

Improved Reading Skills and Behavior in Primary School Students who Used Fast ForWord® Language at a Singapore Public School

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ABSTRACT

Purpose: This study investigated the use of the Fast ForWord Language product as a reading intervention for students with reading problems alone or with auditory processing disorders (APD) and reading problems. **Study Design:** This study used a pre-test/post-test correlational design to explore the relationship between pre-intervention status (APD or non-APD) and intervention outcomes. A battery of commercially available, standardized or criterion-referenced tests was used to evaluate outcomes. **Participants:** Study participants were poor readers ranging in age from 6.5 to 10 years old, recruited from a public primary school in Singapore. The participants included an equal number of students with APD and without APD. **Materials & Implementation:** Following staff training on the Fast ForWord products, students used the Fast ForWord Language product over a period of 5 weeks. Before and after Fast ForWord Language use, student skills were evaluated with a test battery comprising the SCAN-C Test for Auditory Processing Disorders In Children-Revised, the Phonological Awareness subtest from the Clinical Evaluation of Language Fundamentals-4th Edition, the Test of Word Reading Efficiency, and the Strengths and Difficulties Questionnaire. Repeated measures ANOVAs were used to identify significant performance gains and differences in improvement across the APD and non-APD groups. **Results:** On average, the students who used the Fast ForWord Language product made significant improvements in auditory processing, phonemic awareness, phonological decoding, sight word reading, and attention/conduct as measured by the test battery, with no significant differences between the improvements of the APD and non-APD groups. The improvements on early reading skills were quite substantial: on average, students with auditory processing disorders improving their sight-word reading from around the 13th percentile to the 27th percentile, while students without auditory processing disorders improved from 25th percentile to the 52nd.

Keywords: Singapore, elementary school, primary school, observational study, reading disorder, auditory processing disorder (APD), Fast ForWord Language, SCAN-C Test for Auditory Processing Disorders In Children-Revised, the Phonological Awareness subtest from the Clinical Evaluation of Language Fundamentals-4th Edition (CELF-4), the Test of Word Reading Efficiency (TOWRE), and the Strengths and Difficulties Questionnaire (SDQ).

INTRODUCTION

Early laboratory tests evaluated a prototype of a computer-based product that combines an optimal learning environment with a focus on early reading and cognitive skills. The findings were dramatic improvements in the auditory processing and language skills of elementary school children who had specific language impairments (Merzenich et al, 1996; Tallal et al., 1996) or were at-risk for academic failure (Miller et al., 1999). Researchers at the University of West Australia were interested in evaluating whether there would be a differential response to this approach by poor readers depending on whether they also had auditory processing disorders (APD). Specifically, they wanted to determine whether one group would show greater gains in auditory processing, phonological awareness, word reading skills, and/or psychosocial adjustment

as measured by clinical tests. In this study, a commercially available computer-based product (Fast ForWord Language) was used to evaluate the approach for students with and without APD. The study was carried out by Cheryl Ho, a graduate student at the University of Western Australia under the supervision of Dr. Janet Fletcher, and was reported in Ms. Ho's Honours Thesis. Clinical staff members at the Singapore branch of KidzGrow, a center for children with learning disabilities, provided the expertise on using the Fast ForWord products.

METHODS

Participants

The students who participated in this study were attending a public primary school in Singapore. Among students entering Singapore's public school system, there is a wide variety of home language

backgrounds. Over the past decade the use of English in the home environment has grown but the native languages of Mandarin, Malay or Tamil represent the most common spoken language in many Singapore homes. (Source: Singapore Department of Statistics, 2006).

The 29 students (18 male and 11 female) were poor readers with and without auditory processing disorder (APD). The study involved an analysis of the students' scores from a battery of tests that was administered before and after they used Fast ForWord Language. The students in the study were selected on the basis of being current recipients of academic support through their school's Learning Support Program. All of these students had poor reading abilities. They were then divided into two groups: students with APD (n=15), and students with normal auditory processing (non-APD, n=14). The students ranged in age from 6.5 to 10.0 years, with a median age of 7.5 years. The racial/ethnic balance of the group was 14 Chinese, 14 Malay, and 1 Indian.

Implementation

Lab managers at the school were trained in current and established findings on the neuroscience of 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 product candidates; the selection of appropriate measures for testing and evaluation; effective implementation techniques; approaches for using Progress Tracker reports to monitor student performance; and techniques for measuring the gains students have achieved after they have finished using the product.

Materials

The Fast ForWord Language product is a computer-based product that combines an optimal learning environment with a focus on early reading and cognitive skills. The product includes seven exercises designed to build skills critical for reading and learning, such as auditory processing, memory, attention, and language comprehension.

Circus Sequence: 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: 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. This exercise improves auditory processing, develops phoneme discrimination, and increases sustained and focused attention.

Phoneme Identification: Students hear a target phoneme, and then must identify the identical phoneme when it is presented later. This exercise improves auditory discrimination skills, increases sound processing speed, improves working memory, and helps students identify a specific phoneme.

Phonic Match: 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. This exercise develops auditory word recognition and phoneme discrimination, improves working memory, and increases sound processing speed.

Phonic Words: 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. This exercise increases sound processing speed, improves auditory recognition of phonemes and words, and helps students gain an understanding of word meaning.

Language Comprehension Builder: 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: 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.

Assessments

Before and after using Fast ForWord Language, students' auditory processing abilities were assessed with the SCAN-C Test for Auditory Processing Disorders in Children (SCAN-C; Keith, 1999); their word reading skills were evaluated with the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999); and their phonological awareness was assessed with the Phonological

Awareness subtest of the Clinical Evaluation of Language Fundamentals – 4th Edition (CELF-4; Semel, Wiig, & Secord, 2003). At the same time points, their teachers completed the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), rating each student’s social behavior.

SCAN-C: Test for Auditory Processing Disorders In Children-Revised: SCAN-C is a test for Auditory Processing Disorders in children ages 5-11yrs. The SCAN-C has four subtests: Filtered Words and Auditory Figure Ground are sensitized speech tests in which the test items have been distorted in a specific way to reduce intelligibility; Competing Words and Competing Sentences are dichotic listening tests in which different words or sentences are presented simultaneously, one to each ear.

A single composite standard score, with a mean of 100 and a standard deviation of 15, is reported for the SCAN-C.

Test of Word Reading Efficiency (TOWRE): The TOWRE is a nationally normed measure of word reading accuracy and fluency. The TOWRE contains two subtests: Phonemic Decoding Efficiency measures the ability to “sound out” words, while Sight Word Efficiency measures the ability to accurately recognize familiar words as whole units.

In the United States, the Institute for the Development of Educational Achievement, in accordance with the Reading First

legislation, determined that the TOWRE subtests are appropriate outcome assessments for accurately measuring improvement in the reading fluency skills of children in early elementary school.

Standard scores, with a mean of 100 and a standard deviation of 15, are reported for each of the TOWRE subtests.

Clinical Evaluation of Language Fundamentals-4th Edition (CELF-4): The CELF-4 is a comprehensive language test widely used to measure a student’s overall oral language ability. It comprises core subtests, various composites, and supplemental subtests including Phonological Awareness.

The Phonological Awareness subtest is a criterion-referenced measure, so raw scores are reported along with the percentage of students who met criterion at each testing time point.

The Strengths and Difficulties Questionnaire (SDQ): is a brief behavioral screening questionnaire that asks about 25 attributes, some positive and others negative. The 25 items are divided between 5 scales of 5 items each, generalizing scores for conduct problems, hyperactivity, emotional symptoms, peer problems, and prosocial behavior; all but the last are summed to generate a total difficulties score.

The SDQ is a criterion-referenced measure, so raw difficulties scores are reported. Scores between 0-15 are considered to be within the normal range, with scores of 16-19 considered “borderline” and scores of 20-40 considered “abnormal.”

Measure	Group	n	Before using Fast ForWord Language			After using Fast ForWord Language		
			Mean	SD	SE	Mean	SD	SE
SCAN-C: Auditory Processing Composite	APD	15	59.33	8.16	2.11	60.53	7.92	2.04
	Non-APD	14	86.00	1.57	0.42	86.86	1.88	0.50
TOWRE: Sight Word Reading Efficiency	APD	15	82.93	8.80	2.27	90.73	9.44	2.44
	Non-APD	14	90.14	11.06	2.96	100.57	11.18	2.99
TOWRE: Phonemic Decoding Efficiency	APD	15	80.47	10.82	2.79	94.00	9.19	2.37
	Non-APD	14	89.00	15.55	4.16	101.57	13.10	3.50
CELF-4: Phonological Awareness	APD	15	29.00	8.03	2.07	40.00	9.33	2.41
	Non-APD	14	41.00	7.44	1.99	53.07	5.92	1.58
SDQ: Total Difficulties Score	APD	15	10.87	4.50	1.16	5.60	2.72	0.70
	Non-APD	14	7.71	3.20	0.86	3.14	1.56	0.42

Table 1. Performance of 29 primary school students, 14 without auditory processing disorder (APD) and 15 with auditory processing disorder (Non-APD), on a battery of clinical tests before and after using Fast ForWord Language.

Analysis

Student achievement was reported in terms of Standard Scores, raw scores, and status relative to criteria. Statistical analyses were done using both Standard Score and raw score values (Standard Scores were used whenever they were available, because they are based on age-norms).

Group averages for each measure are reported in table 1. Initial screening of the data indicated that there were no outliers and the distributions were approximately normal.

T-tests were conducted on the pre-test data to identify pre-intervention differences between the groups. As expected, the APD group had significantly lower Auditory Processing Composite scores on the SCAN-C than the non-APD group, on average ($t(27) = 12.25, p < .05$). No significant pre-intervention differences were found on the other measures.

The pre-test and post-test data were analyzed with a series of repeated measures ANOVAs, using group (APD vs. Non-APD) as the between-group factor and time (Pre-Fast ForWord use vs. Post-Fast ForWord use) as the repeated measures factor. A p-value of 0.05 was used as the criterion for identifying statistical significance.

RESULTS

Assessment Results

SCAN-C

Standard Scores for the SCAN-C Auditory Processing Composite were reported for all study students before and after using Fast ForWord Language (Table 1). A repeated measures ANOVA showed significant main effects of time and group, but no significant interaction between group and time (Table 2).

	ANOVA	
	df	f
time	27	22.91*
group	27	146.90*
time x group	27	0.64

Table 2. An ANOVA showed that students who used the Fast ForWord Language product made significant gains on the SCAN-C, with no difference in the gains of students with APD compared to students without APD. * $p < 0.05$.

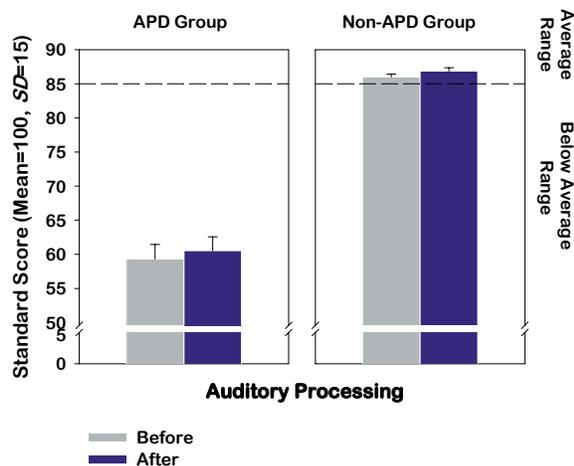


Figure 1. Students with and without APD made small but significant improvements in auditory processing ability following Fast ForWord product use. Results from 29 students are shown.

Qualitative inspection of change scores showed that 60% ($n=9$) of the APD group and 43% ($n=6$) of the non-APD group made gains on the SCAN-C following the intervention, with no students in either group regressing. All of the 15 students in the APD group were classified as having “disordered” auditory processing at pre-test. At post-test, one of those students was reclassified as “borderline.”

TOWRE: Sight Word Reading Efficiency

Standard Scores for Sight Word Reading Efficiency were reported for all study students before and after using Fast ForWord Language (Table 1). A repeated measures ANOVA showed significant main effects of time and group, but no significant interaction between group and time (Table 3).

	ANOVA	
	df	f
time	27	151.15*
group	27	5.33*
time x group	27	3.14

Table 3. An ANOVA showed that students who used the Fast ForWord Language product made significant gains on the Sight Word Reading Efficiency subtest of the TOWRE, with no difference in the gains of students with APD compared to students without APD. * $p < 0.05$.

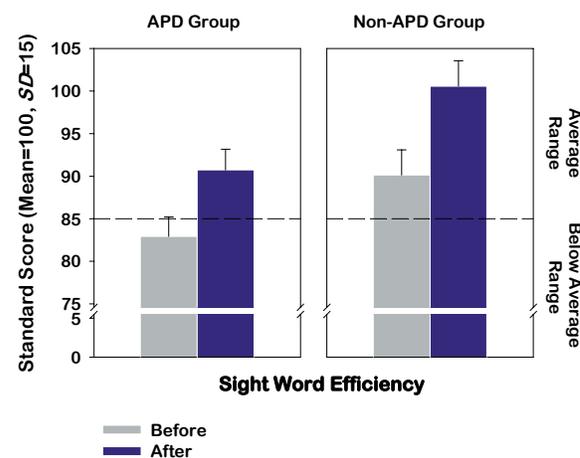


Figure 2. Students with and without APD made significant improvements in sight word reading following Fast ForWord product use. Results from 29 students are shown.

TOWRE: Phonemic Decoding Efficiency

Standard Scores for Phonemic Decoding Efficiency were reported for all study students before and after using Fast ForWord Language (Table 1). A repeated measures ANOVA showed a significant main effect of time, but it did not show either a main effect of group or a

significant interaction between group and time (Table 4).

	ANOVA	
	df	f
time	27	143.40*
group	27	3.28
time x group	27	0.20

Table 4. An ANOVA showed that students who used the Fast ForWord Language product made significant gains on the Phonemic Decoding Efficiency subtest of the TOWRE, with no difference in the gains of students with APD compared to students without APD. * $p < 0.05$.

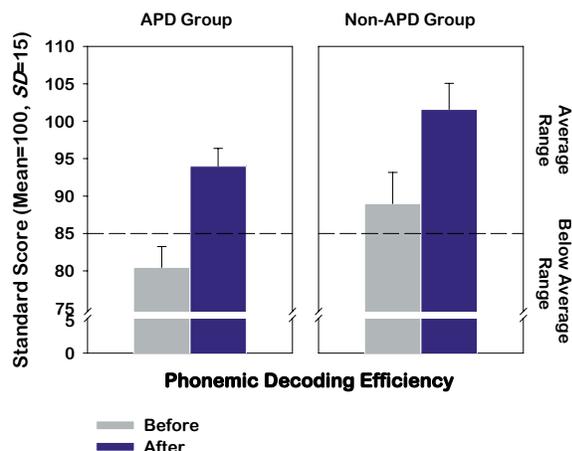


Figure 3. Students with and without APD made significant improvements in phonemic decoding following Fast ForWord product use. Results from 29 students are shown.

CELF-4: Phonological Awareness

Raw Scores for Phonological Awareness were reported for all study students before and after using Fast ForWord Language (Table 1). A repeated measures ANOVA showed significant main effects of time and group, but no significant interaction between group and time (Table 5).

	ANOVA	
	df	f
time	27	326.32*
group	27	19.60*
time x group	27	0.70

Table 5. An ANOVA showed that students who used the Fast ForWord Language product made significant gains on the Phonemic Awareness subtest of the CELF-4, with no difference in the gains of students with APD compared to students without APD. * $p < 0.05$.

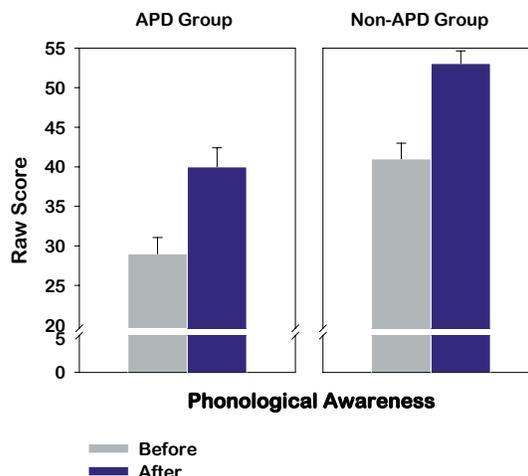


Figure 4. Students with and without APD made significant improvements in phonological awareness following Fast ForWord product use. Results from 29 students are shown.

The percentage of students meeting criterion for phonological awareness rose from 20% (n=3) to 47% (n=7) for the APD group, and from 21% (n=3) to 79% (n=11) for the non-APD group.

Strengths and Difficulties Questionnaire

Raw scores for the Total Difficulties composite of the SDQ were reported for all study students before and after using Fast ForWord Language (Table 1). A repeated measures ANOVA showed significant main effects of time and group, but no significant interaction between group and time (Table 6).

	ANOVA	
	df	f
time	27	73.25*
group	27	7.31*
time x group	27	0.36

Table 6. An ANOVA showed that students who used the Fast ForWord Language product had significantly reduced Total Difficulties scores on the SDQ, with no difference in these improvements for students with APD compared to students without APD. * $p < 0.05$.

Difference scores, showing the reduction in students' scores for social and attentional difficulties, are shown in figure 5.

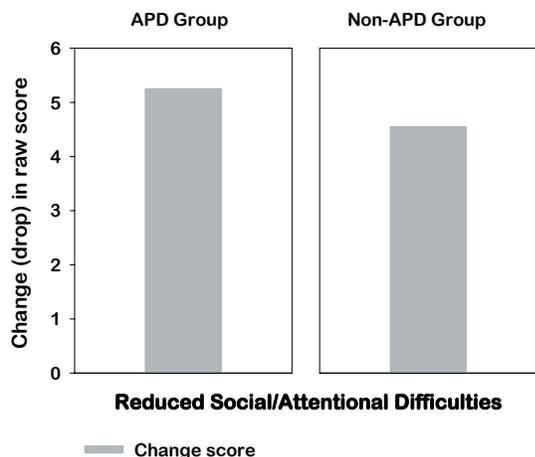


Figure 5. Students with and without APD demonstrated reduced social and attentional difficulties following Fast ForWord product use. Results from 29 students are shown.

Before intervention, 7 APD students and 1 non-APD student were classified as “Abnormal,” based on their Total Difficulties scores. After using Fast ForWord Language, all students were classified as “Normal.”

DISCUSSION

All of the students from a public primary school in Singapore who were selected to participate in this study were receiving academic support and had poor reading skills. In addition, 15 of the 29 were classified as “auditory processing disordered.”

Through their improved assessment scores, these students have shown that they can improve their auditory processing, early reading skills, and social behavior.

Due to practical constraints imposed by the school, this study could not include a control group, so the study was restricted to looking at relative change in the two types of participants. The improvements found were consistent across the two groups with no evidence for differential improvement between the APD and non-APD groups.

Improvements were significant and, in many cases, substantial with reading fluency improving between one-half and one standard deviation corresponding to increases of between 14 and 31 percentile points. An optimal learning environment coupled with a focus on early reading and cognitive skills was followed by significant improvements for both groups of students, as demonstrated by improvements on a test battery.

CONCLUSION

The results found in this study suggest that primary school students with reading difficulties, with and without auditory processing disorders, can show similar gains after using the Fast ForWord Language product in terms of improved auditory processing, basic reading skills, and social behavior.

Notes:

1. To cite this report: Scientific Learning Corporation. (2006). Improved Reading Skills and Behavior in Primary School Students who Used Fast ForWord® Language at a Singapore Public School. MAPS for Learning: Educator Reports, 10(5):1-6.

REFERENCES

- Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A research note. *Journal of Child Psychology, Psychiatry, and Allied Disciplines*, 38 (5), 581-586.
- Ho, Cheryl (2004). *An examination of Fast ForWord language intervention for children with poor reading abilities*. Unpublished honours thesis, School of Psychology, University of Western Australia (2004).
- Keith, R. W. (1999). *SCAN-C: Test for Auditory Processing Disorders in Children—Revised*. San Antonio, TX: The Psychological Corporation.
- Merzenich, M. M., Jenkins, W. M., Johnston, P., Schreiner, C. E., Miller, S. L., & Tallal, P. (1996). Temporal processing deficits of language-learning impaired children ameliorated by training. *Science*, 271, 77-80.
- Miller, S. L., Merzenich, M. M., Tallal, P., DeVivo, K., Linn, N., Pycha, A., Peterson, B. E., Jenkins, W. M. (1999). Fast ForWord Training in Children with Low Reading Performance, *Nederlandse Vereniging voor Lopopedie en Foniatrie: 1999 Jaarcongres Auditieve Vaardigheden en Spraak-taal*. (Proceedings of the 1999 Dutch National Speech-Language Association Meeting).
- Semel, E., Wiig, E. H., & Secord, W. A. (2003). *Clinical Evaluation of Language Fundamentals: Fourth Edition*. San Antonio, TX: The Psychological Corporation.
- Singapore Department of Statistics (2000). *Statistics Singapore: Papers & analyses: Statistical snippets: Languages spoken at home*. Retrieved February 23rd, 2006, from <http://www.singstat.gov.sg/papers/snippets/languages.html>.
- Tallal, P., Miller, S. L., Bedi, G., Byrna, G., Wang, X., Nagarajan, S. S., Schreiner, C., Jenkins, W. M., Merzenich, M. M. (1996). Language comprehension in language-learning impaired children improved with acoustically modified speech. *Science*, 271, 81-84.
- Torgesen, J., Wagner, R., & Rashotte, C. (1999). *Test of Word Reading Efficiency (TOWRE)*. Austin, TX: Pro-Ed, Inc.