

Improved Academic Achievement by Middle School Students in the Danville Area School District who used Fast ForWord® Products: 2006 – 2009

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ABSTRACT

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

Results: After Fast ForWord participation, students significantly improved their reading and math achievement; the percentage of students with reading performance at or above the Proficient level increased from 29% to 53%, and the percentage of students with math performance at or above the Proficient level increased from 38% to 53%. Longitudinal analyses indicated that the Fast ForWord participants continued to learn at an accelerated rate, with even higher percentages of students testing at or above the Proficient level one and two years later.

Study Design & Participants: The design of this study was a single school observational study using high stakes assessments and/or nationally normed assessments of reading skills. Study participants were middle school students in the Danville Area School District of Danville, Pennsylvania.

Materials & Implementation: Following staff training on the Fast ForWord products, the students used the products and had their reading achievement evaluated each spring with the Pennsylvania System of School Assessment (PSSA). Students reading skills were also evaluated before using the products with Reading Progress Indicator, and again after using each product.

Keywords: Pennsylvania, middle school, rural district, observational study, Fast ForWord Middle & High School, Fast ForWord Literacy, Fast ForWord Literacy Advanced, Fast ForWord Reading Level 2, Fast ForWord Reading Level 3, Fast ForWord Reading Level 4, Fast ForWord Reading Level 5, Pennsylvania System of School Assessment (PSSA), Reading Progress Indicator (RPI).

INTRODUCTION

Neuroscience-based education uses the growing body of evidence that neuroscientists are uncovering as they study learning. Learning involves developing and changing neuronal connections, and then strengthening them through use, much like building a bridge over a river. Once the bridge is built, something new has been

learned and crossing the river becomes effortless. Once the neuronal connections have been built, a person can easily process information using these new connections. Neuroscience-based education promotes strengthening and increasing neuronal connections to increase memory capacity and processing skills.

A great deal of the general structure and function of the brain is set (Medina, 2008). The prefrontal cortex takes care of the executive functions of the

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brain such as problem solving, maintaining attention, and inhibiting emotional impulses. The hippocampus transfers working memory into long-term memory. Regions of the brain involved in language processing store words, sentences, and grammatical concepts. Through fMRIs, scientists can see the physical changes in the brain as learning takes place. In a brain that is working effectively, the different regions of the brain work together to execute the steps necessary for learning to take place.

Throughout their schooling, middle school students attend content-specific classes (i.e. math, science, English/language arts, social studies, and so forth). These classes not only build on earlier content-specific classes, but assume that when students enter the classroom, they enter with the cognitive skills (memory, attention, processing, and sequencing) necessary to learn the content of the course. For example, in algebra, students need to remember simple arithmetic acquired in math classes from previous years. However, their cognitive skills are also critical: students must attend to details as they work through multiple steps; they must process the information in the correct sequence, determining which details are important and which are superfluous. However, research studies have shown that cognitive skills are frequently under-developed in at-risk students thus limiting their academic progress (Barton, 2003; Lyon, 1996).

Most teaching focuses on building content, but some students lack the cognitive skills to be able to acquire and manipulate the content. In the classroom, 80% of instruction is delivered orally (Allen, 2008). Often times, a student with weak oral language skills does not have the attention span or processing abilities to follow a set of oral directions or comprehend a complex sentence. In 1996, studies were first published on the impact of computer software that focused on building learning and cognitive skills in an oral language environment. The software provided an optimal learning environment to build the memory, attention span, processing rate, and sequencing skills critical for academic 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 significant 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 students who have specific language impairments, but can benefit the reading achievement of a wide range of students.

The Danville Area School District was interested in evaluating the effectiveness of an optimal learning environment with a focus on early reading and cognitive skills as a way to improve the academic achievement of their students. In this study, commercially available computer-based products (Fast ForWord Middle & High School, Fast ForWord Literacy, Fast ForWord Literacy Advanced, Fast ForWord Reading Level 2, Fast ForWord Reading Level 3, Fast ForWord Reading Level 4, and Fast ForWord Reading Level 5) were used to evaluate the effectiveness of this approach for improving the academic achievement of middle school students¹.

METHODS

Participants

Danville, Pennsylvania is located in eastern Pennsylvania, 65 miles north of Harrisburg. A rural area, the Danville Area School District spans parts of two counties: Montour County (which includes the Borough of Danville) and Northumberland County. It serves approximately 2,500 students of whom 95% are Caucasian and 16% have Individual Education Plans (IEP's). The school that took part in this study, Danville Area Middle School serves nearly 600 students in 6th, 7th, and 8th grade. Thirty-two percent of the students are eligible for free or reduced-price lunches.

This study focused on students who attended the school and used Fast ForWord products between 2006 and 2009. Study participants were in sixth through eighth grade during Fast ForWord participation, and had Pennsylvania System of School Assessment (PSSA) scores available from before and after participation. School personnel administered the PSSA assessments and reported scores for analysis.

¹ Products used by fewer than five students are not included.

Additional analyses used scores from Reading Progress Indicator – an assessment that was administered prior to students using the Fast ForWord products, and then again after each product was completed. Reading Progress Indicator was first administered in the Danville Area School District in the fall of 2007 and the RPI data included in this report continues through February, 2010.

Implementation

The school designated a full-time Fast ForWord coordinator to lead the program's implementation. In addition, a full-time paraprofessional functioned as a coach, assisting in the program's implementation.

The Fast ForWord coordinator was trained in current and established neuroscience findings on how phonemic awareness and the acoustic properties of speech impact rapid development of language and reading skill. In addition, the Fast ForWord coordinator was trained in 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.

Middle school students who scored basic or below basic on their PSSA assessments in reading and/or math were selected to participate in the Fast ForWord program. For the most part, students who scored Below Basic used Fast ForWord products during the first and third marking periods; students who scored Basic used Fast ForWord products during the second marking period.

Fast ForWord was integrated into the daily curriculum of selected students. That is, Fast ForWord was among one of six different special classes that students took over the course of the

four marking periods that frame the school year. When students were not scheduled for Fast ForWord, they were scheduled for art, music, gym, health, industrial technology, or Family and Consumer Science. At no time did students miss core content classes for participation in the Fast ForWord program (i.e., Math, English/Language Arts, Science, and Social Studies).

Participants received Fast ForWord during a 42 minute class period that met daily for one nine-week marking period. Students followed a 40 minute protocol and were expected to work for the entire period. The lights in the computer lab were dimmed to prevent distractions.

The Fast ForWord coordinator and coach actively conducted interventions when red intervention flags appeared on Progress Tracker, the software's progress monitoring system. Students met with the coach or coordinator in small groups or individually to receive supplemental instruction.

Students who scored proficient on two consecutive benchmark assessments after participating in Fast ForWord were dismissed from the program.

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 in Table 1. More detailed descriptions of the exercises and learning modes within each product can be found online at <http://www.scientificlearning.com>.

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 Middle & High School	•	•	•	•	•	•			•	
Fast ForWord Literacy	•	•	•	•	•	•			•	
Fast ForWord Literacy Advanced	•		•	•	•	•	•		•	
Fast ForWord Reading Level 2					•	•	•	•	•	•
Fast ForWord Reading Level 3						•	•	•	•	•
Fast ForWord Reading Level 4						•	•	•	•	•
Fast ForWord Reading Level 5						•	•	•	•	•

Table 1: The Fast ForWord 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 Fast ForWord participation, student achievement was assessed with the Pennsylvania System of School Assessment (PSSA) and/or Reading Progress Indicator (RPI).

Pennsylvania System of School Assessment (PSSA): The Pennsylvania System of School Assessment (PSSA) is a standards-based criterion-referenced assessment designed to evaluate a student's academic achievement relative to the Pennsylvania state standards. Since the 2005-2006 school year, the assessment has been administered each spring to all students in 3rd – 8th grades. Results are given in terms of a grade-level dependent scaled score and a proficiency level.

Reading Progress Indicator (RPI): Reading Progress Indicator is a nationally-normed 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 score and achievement level for the PSSA and percentile, grade equivalent, and scaled scores for Reading Progress Indicator. The PSSA scores were evaluated in terms of

both scaled scores and achievement level. Scaled scores and normal curve equivalents were used to analyze Reading Progress Indicator scores. Data were analyzed using paired t-tests. 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). Students in the Danville Area Middle School typically used the 40- or 50-Minute Protocols during the 2006 – 2007 and 2008-2009 school years, and used the 90-Minute protocols during the 2007-2008 school year. These protocols call for students to use the product for 40, 50, or 90 minutes a day, five days per week for four to thirteen weeks. Detailed product use is shown in Table 2.

2006 – 2009 Product Use						
	Number of Students	Days Participated	Calendar Days	Percent Complete	Attendance Level	Participation Level
Fast ForWord Middle & High School	91	24	51	84	83	87
Fast ForWord Literacy	107	26	51	86	78	87
Fast ForWord Literacy Advanced	142	34	100	65	80	88
Fast ForWord Reading Level 2	156	21	85	82	78	84
Fast ForWord Reading Level 3	114	22	136	59	75	83
Fast ForWord Reading Level 4	47	24	87	58	75	83
Fast ForWord Reading Level 5	14	24	52	23	83	86
Total	182	108	367	--	76	87

Table 2. Product use data showing the number of students who used the Fast ForWord products during the 2006 – 2009 school years, 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 attendance level, and the participation level. Total values reflect the average total number of days that students used products and the average Attendance and Participation Levels across all products. Note: Students often use multiple products.

Assessment Results

Pennsylvania System of School Assessment (PSSA):

This analysis focuses on students who used Fast ForWord products and had PSSA scores available from before and after participation. Because of the grade-based variations in PSSA scores, students were grouped by grade-level.

Most students at the Danville Area Middle School started using the Fast ForWord products when they were in sixth grade. Therefore, students who were in sixth grade between 2006-2007 and 2008-2009 had fifth grade scores used as pre-test scores, and sixth, seventh, and eighth grade scores used as post-test scores and longitudinal follow-up. Table 3 shows the number of students in each cohort, the average scaled score, and the standard error. Only students who used the products during the 2006-2007 school year currently have data available from two years after

product use, resulting in a smaller cohort. In addition, only 6th grade participants have data available from two years after use since the PSSA Reading and Math tests stop after 8th grade.

The scaled score associated with each achievement level varies by grade and subject. For Math, the minimum score required to demonstrate Proficiency diminishes slightly from 5th grade (1312) to 8th grade (1284). For Reading, it increases slightly from 5th grade (1275) to 8th grade (1280). The minimum score required to reach Basic also varied by grade – for both Math and Reading, between 5th and 8th grade, the cutoff varied by 25 points or less. As is evident in Table 3, students who used Fast ForWord products generally increased their scaled scores with average increases in both Reading and Math scaled scores exceeding 25 points.

initial grade of use		Before		After		n	Before		One Year After		n	Before		Two Years After		
		n	Mean	SE	Mean		SE	Mean	SE	Mean		SE	Mean	SE		
6th	Reading	67	1172	16.6	1240	16.4	45	1182	18.5	1290	19.8	20	1176	38.0	1357	37.5
	Math	67	1276	15.8	1301	17.0	45	1271	19.0	1355	22.7	20	1264	29.6	1348	30.0
7th	Reading	28	1303	21.8	1385	25.3	13	1297	26.9	1489	36.3					
	Math	28	1318	24.6	1369	25.0	13	1280	35.2	1397	28.3					

Table 3. This table shows the average scaled score and the standard error (SE) for the PSSA Reading and Math tests, at each grade. T-tests were used to analyze results from the subtests. Significant improvements were apparent at all time spans for 6th graders in both Reading and Math. Seventh graders showed significant improvements in all time spans in Reading, and after one year in Math.

PSSA scores were also reported in terms of the students' achievement level. Ninety-nine students had scores from before and after Fast ForWord participation; this included 67 students who were in sixth grade at the time of first use, 28 students in seventh grade, and 4 students in eighth grade. Initially

a minority of the students (n=24) were at the Proficient or Advanced achievement level. One year later, this number more than doubled and a majority of the students (n = 51) were Proficient or Advanced. Table 4 shows the Achievement Level before participation (in rows) and after participation (in

columns) with the number in the boxes indicating the number of students who started and ended at each combination of achievement levels. The highlighted boxes indicate students who were at the same level before and after participation. Students above and to the right of the highlighted boxes improved their achievement level. A histogram (Figure 1) shows the groups' performance before and after participation.

Reading		After Participation			
		Below Basic	Basic	Proficient	Advanced
Before Participation	Below Basic	10	12	3	0
	Basic	3	17	19	6
	Proficient	0	5	16	5
	Advanced	0	0	0	3

Table 4. Ninety-nine students had reading achievement levels from before and after participation. The numbers in the highlighted boxes on the diagonal indicate the students who maintained a constant achievement level. Students above and to the right (45%) improved one or more achievement levels.

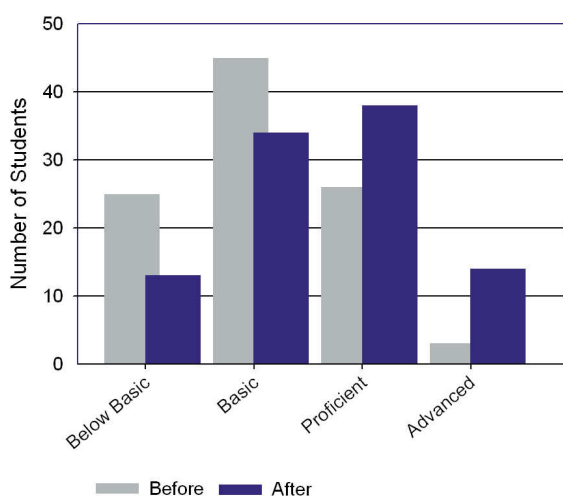


Figure 1. This histogram shows the reading achievement levels of the students before, and after Fast ForWord participation. Results from 99 students are shown here.

Table 5 shows the students' performance one year later – 64% of the students had improved one or more achievement levels and 67% of the group was Proficient or higher (in contrast to 26% prior to Fast ForWord participation.)

Reading		One Year After Initial Participation			
		Below Basic	Basic	Proficient	Advanced
Before Participation	Below Basic	3	6	7	0
	Basic	2	5	16	4
	Proficient	1	2	7	4
	Advanced	0	0	0	1

Table 5. Fifty-eight students had reading achievement levels from before participation and one year later. The numbers in the highlighted boxes on the diagonal indicate the students who maintained a constant achievement level. Students above and to the right (64%) improved one or more achievement levels.

General learning skills are also critical for math. A similar analysis using the PSSA Math results showed improvements in the Math achievement levels (see Table 6 and 7; Figure 2.)

Math		After Participation			
		Below Basic	Basic	Proficient	Advanced
Before Participation	Below Basic	10	5	2	1
	Basic	2	22	18	1
	Proficient	0	8	16	5
	Advanced	0	0	1	8

Table 6. Ninety-nine students had math achievement levels from before and after participation. The numbers in the highlighted boxes on the diagonal indicate the students who maintained a constant achievement level. Students above and to the right (32%) improved one or more achievement levels.

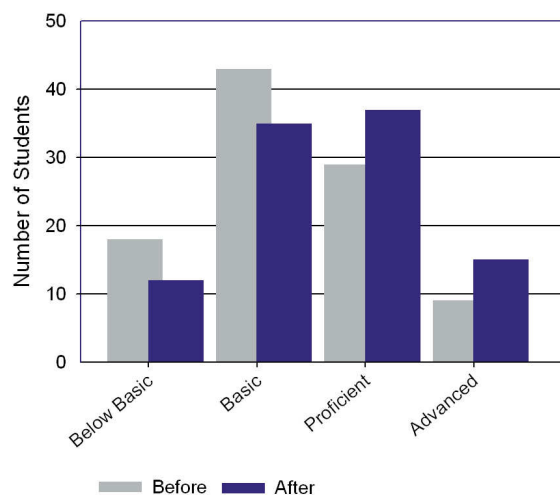


Figure 2. This histogram shows the math achievement levels of the students before, and after Fast ForWord participation. Results from 99 students are shown here.

Math		One Year After Participation			
		Below Basic	Basic	Proficient	Advanced
Before Participation	Below Basic	8	3	18	5
	Basic	0	2	2	1
	Proficient	0	0	10	5
	Advanced	0	0	1	3

Table 7. Fifty-eight students had math achievement levels from before participation and one year later. The numbers in the highlighted boxes on the diagonal indicate the students who maintained a constant achievement level. Students above and to the right (59%) improved one or more achievement levels.

At the two-year follow-up, only 20 students had achievement levels available. All of these students were 6th graders at the time of use. Prior to participation, 25% of them had been Proficient or above on the Reading portion of the PSSA. Two years later, at the end of 8th grade, 80% of them were Proficient or above. Likewise, great improvements were seen on the Math test. As fifth graders, prior to the use of Fast ForWord, 20% of the students were Proficient or above on the PSSA Math test. As eighth graders, the percent of students at the Proficient level or above increased to 70%

Reading Progress Indicator (RPI): In addition to the PSSA, RPI was used to evaluate the impact of the Fast ForWord products on students in the Danville Area School District who used the Fast ForWord products. RPI is administered before Fast ForWord participation and then again after each Fast ForWord product. Reading Progress Indicator was first used by the district in the fall of 2007. Between then and February, 2010, 310 students in second through eighth grade have been tested on RPI two or more times and are included in the following RPI evaluation.

Across all 310 students, the average grade level at the time of their initial test was 6.1, which was slightly higher than their reading level of 5.5. When students were re-tested 5 ½ months later, after using the Fast ForWord products, the students' skills had improved to the 6.3 level, an improvement of eight months (Figure 3). This corresponds to improving from the 27th percentile to the 35th percentile. Most of the students (53%) were initially in the Struggling category (below the 30th percentile). After Fast ForWord participation, the number of students below the 30th percentile dropped by 18%, from 166 students to 136.

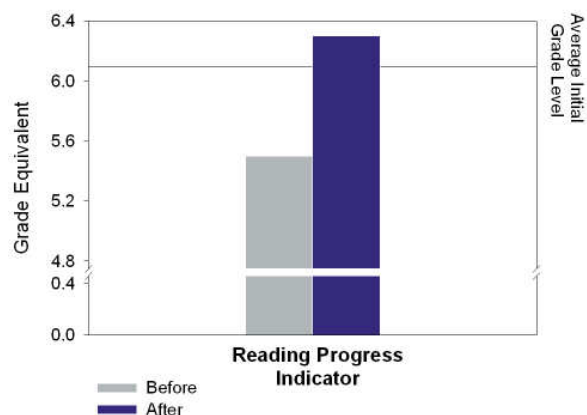


Figure 3. Three hundred ten students were evaluated two or more times with Reading Progress Indicator. On average, there were 5 ½ months between the first and last assessment. Students were initially performing several months below grade level. After using the Fast ForWord products, the students achieved significant improvements in their reading skills, moving towards grade level performance.

DISCUSSION

The Fast ForWord products improve students' cognitive skills including their memory, attention, processing, and sequencing. These skills are used by students in all of their academic classes. The Fast ForWord products develop these skills in a language and reading environment, but the skills are transferable and critical to other academic areas.

On average, during the 2006 – 2009 school years, Fast ForWord participants in the Danville Area School District significantly improved their reading skills and their reading and math achievement. Students were evaluated on the PSSA and RPI. Most of the students were initially struggling, at the Basic or Below Basic level on the PSSA, and at the Struggling level on RPI. Despite the students' history of struggles, the students made improvements in their reading and math achievement with the percentage of Proficient or Advanced level students improving from 29% to 53% on Reading and from 38% to 53% on Math. Those students who were followed from one to two years after initial Fast ForWord participation showed even greater achievement gains, indicating that they maintained an accelerated learning trajectory.

In 2009, after three years of Fast ForWord implementation at the Danville Area Middle School, 90% of the Danville Area School District 8th graders were Proficient or Advanced on the PSSA Reading test and 89% were Proficient or Advanced on the PSSA Math test.

These findings demonstrate that, within the Danville Area School District, an optimal learning environment coupled with a focus on cognitive and early reading skills can help students attain a higher level of academic 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 which, in turn, are critical for strong performances in other academic areas. After Fast ForWord use, students in the Danville Area School District made significant gains in their reading and math achievement. 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.

Notes:

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