

Scientific Learning: Research Highlights

Numerous research studies have been conducted using Scientific Learning software. These studies have included both the Fast ForWord® and the Reading Assistant™ products. Our website, www.scientificlearning.com/results, provides a link or direct access to more than 250 of these studies. Some studies used experimental designs, including the use of random assignment, while others have been case studies*. Some of the studies had a short timeline and have shown that students start reaping the benefits within a few weeks while others have been longitudinal and show that the benefits endure over years. Several studies have been published in major peer-reviewed journals such as Science and the Proceedings of the *National Academy of Sciences* while others have been evaluated by the doctoral dissertation committees of students working towards their doctoral degrees.

In addition to traditional journal-based peer-review, studies on Fast ForWord software have been positively reviewed by the What Works Clearinghouse, established in 2002 by the United States Department of Education as a central and trusted peer-reviewed source of scientific evidence for what works in education (<http://ies.ed.gov/ncee/wwc/>). The Clearinghouse only reviews high-quality studies and has reviewed several studies on the impact of the Fast ForWord products in a variety of topic areas, including Beginning Readers, English Language Learners, and Adolescent Literacy.

The National Center on Intensive Interventions (NCII) is housed at the American Institutes for Research and works in conjunction with many of our nation's most distinguished data-based individualization (DBI) experts. It is funded by the U.S. Department of Education's Office of Special Education Programs (OSEP) and is part of OSEP's Technical Assistance and Dissemination Network (TA&D).

There are also numerous studies where schools or districts independently gather data and request Scientific Learning's assistance on the analysis and reporting. These reports are reviewed for accuracy by educators at the district prior to being shared with others. Some of these schools use the products with students in a specific grade while others target English language learners, students receiving services for Special Education, students who did not score at the proficient level on their high stakes test, or students who are not succeeding in a typical school environment. Across all the studies, data from more than 100,000 students at 1,000 schools has been analyzed and reported. Highlights from a sampling of the studies are included.

These studies demonstrate the effectiveness of the Fast ForWord products, which incorporate brain fitness exercises to improve reading skills, and the Reading Assistant software which targets fluency. They show the impact of the products on diverse populations and in a variety of settings.

* Definitions of Terms

Experimental Design: A two-group study where one group uses the intervention and the other group does not. This type of design allows a comparison between the two groups.

Random Assignment: Students are randomly assigned to the intervention group or the comparison group. By using random assignment, systematic influence of unknown factors (such as after school activities or nutrition) is eliminated and any differences between the improvements of the two groups can be attributed to the intervention.

Case Study: A single group study where all the participants use the intervention and students' skills after the intervention are compared to their skills before the intervention.

Significant Improvement: The improvement was unlikely to have occurred by chance – it was likely due to the intervention. It is typical to use a value of $p < 0.05$, meaning that the probability of that size improvement happening by chance is less than 5%.

Overviews of Selected Studies on the Fast ForWord & Reading Assistant Products

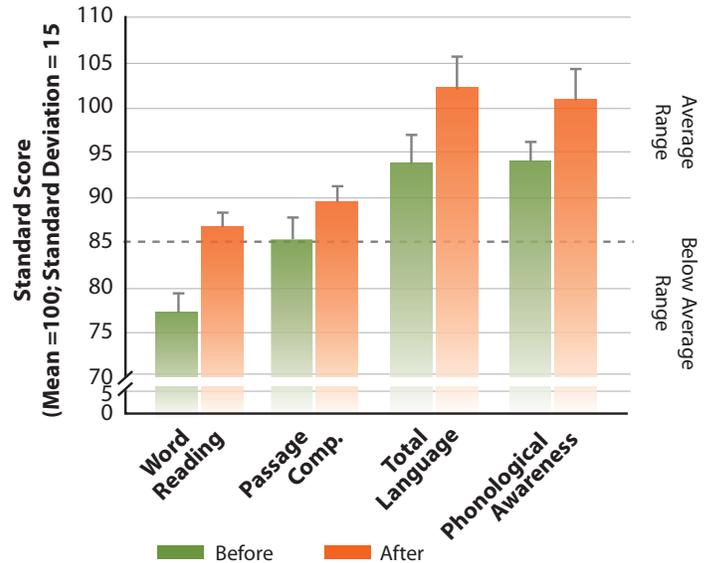
Massachusetts Institute of Technology; Stanford University; Rutgers University; Dartmouth College; Harvard Medical School

fMRI shows that physiological differences in children with dyslexia can be alleviated through remediation

Researchers showed that children with typical reading skills had greater activation in the prefrontal cortex when exposed to rapid transitions than when exposed to slow transitions. Children with dyslexia did not have differentiated activation. Eight weeks of remediation that focused on improved rapid auditory processing and phonological and linguistic training (Fast ForWord) resulted in the children with dyslexia developing differentiated activation to rapid and slow transitions similar to that of children with typical development.

Gaab N, Gabrieli JDE, Deutsch GK, Tallal P, Temple E (2007). Neural correlates of rapid auditory processing are disrupted in children with developmental dyslexia and ameliorated with training: An fMRI study. *Restorative Neurology and Neuroscience*, 25(2007)295-310.

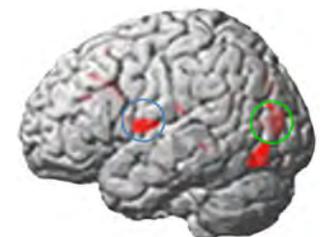
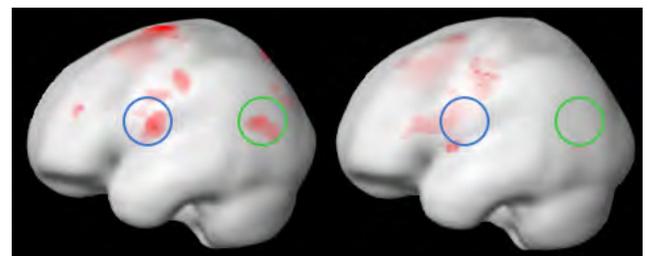
<http://www.scilearn.com/resources/brain-fitness/sound-training-rewires-dyslexic-childrens-brains-for-reading.php>



Stanford University; University of California, Los Angeles; Scientific Learning Corporation; Rutgers University; University of California, San Francisco

fMRI shows differences in cortical activation of children with and without dyslexia are diminished following Fast ForWord participation.

Researchers used fMRI to show that during phonological awareness tasks, the left hemisphere of children with typical development (top left) had more coherent activation in cortical regions critical to reading (circled regions) than children with dyslexia (top right). Following training with the Fast ForWord products, the cortical activation in children with dyslexia (bottom) became more similar to the activation of typically-developing children.



Temple E, Deutsch GK, Poldrack RA, Miller SL, Tallal P, Merzenich MM, Gabrieli JD (2003). Neural deficits in children with dyslexia ameliorated by behavioral remediation: Evidence from functional MRI. *Proceedings of the National Academy of Sciences*, Vol. 100, No. 5: pp. 2860-2865.

<http://www.pnas.org/content/100/5/2860.abstract>

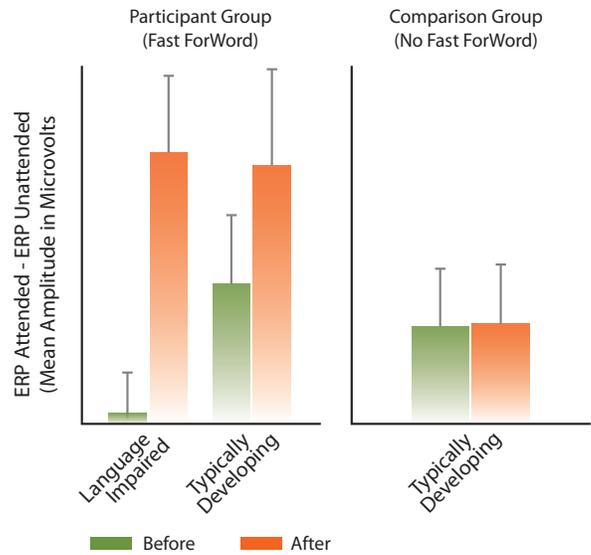
University of Oregon; Saint Lawrence College

Children with and without language impairments improved receptive language and selective attention.

It has been shown that children with specific language impairments are weak in their selective auditory attention skills. In this study, researchers trained children on Fast ForWord for six weeks and found that children both with and without language impairments had improvements in their receptive language scores. These improvements were significantly greater than those of typically developing children who did not use Fast ForWord and were consistent with improvements in selective attention measured through event-related potentials (ERP's).

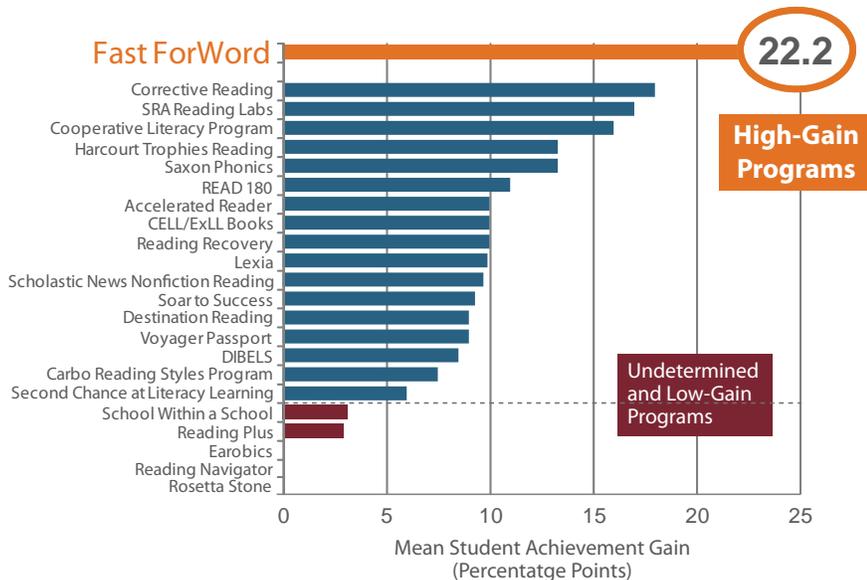
Stevens C, Fanning J, Coch D, Sanders L, Neville H (2008). Neural mechanisms of selective auditory attention are enhanced by computerized training: Electrophysiological evidence from language-impaired and typically developing children. *Brain Research*, 1205:55-69.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2426951/>



Nevada Department of Education and The Leadership and Learning Center:

Fast ForWord is a "High-Gain Program"



The Nevada Department of Education commissioned the Colorado-based Leadership and Learning Center to conduct an in-depth analysis of programs purchased with Nevada State Bill 185 funds. The report concludes that the Fast ForWord products increased student reading achievement by an average of 22.2 percentage points. This was the greatest increase of all the programs reviewed, and qualified Fast ForWord as a "High-Gain Program."

The Nevada Department of Education and The Leadership and Learning Center. (March, 2010). *Innovation and Remediation Interim Report: A Collaborative Project between The Nevada Department of Education and The Leadership and Learning Center*. Englewood, Colorado.

<http://www.scilearn.com/alldocs/cp/research/NevadaDOEBriefing.pdf>

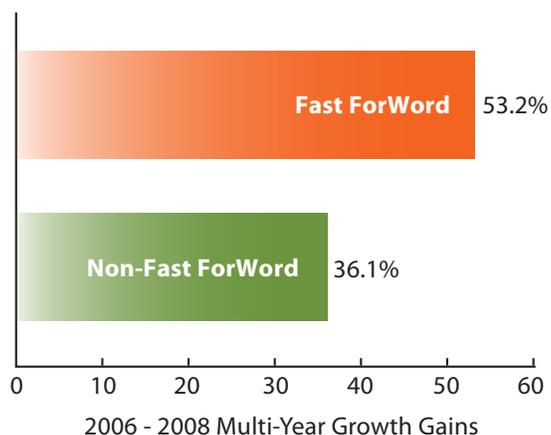
Schultz Center for Teaching and Leadership; Duval County Public Schools, FL

53.2% of Fast ForWord participants made expected gains

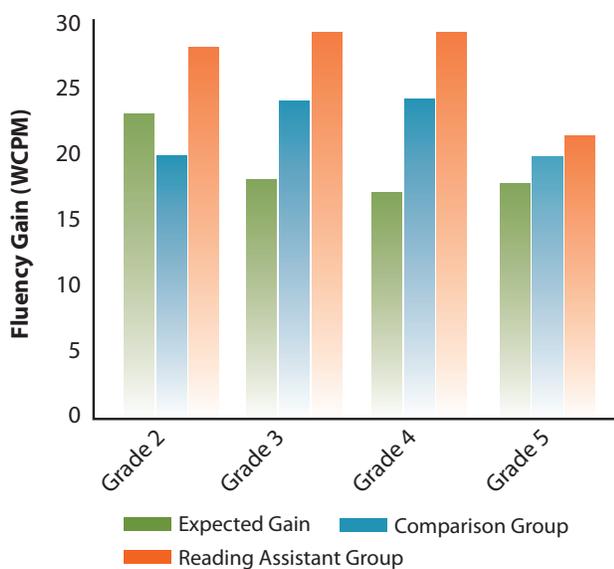
More than 23,000 students in first through twelfth grades in Duval County Public Schools used Fast ForWord products between 2006 and 2008. 5,219 participants had FCAT scores from 2006, 2007, and 2008; 5,010 students served in a comparison group. The FCAT's Annual Learning Gains (ALG) provided the students' expected gains. Cumulative effects showed that in 2008, 970 more Fast ForWord participants had made expected gains than comparison students.

Divine, K.P. & Botkin, D. (2008). A Study of the Longitudinal Effects of Fast ForWord on Student Performance.

<http://www.kpdevaluation.com/assets/fast-forward-longitudinal-impact-study.pdf>



Massachusetts Students Increase Fluency, Outperforming Comparison Group and Exceeding Expectations



Four hundred ten students at two schools in Massachusetts took part in an experimental study evaluating the impact of Reading Assistant software. At one school, second and third graders used the product; at the other school, fourth and fifth graders used the product. Second through fifth graders who did not use the products served as the comparison group. Edformation was used to evaluate students before and after participation. Edformation has a large database of graded passages making it possible to provide expected fluency gains (words correct per minute). On average, students who used Reading Assistant had significantly greater fluency gains than students who received the standard reading curriculum alone, and they exceeded the expected gains at all grade levels.

Adams, M. J. (2006). The promise of automatic speech recognition for fostering literacy growth in children and adults. In M.C. McKenna, L.D. Labbo, R. D. Kieffer, & D. Reinking (Eds.), *International Handbook of Literacy and Technology*, Volume 2. Mahwah, NJ: Lawrence Erlbaum Associates.

<http://www.scilearn.com/alldocs/rsrch/30390RAImpactStudy.pdf>

<http://www.scilearn.com/alldocs/rsrch/30389RASensitivity.pdf>

The National Center on Intensive Intervention (NCII) Reviewed Fast ForWord Studies

NCII reviewed two-group studies showing the impact of interventions on struggling students. The outcomes measures were evaluated for accuracy and importance. The study design was examined in order to determine whether the results could be attributed to the intervention program, rather than extraneous variables. Three studies on the Fast ForWord Language series were included in the review and demonstrated medium to large effect sizes.

Study Information	Study Authors	Miller, Merzenich, Tallal, DeVivo, Linn, et al.	Scientific Learning Corporation	Slattery
	Year Published	1999	2004	2003
	Students	388	50	60
	Study Design	Randomized Control Trial (RCT)	Two-Group, Matched	Randomized Control Trial (RCT)
	Effect Size (Targeted)*	Medium (0.59)	Medium (0.44)	Large (1.44)
	Effect Size (Broader)*	-	Medium (0.51)	Large (1.03)
	Statistically Significant	Yes	No	Yes

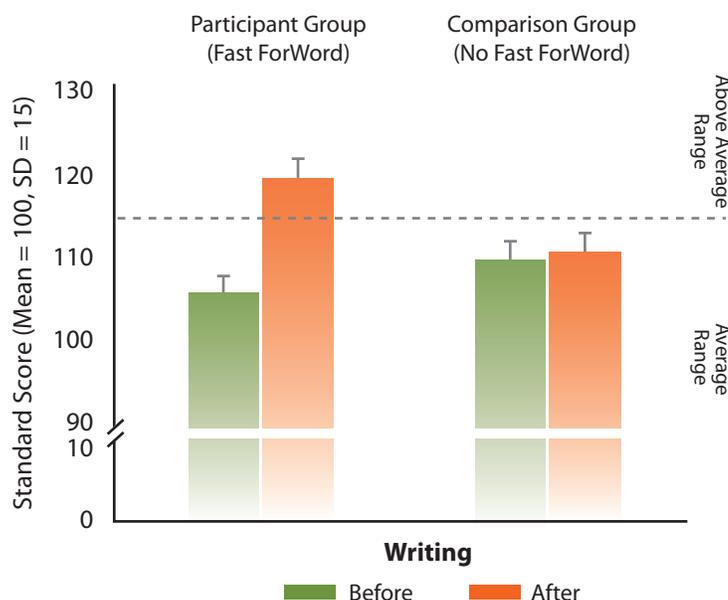
*Ellis, PD, (September 7, 2009). "Thresholds for Interpreting Effect Sizes." In *Thresholds for Interpreting Effect Sizes*. Retrieved from http://www.polyu.edu.hk/mm/sizefaq/thresholds_for_interpreting_effect_sizes2.html.

National Center on Intensive Intervention.

<http://www.intensiveintervention.org/chart/instructional-intervention-tools>.

Wilkes University

Middle school students improve writing skills



Sixth graders were randomly assigned to a group that used the Fast ForWord products or to a comparison group. Students in both groups were evaluated at the beginning and end of the study with the Written Expression component of the Oral and Written Language Scales (OWLS). At the beginning of the study, the students' skills were comparable; two months later, at the end, there was a statistically significant difference between the two groups, with the group that had used the Fast ForWord products improving from the 66th percentile to the 90th percentile.

Rogowsky, B. (2010). *The Impact of Fast ForWord® on Sixth Grade Students' Use of Standard Edited American English*. Doctor of Education dissertation, Wilkes University.

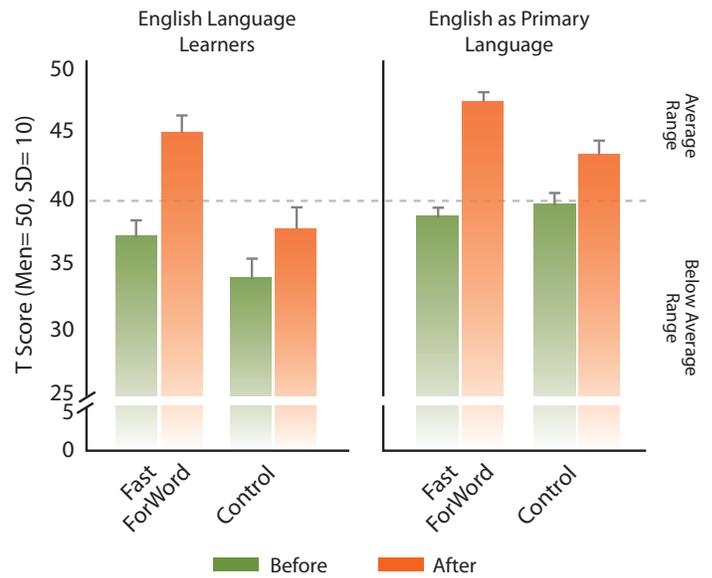
<http://gradworks.umi.com/34/32/3432348.html>

Fast ForWord Language Product Report

Both English language learners and English speakers improve early reading skills

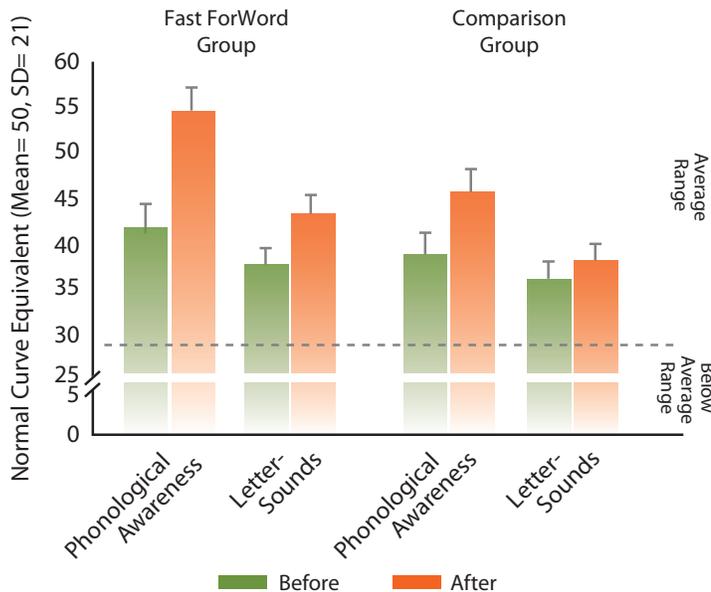
At-risk students in kindergarten through fifth grade were randomly assigned to an experimental group that used the Fast ForWord Language product, or to a comparison group that did not. Of the 452 students in the study, 85 were English language learners. Students were evaluated at the beginning and end of the study with a test of early reading skills, the Test of Auditory Comprehension of Language (TACL). For both the English language learners and the students whose primary language was English, the students who used the Fast ForWord products made significantly greater gains on their early reading skills than the students in the comparison group.

<http://www.scilearn.com/alldocs/rsrch/sbr/30052ffwlanguageprodrpt.pdf>



Fast ForWord Reading Level 1 Product Report

Elementary school students improve phonological awareness and phonics skills



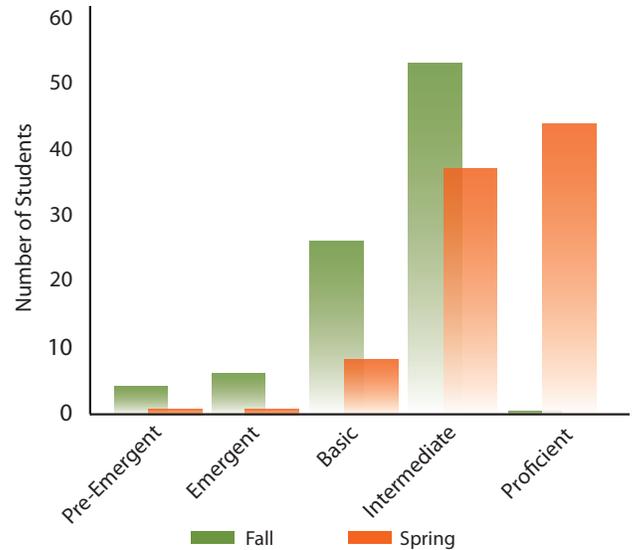
Three districts took part in an evaluation of the Fast ForWord Reading Level 1 product. The 208 first and second graders were randomly assigned to an experimental group that used the product, or a comparison group that did not. The students were evaluated at the beginning and end of the study with the Test of Phonological Awareness (TOPA). Students assigned to use the Fast ForWord Reading Level 1 product made statistically greater gains than the students in the comparison group.

<http://www.scilearn.com/alldocs/rsrch/sbr/30153reading1prodrpt.pdf>

Deer Valley Unified School District, AZ

Improved English skills for students with Limited English Proficiency; 79% improved one or more levels

In the Deer Valley Unified School District, elementary school students with limited English proficiency were assessed with the Arizona English Language Learner Assessment (AZELLA) in the Fall and again in the Spring. Students in the state typically have a difficult time moving beyond the Intermediate level; generally 38% move to Proficient after one year, and 46% move to Proficient after two years. After using the Fast ForWord products, 68% of the Intermediate students reached the Proficient level. In fact, 22% of the students initially at Basic reached Proficient.

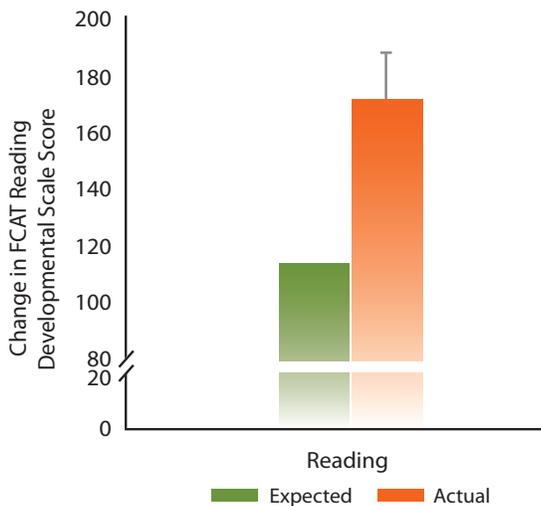


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<http://www.scilearn.com/alldocs/rsrch/sbr/30467deervalleyedurpt.pdf>

Marion County Public Schools, FL

Improved reading achievement for struggling middle and high school students served by ESE Services



Students in sixth through ninth grades were evaluated with the Florida Comprehensive Assessment Test (FCAT). The students were all FCAT Reading Level 1 or 2, and most were eligible for Exceptional Student Education services. In order for students to meet their Annual Learning Gains (ALG), a component of a school's grade, the Florida DOE sets criteria. To make ALG, students in this study needed to improve their achievement level, or improve their Developmental Scale Score, by more than the state-determined expected gain, which varies by grade. Sixty percent of the students made their ALG with an actual improvement of 173 points, which was statistically greater than the expected gain of 115 points that was set by the state.

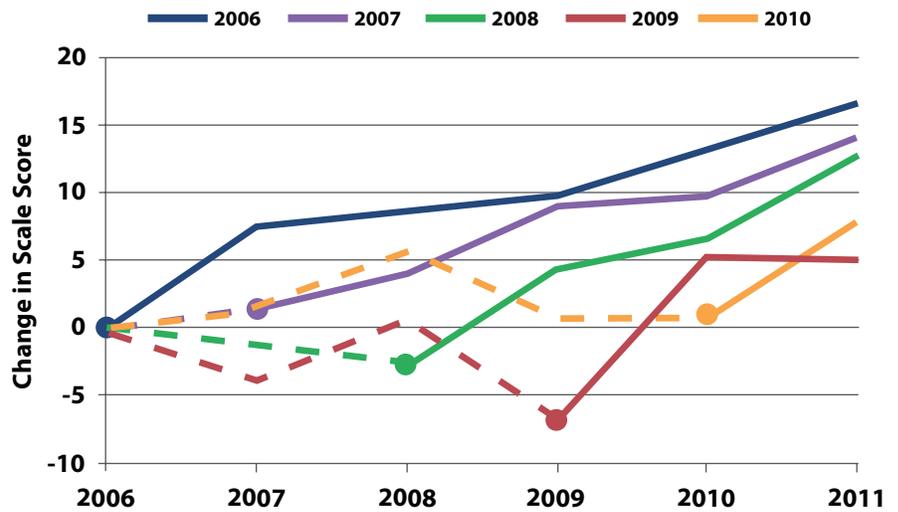
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<http://www.scilearn.com/alldocs/rsrch/sbr/30512marioncoedurpt.pdf>

Clarke County School District, GA

Fast ForWord participants improve academic achievement

Clarke County School District students started using Fast ForWord products during the 2006 - 2007 school year after which the students made, and maintained, improvements on the state's high stakes reading test, the CRCT. The graph shows the change in scores for six groups of students evaluated annually from 2006 to 2011. Each year saw a different group of students starting the Fast ForWord products. The dashed lines show achievement prior to Fast ForWord participation, and the solid lines show achievement following participation. The dot indicates the start of the school year in which Fast ForWord products were first used.

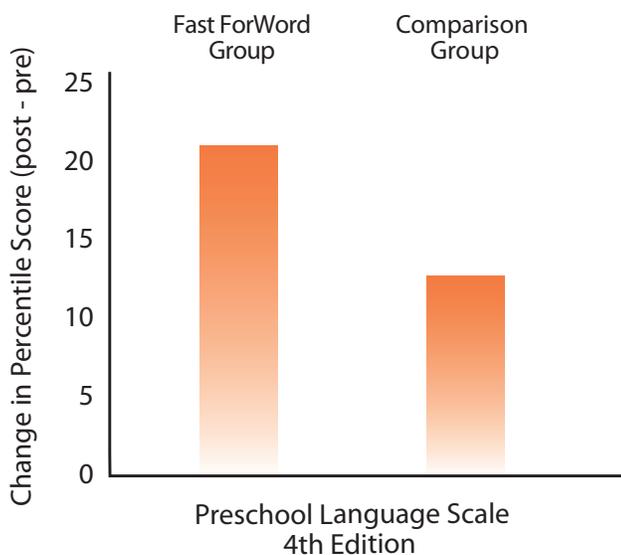


<http://www.scilearn.com/alldocs/rsrch/sbr/30516clarkcoedubrief.pdf>

<http://www.scilearn.com/alldocs/rsrch/sbr/30517clarkecoedurpt.pdf>

Davenport Community Schools, IA

Preschool students improve early literacy skills



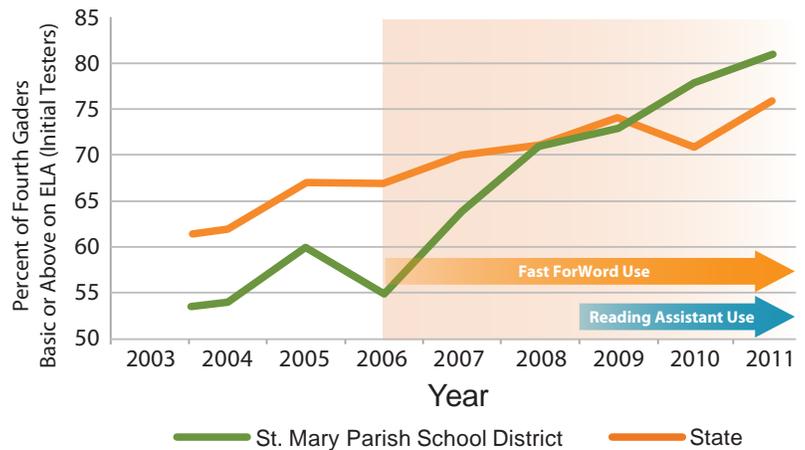
Preschool students, 3 – 5 years of age, were randomly assigned to use the Fast ForWord products or to serve in a comparison group. The early literacy skills of the 592 students were evaluated at the beginning of the study with the Preschool Language Scales, 4th Edition (PLS-4). Students were re-evaluated six months later. The improvement of the Fast ForWord participants was statistically greater than that of the comparison group, with the students moving from the 41st percentile to the 62nd percentile.

<http://www.scilearn.com/alldocs/rsrch/sbr/30528davenportedubrief.pdf>

St. Mary Parish School District, LA

The percentage of proficient students increased from 55% to 81%

St. Mary Parish School District is a rural district in southern Louisiana. The district started using the Fast ForWord products during the 2006 - 2007 school year, with eight elementary schools that were in Academic Assistance, a designation for schools that fail to improve sufficiently. At the start of the 2008 - 2009 school year, for the first time in years, no schools in the district were rated "Academically Unacceptable." The graph shows the increased proficiency of fourth graders on the LEAP, Louisiana's state assessment.

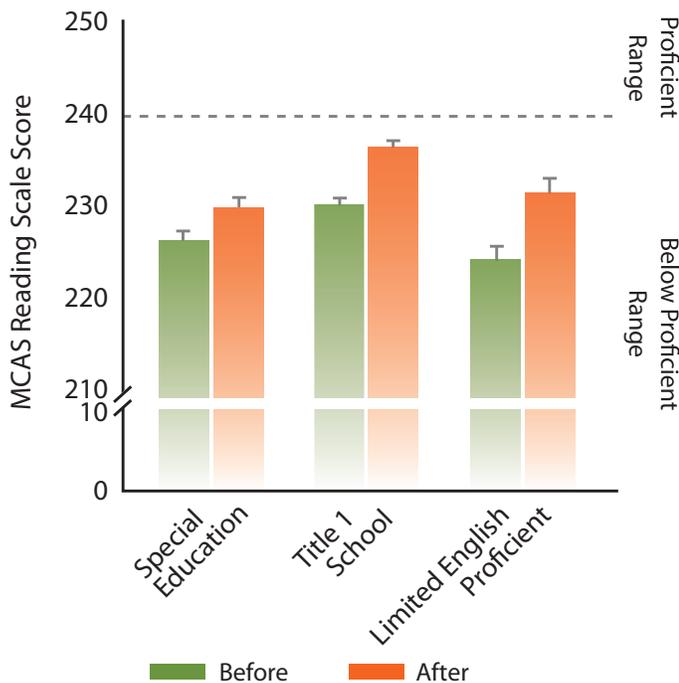


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Everett Public Schools, MA

The percentage of proficient students increased from 23% to 36%



The Everett Public Schools, a small urban district in Massachusetts, has a high number of students who are English language learners (54%) and/or economically disadvantaged (64%). Students are evaluated each spring on the Massachusetts Comprehensive Assessment System (MCAS). Students who used the Fast ForWord products made statistically significant improvements on the MCAS. Those improvements were apparent for a variety of subgroups, including students receiving Special Education services, students attending Title I schools, and students with Limited English Proficiency.

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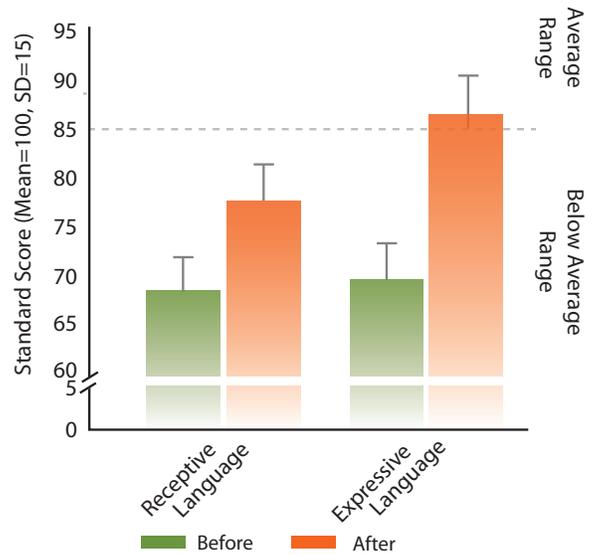
Buffalo Hearing and Speech Center, NY

Students gain 2 years and 7 months in language age

Middle and high school students with emotional or behavioral difficulties who were receiving language intervention services from the Buffalo Hearing and Speech Center participated in this study. On average, after Fast ForWord use, students made significant gains in language skills as measured by the CELF-3. In two months, the students' average language age increased from 8 years, 9 months to 11 years, 4 months.

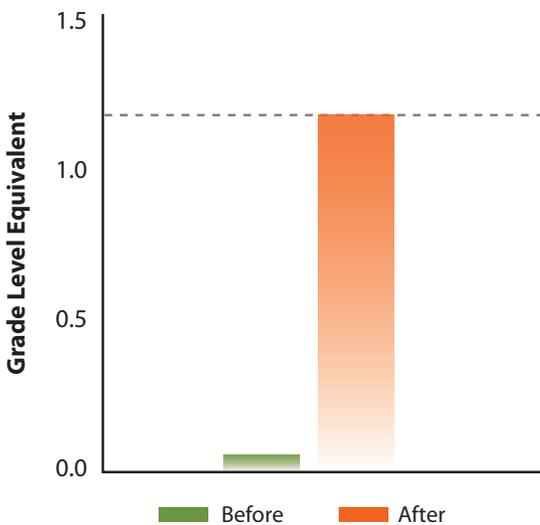
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Hamilton County Department of Education, TN

Struggling first and second graders improve early reading skills by 1 year and 1 month



Hardy Elementary is a school where 99% of the students come from economically-disadvantaged families. A group of first and second graders took part in this study (average grade level of 1.2). At the beginning of the study, the students' reading skills, as measured by Reading Progress Indicator, were at the beginning kindergarten level. Four months later, after using the Fast ForWord products, the students' skills had improved by more than one year and were at the early first grade level.

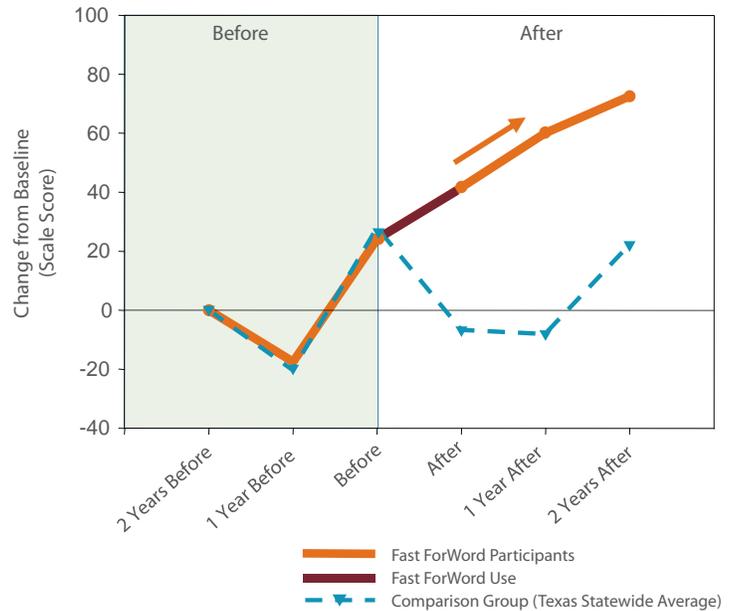
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Dallas Independent School District, TX

Four-year longitudinal study shows improved TAKS scores – achievement gap decreased by 25%

High school students in the Dallas Independent School District used the Fast ForWord products. During the three test administrations prior to Fast ForWord use, participants' TAKS Reading scores moved in the same manner as their statewide peers' scores. After using the Fast ForWord products, the students made significant improvements in their TAKS scores. The Fast ForWord participants initially had an achievement gap of approximately 200 points. After participation, the average decrease in the gap for the 544 students was 25%.

Dallas ISD TAKS Scores

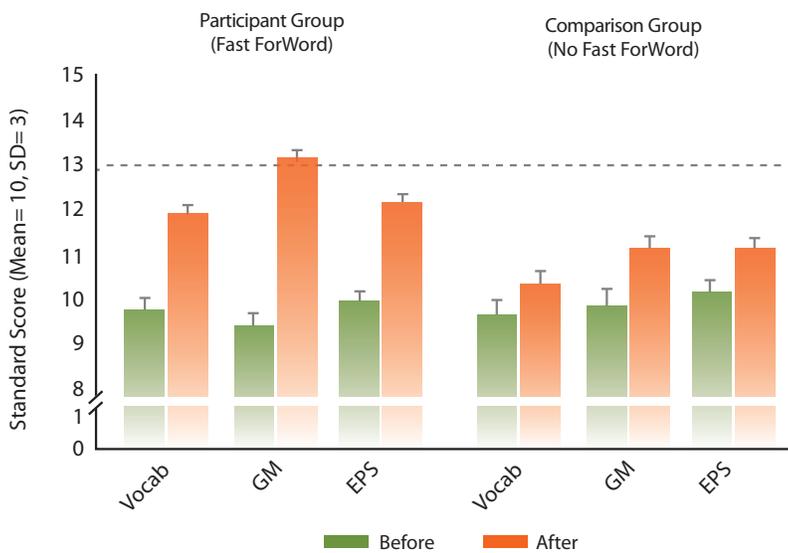


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School District 16, New Brunswick, Canada

Fast ForWord students improve from the 45th to the 81st percentile



Second grade students who used Fast ForWord products significantly outperformed a comparison group on the Test of Auditory Comprehension of Language-Third Edition (TACL-3), a test of early reading skills. For the Fast ForWord group, average gain across subtests was nearly one standard deviation, resulting in Fast ForWord users improving their overall language score from the 45th to the 81st percentile.

<http://www.scilearn.com/alldocs/rsrch/sbr/30267sd16edubrief.pdf>

<http://www.scilearn.com/alldocs/rsrch/sbr/30268sd16edurpt.pdf>