and post-participation scores and are included in the RPI evaluation. The students’ average grade level was early-4th grade (4.1), while their skills were at a mid-2nd grade level (2.6). On average, students took the post-test four months after the pre-test and performed at a mid-3rd grade level (3.6). This improvement of 1 year in the four months between

tests was statistically significant ($t(889) = 26.6; p < 0.001$)

DISCUSSION

On average, during the 2011 – 2012 school year, students using Scientific Learning products in the Hoke County Schools significantly improved their reading achievement and skills as well as their math achievement. Students were evaluated on a variety of assessments including the EOG and RPI. Initially, most of the students were struggling: Level 1 and Level 2 on the EOG, and well below grade level on RPI. Despite their history of struggles, the students with moderate use made statistically significant improvements.

There was a statistically significant difference between the growth of students with moderate product use and those without moderate use. In addition, students who completed more Fast ForWord products achieved greater reading gains. These findings demonstrate that, within the Hoke County Schools, an optimal learning environment coupled with a focus on cognitive and early reading skills can help students attain a higher level of academic achievement. However, they also point to the importance of strong implementations and the value of following recommended product use: attendance of at least 80%, participation of at least 95%, and the completion of at least two products per year.

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 using Scientific Learning products, students in the Hoke County Schools made significant gains in their academic achievement. These results replicate other studies and suggest that using the Scientific Learning products strengthened the students' foundational skills and better positioned them to benefit from the classroom curriculum.

Notes:

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