Improved Cognitive and Language Skills by Students in the Niagara Falls City School District who used Fast ForWord® Products

MAPS for Learning: Educator Reports, 8(35): 1-6

ABSTRACT

Purpose: This study investigated the effects of the Fast ForWord products on the cognitive and language skills of students who used the products within the curriculum in a school setting. **Study Design:** The design of this study was a multi- school case study using nationally-normed tests of cognition and language. **Participants:** Study participants were 94 students attending elementary or middle schools in the Niagara Falls City School District in Niagara Falls, New York. Students were from a variety of educational settings ranging from general education to self-contained classrooms. **Materials & Implementation:** Following staff training on the Fast ForWord products, students used the products during the 2003 – 2004 school year. Before and after Fast ForWord participation, student performance was evaluated with three assessments that measure early reading skills: Oral and Written Language Scales (OWLS), and two subtests from the Test of Auditory Perceptual Skills (TAPS). **Results:** Overall, after using Fast ForWord products, the students made significant improvements on their cognitive and language skills with the group moving from the low- or below-average range solidly into the average range. Improvements were consistent for students in the different educational settings, and the students receiving special education services. Overall, on each of the three assessments, the students increased their scores between ½ and 1 ½ standard deviations.

Keywords: New York, public, elementary school, middle school, special education, general education, urban district, observational study, Fast ForWord Language, Fast ForWord Language to Reading, Oral and Written Language Scales (OWLS), Test of Auditory Perceptual Skills (TAPS).

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).

The Niagara Falls City School District is interested in guiding students to become lifelong learners capable of achieving quality in all facets of their lives. However, the students struggle with many challenges. Increasingly more students are coming from families with single parents, two working parents, unemployed parents, or teenage parents. And yet, the District believes that all students can succeed. To help the students, the District was interested in evaluating the

effectiveness of an optimal learning environment with a focus on early reading and cognitive skills as a way for improving the cognitive, language and early reading skills of low-performing students in a school setting. In this study, commercially available computer-based products (Fast ForWord Language, Fast ForWord Middle & High School, and Fast ForWord Language to Reading) were used to evaluate the effectiveness of this approach at improving the cognitive, language and early reading skills of students.

METHODS

Participants

The Niagara Falls City School District, an urban district located on the Niagara River between Toronto and Buffalo, serves over 9,000 students in 14 schools. Three of the schools (Harry F. Abate Elementary, Niagara Street Elementary, and Lasalle Middle) set up computer labs for at-risk and struggling students to use Fast ForWord products.

Students were selected to use Fast ForWord products based upon pupil service team and teacher recommendations, and based upon whether the students were receiving services for special education. During the summer of 2003, 52 students used the Fast ForWord products. During the 2003 – 2004 school

year, another 300 students in first through eighth grade used the products. Of those students, 94 took part in a study where their cognitive, language and early reading skills were assessed. Seventy-seven students had assessments from both before and after use of the Fast ForWord products, and had used the products for at least 15 days. Those 77 students are included in this report.

The 77 students were from a variety of educational settings. Fifty-one (66%) were receiving services for special education: 44 in the form of a consultant teacher, and seven within a self-contained classroom. The remaining 26 students were all in general education settings.

Implementation

The Niagara Falls School District's mission is to guarantee educational excellence for every student and to prepare students for successful employment, continuing education, and lifelong learning in an ever-changing world. As such, District personnel were interested in research-based interventions that would benefit their students.

Schools involved in the study setup computer labs dedicated to running the products. Educators were trained in current and established neuroscience findings on how phonemic awareness and the acoustic properties of speech impact rapid development of language and reading skills; the scientific background validating the efficacy of the products; methods for assessment of potential candidates for participation; the selection of appropriate measures for testing and evaluation; effective implementation techniques; approaches for using Progress Tracker reports to monitor student performance; and techniques for measuring the gains students have achieved after they have finished using Fast ForWord products.

Students were monitored during product use by speech teachers, classroom associates, teaching assistants, and classroom special education teachers. Coaches regularly shared student progress and data gathered from assessments with classroom teachers. In turn, classroom teachers used this information to adjust classroom instruction and student work.

Materials

The Fast ForWord Language, Fast ForWord Middle & High School, Fast ForWord Language to Reading, and Fast ForWord to Reading 3 products are computer-based products that combine an optimal learning environment with a focus on early reading and cognitive skills. All were used during the 2003 – 2004 school year; however, only the Fast ForWord Language, Fast ForWord Middle & High School, and

Fast ForWord Language to Reading products were used by students in the study, during the period of the study.

The Fast ForWord Language, Fast ForWord Middle & High School, and Fast ForWord Language to Reading products include five to seven exercises. The exercises are designed to build skills critical for reading and learning, such as auditory processing, memory, attention, and language comprehension. While there are differences between these products, they help develop certain critical skills as detailed in the following exercise descriptions.

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 the different syllable. They must respond when they hear a change in the syllable. These exercises improve auditory processing, develop phoneme discrimination, and increase 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.

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[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.

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. These exercises increase sound processing speed, improve auditory recognition of phonemes and words, and help 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.

Assessments
Students in the Niagara Falls City School District had their cognitive and language skills assessed immediately before and after Fast ForWord participation. The Oral and Written Language Scales (OWLS) and two tests from the Test of Auditory Perceptual Skills were used for the assessments, and were administered by school personnel. After assessing the students, the scores were reported for analyses. The scores reported were age-normed standard scores, where 100 is the mean, and 15 is the standard deviation, independent of students' age.

Oral and Written Language Skills (OWLS): The OWLS is an assessment of receptive and expressive language. It is designed to assess vocabulary and grammar as well as higher-order thinking and the function and structure of language. The Oral Composite, used in this analysis, is an overall composite for the Listening Comprehension and Oral Expression Scales.

Test of Auditory Perceptual Skills (TAPS): The TAPS is a nationally normed assessment that evaluates a student's auditory and/or language skills. The two subtests that were used for this study include Auditory Sentence Memory and Auditory Word Discrimination.

Analysis
All data were reported in terms of standard scores. Data were analyzed using a repeated measures multivariate analysis of variance; t-tests were used for post hoc evaluations. All 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 Fast ForWord Language protocol chosen by the school called for students to use the product for 100 minutes a day, five days a week for four to eight weeks. The Fast ForWord Language to Reading protocol called for students to use the product for 90 minutes a day, 5 days a week for four to eight weeks. Seventy-seven students from the Niagara Falls City School District used the Fast ForWord products as part of the 2003 – 2004 study, had assessment data available from before and after product use, and used the products for at least 15 days.

As part of the study, the students used the Fast ForWord Language or Fast ForWord Middle & High School product and / or the Fast ForWord Language to Reading product. On average, 64 students used the Fast ForWord Language product for 31 days over a period of 3 months. Students completed an average of 54% of the content.   Nine students used Fast ForWord Middle & High School – comparable to the Fast ForWord Language product, but geared towards middle and high school students. Eighteen of the 73 students who used the Fast ForWord Language or Fast ForWord Middle & High School products, and an additional four students who had previously used the Fast ForWord Language product, went on to use the Fast ForWord Language to Reading product during the study. Detailed usage information is shown in Table 1.

Figures 1 - 3 show the average daily progress through the exercises in each product for all the students who had two assessment scores available. The final day shown on each graph 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.

Product	Number of Students	Days Participated	Calendar Days	Percent Complete	Participation Level
Fast ForWord Language	64	31	98	54%	22%
Fast ForWord Middle & High School	9	27	51	51%	35%
Fast ForWord Language to Reading	22	10	21	27%	36%

Table 1. Usage data showing the number of students who used each product. For groups with more than five students, the group averages are shown for the number of days of product use, calendar days between start and finish, the percentage of content covered, and the participation level.
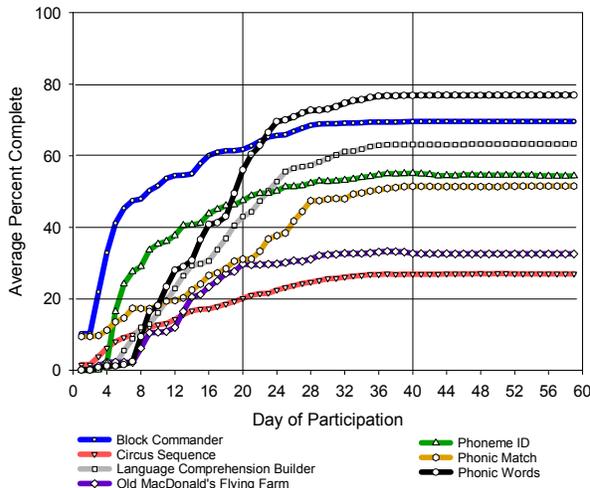
Figure 1. Average daily progress of students through the Fast ForWord Language exercises. Results from 64 students are shown.
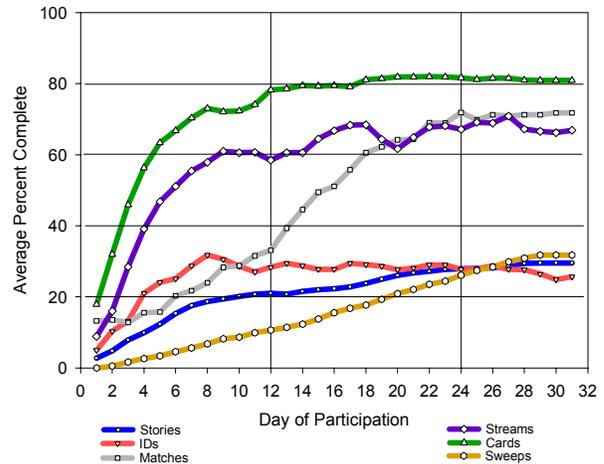
Figure 2. Average daily progress of students through the Fast ForWord Middle and High School exercises. Results from 9 students are shown.
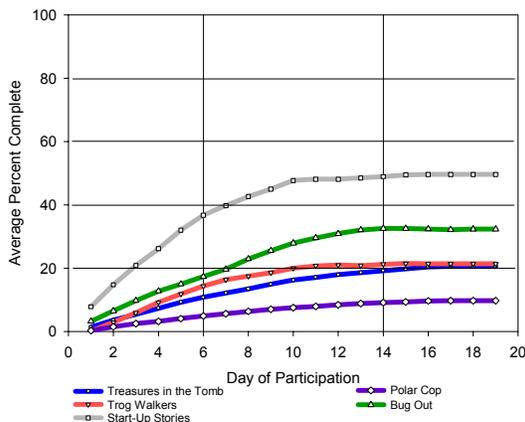
Figure 3. Average daily progress of students through the Fast ForWord Language to Reading exercises. Results from 22 students are shown.

Assessment Results

For the three assessments, student data were reported in terms of standard scores. A repeated measure multivariate analysis of variance (MANOVA) showed that there were significant differences between student performance on the different assessments, as well as between the two administrations of the assessments with scores significantly higher after Fast ForWord participation. There was also a time by test interaction (Table 2).

Post hoc analyses were carried out on the individual assessments. The post hoc analyses demonstrated that the group of students who used Fast ForWord products made significant improvements on all three assessments with the greatest improvements on the TAPS: Auditory Sentence Memory (greater than one standard deviation), and the smallest improvements on the OWLS (greater than one-half standard deviation).

	df	ANOVA-F
Test	75	21.8*
Time	76	243.0*
Test x Time	75	12.0*

*Table 2. Students who used the Fast ForWord products had significant gains in language and auditory skills. There was a significant difference between the students' performance on the various assessments. *p<0.05.*
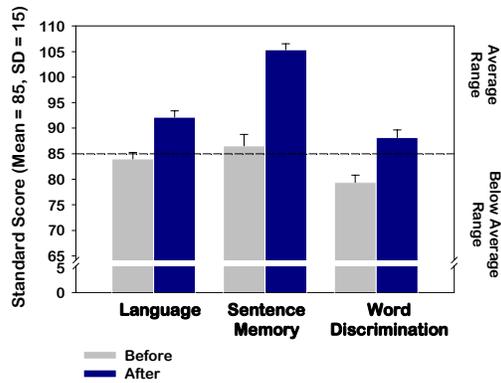
Figure 4. Assessment scores from before and after participation on the Fast ForWord products show that, on average, the students improved their memory skills the most. Overall, students made significant improvements on all three assessments.
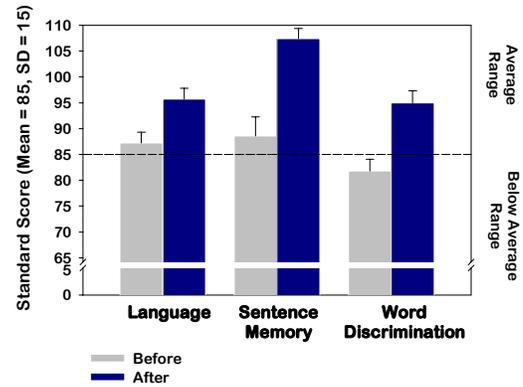
	n	Before		After		
		Mean	SE	Mean	SE	t-statistic
OWLS	77	84.0	1.3	92.1	1.3	8.2*
TAPS: Auditory Sentence Memory	77	86.6	2.2	105.3	1.2	10.1*
TAPS: Auditory Word Discrim.	77	79.4	1.4	88.2	1.5	7.2*

*Table 3. In this post hoc analysis, students, who used Fast ForWord products had significant improvements on tests of language and auditory skills. *p< 0.05*

DISCUSSION

The Niagara Falls City School District used the Fast ForWord products with different populations of students in a variety of educational settings. The effect of student population was investigated within the MANOVA, and it was determined that there were not significant differences between the benefits received by students across the three populations. However, due to the small number of students in self-contained classrooms, the power of this analysis was not strong, and further study may show that some populations benefit more than others. Figures 5 – 7 show the results for students in the general education population, students receiving services of a consultant teacher, and students receiving special education services in the form of self-contained classrooms. As might be expected, there were differences in skill level for the three populations with students in the general education population having the strongest skills, and students in the self-contained classrooms having the weakest. Despite differences in initial skill, all populations showed substantial improvements on measures of cognitive skills (TAPS: Auditory Sentence Memory), listening skills (TAPS: Word Discrimination) and language skills (OWLS).

Figure 5. Assessment scores from before and after participation on the Fast ForWord products show that, on average, 26 students in the general education population improved their language, memory, and auditory discrimination skills.
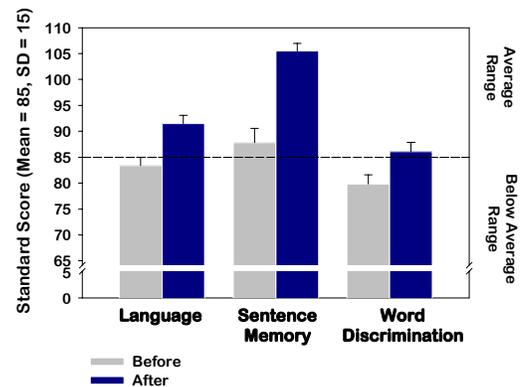
Figure 6. Assessment scores from before and after participation on the Fast ForWord products show that, on average, 44 students receiving services for special education through consultant teachers improved their language, memory, and auditory discrimination skills.
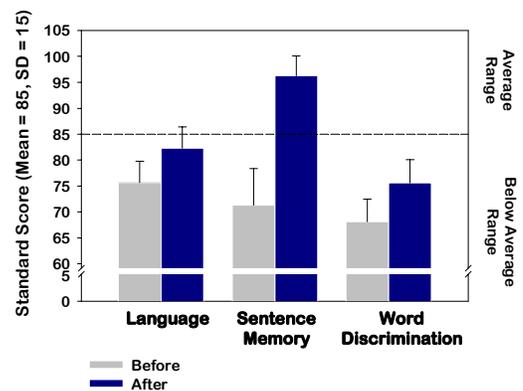
Figure 7. Assessment scores from before and after participation on the Fast ForWord products show that, on average, seven students receiving special education services in a self-contained classrooms improved their language, memory, and auditory discrimination skills.

CONCLUSION

 Strong cognitive and listening skills are critical for all students, impacting their ability to benefit from instruction and participate in class discussions. Cognitive and linguistic skills also provide a critical foundation for building reading and writing skills. Scores from before and after Fast ForWord participation show that, on average, students achieved substantial increases in their cognitive and listening abilities. These improvements were apparent and substantial across all three populations: students in general educational settings, students in self-contained classrooms, and students receiving services through consultant teachers.   On average, the improvements ranged from one-half a standard deviation on language skills to more than one standard deviation on auditory sentence memory skills.

These improvements suggest that using the Fast ForWord products strengthened the students' foundational skills and better positioned the students to take advantage of the academic environment.

 Notes:
To cite this report: Scientific Learning Corporation. (2004). Improved Cognitive and Language Skills by Students in the Niagara Falls City School District who used Fast ForWord Products, MAPS for Learning: Educator Reports, Vol. 8, No. 35: pp. 1-6.

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