EVALUATION AND RESEARCH STUDY

MY READING COACH &

FLRT – A FLUENT READING TRAINER

Year Two Report

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1.0 EXECUTIVE SUMMARY

This report presents the results of a randomized control study of a reading intervention designed to improve literacy levels of both elementary and high school students. The intervention consists of two software programs: *My Reading Coach (*MRC*)*, providing explicit instruction and practice in both phonics and phonemic awareness skills; and FLRT – a *fluent reading trainer (*FLRT*)*, providing instruction and practice in both reading fluency and comprehension.

The data for this study comes from five schools (four elementary schools and one high school) obtained during the 2007-2008 academic year. The report includes both formative and summative assessments to measure the effect of the intervention on both the rate of change in phonics and phonemic awareness skills as well as the change in reading achievement at the end of the school year. Key findings of the present study are that:

- On average, the improvement on phonics and phonemic awareness skills for treatment students was higher compared to control students (statistically significant). Further, the improvement was more rapid for treatment students compared to control students (statistically significant).
- On average, students who completed the intervention had higher gains on five of the six measured reading skills compared to control students and treatment students who did not complete the intervention (statistically significant).
- On average, students designated as English Language Learners (ELL) who completed the intervention had higher gains in spelling achievement scores compared to ELL control students and ELL treatment students who did not complete the intervention (statistically significant).
- For elementary students within the treatment group, there were statistically significant associations between; 1) changes in fluency and comprehension and improvement on five of the six measured reading skills; 2) time spent on the intervention and improvement in reading comprehension; and 3) the number of lessons achieved and improvement in spelling.
- For high school students within the treatment group, the number of lessons achieved was associated with improvement in vocabulary (statistically significant).

- For high school students in the treatment group, there was a trend for higher changes in language scores compared to high school students in the control group.

Details of the study, including excerpts from interviews conducted with high school students in the treatment group, are presented in the remainder of this report.

2.0 BACKGROUND

2.1 Purpose of the Study

The purpose of the present study was to extend findings of previous research on the effects of MRC on the reading skills of elementary and high school students. Early studies with smaller sample sizes and a non-randomized design showed that students using MRC had higher gains in reading performance compared to students who did not use the program. These results were replicated in a multi-state randomized control study of more than 300 elementary students during the 2005-2006 school year.

During the 2006-2007 school year, a randomized control study of over 1,300 struggling readers (i.e., two or more grade levels below their peers in reading achievement) in Grades 1-12 examined both the rate of impact of the intervention on reading skills and the effect on students' reading performance. Across grade-levels, both the rate and overall level of improvement in decoding, spelling, phonics, and phonological awareness skills of students in the treatment group surpassed that of students in the control group. The change in reading performance (i.e., pre-test/post-test) between the groups was mixed.

Public schools in three different school districts in Arizona and Texas were invited to participate in a controlled evaluation research study during the 2007-2008 school year. The study was designed to expand upon the previous research studies, by adding a reading fluency program, FLRT. Each of the districts was familiar with the MRC program, having participated in the research study the previous year. One district declined to participate choosing to use the program with all their students rather than randomly assigning students to treatment and control groups. Four public elementary schools in Arizona and one public high school in Texas agreed to participate in the controlled evaluation research study.

2.2 Research Objectives

The primary goal of the 2007-2008 study was to examine the individual and combined effects of MRC and FLRT on the reading skills of elementary and high school students. In support of this goal, we sought to respond to the following research questions:

1) How quickly do students using MRC acquire decoding and pre-reading skills compared to control students?
2) What are the formative and summative variations in performance between students receiving the intervention and students receiving only the standard school curriculum?
3) What are the factors that contribute to improved reading performance among students in the treatment group?

3.0 Evaluation Approach

A challenge in all evaluation research is to go beyond identifying effective techniques to understanding the conditions under which the techniques are most effective. Unlike randomized studies in controlled laboratory settings, research conducted in the context of the regular school environment must contend with the reality of system constraints. Class scheduling, student absences and student mobility, NCLB, and district testing requirements, are examples of factors that may impact the implementation of an intervention. In addition, assessments that focus solely on student academic performance on discrete reading skills may fail to capture changes in other important skills, for example, changes in how students think and the processes they apply in solving problems.[1]

To balance these issues, we adopted a multi-method multi-measure approach in conducting this study. We incorporated both formative and summative measures to assess both year-end changes in discrete reading skills and to monitor progress during the school year. In addition, we spoke with several high school students in the treatment group to obtain their view on how the intervention affected their reading and overall school experience.

[1] Micari, Light, Calkins,& Streitwieser (2007). Assessment beyond performance: Phenomenography in educational evaluation. *American Journal of Evaluation, 28,* 458-476.

Finally, we took several additional steps designed to either minimize or capture the factors that would impact the study outcomes.

- The study participants from each school were from the same grade level: three schools chose to conduct the study with all Grade 2 students; one school chose all Grade 3 students; the high school chose all Grade 9 students enrolled in a required reading intervention course.
- The intervention was conducted in a separate computer lab setting, administered by teachers trained in the intervention.
- The research team randomly assigned students to a study group (i.e., treatment vs. control).
- The version of the standardized pre-test administered to students was based on the classroom teachers' assessment of students' reading level (low, average, and above) according to the students' performance on past and current school administered assessments. This process minimized the potential for floor and ceiling scoring effects. [2]
- Teachers received ongoing support for effectively using the intervention programs throughout the school year from a certified MindPlay teacher/trainer.
- Measures of weekly student usage of the intervention were recorded.

4.0 METHOD

4.1 Reading Intervention

MRC is a technology-based program that includes 61 computer-based lessons as well as supplemental activities and support materials. The order of the online lessons is based on a model of speech acquisition: sounds are presented based on ease of producing and blending sounds together. MRC instruction begins with sound/symbol association using written letters and emphasizing auditory and visual discrimination skills. Once the letter and its sound are introduced, the student begins a series of advanced phonemic awareness practice activities (e.g.,

[2] Since all High School students were reading below level, the researcher divided the students into reading levels based on the pre-test reading scores (lowest third, middle third and higher third)

drag and drop letters to build words, visual and auditory recognition of words/images, visual and auditory discrimination among multiple words/images). Fluency and comprehension are taught in MRC within the context of grammar and punctuation. Teachers work with students one-on-one or in small groups using offline comprehension exercises, called Expert Sheets, after students master each set of four online lessons. Additional offline supplemental lessons and remediation activities are provided so that teachers can work directly with students having difficulty mastering an online lesson.

FLRT is an online program designed to systematically increase reading speed while ensuring proficient reading comprehension. FLRT provides individualized fluency practice to foster efficient eye movement, eye teaming convergence and efficient left-to-right eye-tracking. Once students have completed the pre-reading activities, they practice reading passages to increase silent reading speed and comprehension. Students are presented with several questions after reading passages to assess comprehension. Reading passages are presented to the student based on his/her current reading rate and advance to more complex passages as the student's reading skills improve.

4.2 Teacher Training and Support

Three separate training sessions were held to accommodate school schedules and to limit the number of attendees in each session. All sessions were conducted by the same trainer, certified by the program developer. Teachers with previous MRC experience as well as new teachers attended the training. The first day of each training session centered on the MRC program. Attendees reviewed the structure of the lessons and activities embedded in the software (e.g., instruction and practice delivered in multiple modalities), learned how to monitor student performance and adjust settings for individual students, and discussed several remediation techniques. The trainer conducted the FLRT training at each school site during the second day, including installation and set up of classes via the internet. The trainer allotted time to dialog with teachers about specific concerns at their site. The trainer visited each site approximately every three weeks throughout the fall semester to observe the teachers/students, to assess how closely teachers were using the program as intended, and to answer questions and provide

direction about using the software. On-going technical support was provided by the program developer as needed throughout the study period.

4.3 Sample

At the beginning of the study, there were 382 elementary and 119 high school students participating. Due to student absences and mobility (e.g., transfers, dropout), the data for this report come from the 412 students enrolled throughout the school year. There were no demographic differences between students who remained in the study and those who left the study (as confirmed by Chi-square tests of equivalence). The sample included more boys (54%) than girls (46%). The majority of the students were elementary students (77% compared to 23% high school students). The sample included students reading below grade level (79%), at/close to grade level (12%), and above grade level (9%). Slightly more than half of the students were in the treatment group (51%) than in the control group (49%). A further breakdown of the characteristics of the students follows.

Gender. There were more boys than girls at both the elementary (53% vs. 47%) and high school level (56% vs. 44%). While students reading below grade level made up the majority of the sample for both elementary and high school, there was a higher percentage of boys at the lower reading level (boys: 81% - Low, 12% - At/close, 7% -High; girls: 78% - Low, 21% - At/close, 11% - High). Slightly less than half of the boys were in the treatment group (49%) whereas 52% of the girls were in the treatment group.

Table 1. Number of Students by Gender

		Grade			Reading level			Treatment	
		2	**3**	**9**	**Low**	**At**	**High**	**No**	**Yes**
Total	412	229	87	96	327	49	36	202	210
Boys	220	123	43	54	177	27	16	111	109
Girls	192	106	44	42	150	22	20	91	101

Ethnicity. The reported ethnicity for the students was as follows: Hispanic (75%), White (13%), Black (8%), Asian (2%), and Other (2%). Ethnicity was missing for two students. There

was diversity in the composition of students at each reading level, in particular, students reading at the lowest level included the majority of students in each ethnic group.

Table 2. Number of Students by Ethnicity

		Grade			Reading level			Treatment	
		2	**3**	**9**	**Low**	**At**	**High**	**No**	**Yes**
Total	410	228	86	96	325	49	36	201	209
White	53	33	17	3	46	5	2	31	22
Black	31	12	6	13	22	4	5	15	16
Hispanic	308	166	62	80	239	40	29	146	162
Asian	7	7	0	0	7	0	0	4	3
Other	11	10	1	0	11	0	0	5	6

English Language Learners (ELL). The sample included a large minority of ELL students (44%). There were more ELL students in elementary schools than in the high school (49% vs. 28%). In addition, more ELL students were reading at the lowest level.

Table 3. Number of ELL and non-ELL Students

		Grade			Reading level			Treatment	
		2	**3**	**9**	**Low**	**At**	**High**	**No**	**Yes**
Total	412	229	87	96	327	49	36	202	210
Non ELL	230	87	74	69	166	31	33	115	115
ELL	182	142	13	27	161	18	3	87	95

Special Education Students (SpEd). The sample included a number of special education students (11%), with the majority of these students in Grade 2.

Table 4. Number of Regular Ed and Special Ed Students

		Grade			Reading level			Treatment	
		2	**3**	**9**	**Low**	**At**	**High**	**No**	**Yes**
Total	412	229	87	96	327	49	36	202	210
Regular	368	197	84	87	290	43	35	185	183
Sp. Ed	44	32	3	9	37	6	1	17	27

4.4 Treatment and Control Group Assignment

Schools provided the research team with the list of participating students. The research team randomly assigned students to either the treatment or control group. Schools were instructed that students were to remain in their assigned group throughout the intervention (i.e., teachers did not transfer students between groups). If a treatment student left the school or was removed from the study, they were not replaced. Teachers were reminded that the techniques and tools accompanying the intervention were not to be used with the control students.

4.5 Intervention Protocol

The prescribed intervention protocol comprises four components:

1. Adequate time and regular usage of the MRC software. The recommended usage for students in Grade 2 is 2-3 hours per week (30 minutes a day / 4 days per week) to complete the 46 lessons needed to obtain the skills required to read at grade level; the recommended usage for students Grade 3 and above is 4-5 hours per week (45 minutes a day / 5 days per week) to complete the 61 lessons needed to obtain the skills required to read at grade level.
2. Scheduled one-on-one and small group teacher / student comprehension exercises. After students master each set of four lessons, teachers are expected to conduct offline comprehension exercises to reinforce learned skills, practice comprehension techniques, and assess student progress. Each exercise takes approximately 15 minutes to complete.
3. One-on-one / small group remediation activities as needed. Students who are unable to master an online lesson may require additional intervention support on specific lessons (e.g., distinguishing between the short vowel sounds “i” and “e”). For these students, teachers are asked to conduct the supplemental offline exercises that accompany the program.
4. Weekly usage of the FLRT software after mastering decoding skills. Once students have successfully completed the word decoding lessons (i.e., Lessons 1-32), one session each week is allocated to FLRT in place of MRC.

4.6 Control Group Protocol

While the treatment group followed the intervention protocol, students in the control group followed the reading program prescribed by their school. The elementary schools used a Four Blocks Literacy Model. During the *Working with Words* block, treatment students followed the intervention protocol while control students continued the regular classroom *Working with Words* instruction for their reading level. High school study students (i.e., both treatment and control) were assigned to a mandatory reading remediation program. While treatment students followed the intervention protocol, control students followed a reading curriculum aimed at the needs of low-achieving disadvantaged students[3] that included teacher-led explicit instruction (e.g., word-attack skills, reading comprehension strategies) and enrichment activities (e. g., daily vocabulary, high-interest reading) as well as online usage of non-study reading programs.

4.7 Measures

In this section we present a description of the measures used to capture quantitative changes in reading achievement.

Reading Analysis & Prescription (*RAPS*). RAPS is an online diagnostic tool that assesses students' phonemic awareness and phonetic skills in the following areas: *Short Vowel Sounds*; *Long Vowels And Diphthongs*; *Consonants And Digraphs*; *Consonant Blends*; *Word Structure* (e.g., every syllable has at least one vowel); and *Rules* (e.g., when to use "c", "k", and "ck"). Control students took three RAPS tests: at the beginning of the school year, mid year, and again at the end of the school year. Treatment students took an initial test before starting the program and each time they mastered a program unit (i.e., after lessons 20, 32, 46 and 61 respectively). RAPS results are used as a formative assessment to monitor progress during the school year.

Metropolitan 8 (Metropolitan Achievement Test). Assessment of reading achievement was determined by the Metropolitan Achievement Tests®, Eighth Edition (MAT 8, Harcourt, 2000). The MAT 8 was selected because it assessed several discrete reading skills (e.g., comprehension, vocabulary, and spelling) and is norm-referenced for students in Grades K-12. In addition, the

[3] Payne, R. K. (2005). *A framework for understanding poverty*. Highlands, TX: Aha! Process Inc.

MAT 8 can be group-administered, making it a less intrusive option for the classroom teacher to administer. MAT 8 results are used as a summative pre-assessment / post-assessment of reading progress.

In addition to the formative and summative assessments, additional measures will be used to consider the association between adherence to the program protocol and student performance within the treatment group.

> ***Improved Fluency and Comprehension.*** FLRT records information on students reading speed and reading comprehension level. To assess improvement in reading fluency and comprehension, we computed a measure of improvement that accounted for changes in both the reading speed and reading comprehension as recorded by the FLRT program. We first computed the starting rate by multiplying the initial reading speed by the initial reading comprehension level. We then computed the ending rate by multiplying final reading speed by final reading comprehension level. Finally, we computed ***Improved Fluency and Comprehension*** as the difference between the ending and starting rate.
>
> ***Treatment Fidelity.*** Two measures were created to assess if students received the full treatment fidelity of the MRC program. The first measure, ***Average Time Per Week,*** measures the average number of minutes per week a student spent online as logged by the MRC software. The second item, ***Lesson Achieved,*** measures the highest number of online lessons reached by each student as recorded by the MRC software.

5.0 FINDINGS

5.1 Effect on Reading Foundation Skills

A phonological model of reading literacy assumes that students must possess competency in several underlying skills to have an adequate foundation for reading at grade level. In this section, we examine the impact of the intervention on discrete phonics and phonemic awareness skills comparing treatment and control students across the school year, using the RAPS online diagnostic tool. RAPS measures competency in six discrete skills. Students achieving a minimum 80% in all areas demonstrate adequate mastery of required reading foundation skills.

Of the 412 students in the study, only 238 of these students completed all three RAPS assessments. Thus, analyses of the RAPS assessments are based on only the data from the 238 students who completed the three assessments.

The average scores on the first RAPS assessment (taken in Fall, 2007) showed that students in the treatment group were at competency level in one skill (i.e., consonants) and approaching competency level in one skill (i.e., structure). Students in the control group were approaching competency level in one skill (i.e., consonants). On average, students in the treatment group scored higher than students in the control group on four skills: Short vowel sounds, consonants, rules, and structure (statistically significant). Thus, we computed difference scores on each of the skills (i.e., differences between each test interval) and compared difference scores to assess improvement.

Comparing the scores from the mid-term RAPS assessment (Winter 2008) to the initial assessment (Fall 2007), we found that the treatment students showed more improvement in three skill areas: *short vowel sounds, consonants,* and *rules*. In addition, treatment students exceeded competency levels in four skill areas: *short vowel sounds, consonants, blends,* and *structure*. In contrast, the control students exceeded competency levels in *consonants* only.

Comparing the scores from the final RAPS assessment (Spring 2008) and the initial assessment (Fall 2007), we found that the improvement in *short vowel sounds, consonants,* and *rules* for treatment students again exceeded the gain of control students. The control students showed more improvement on *structure*. The average structure score for control students was still significantly below the scores of the treatment students, who started the school year with higher scores on this skill.

For ease of readability, we present only the comparison of the results between the initial assessment and the final assessment in Figure 1.

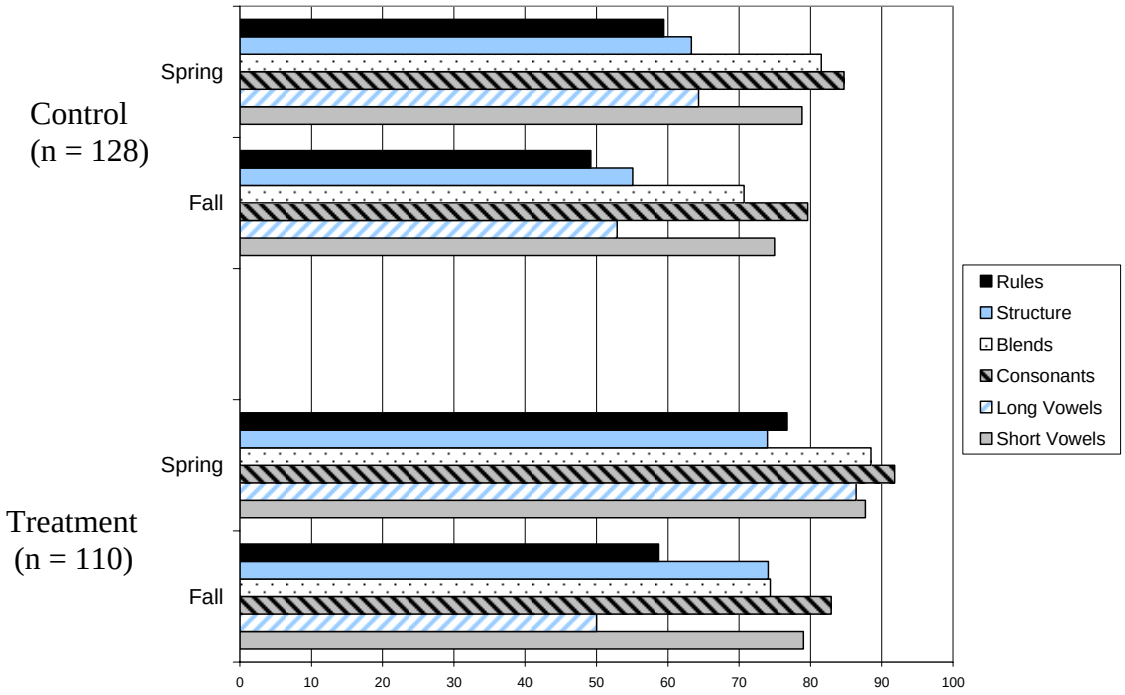

Figure 1. Comparison of Changes in Phonetic and Phonemic Awareness Skills

These results suggest that, on average, by the end of the school year, students in the treatment group were poised for growth in reading achievement whereas students in the control group still had significant gaps in reading foundation skills.

5.2 Rate of Response to Intervention

We then examined the average scores of students in the treatment and control groups at each of the three time points to consider if there were group differences in the rate at which students improved their phonics and phonemic awareness skills. The results are depicted in Figure 2.

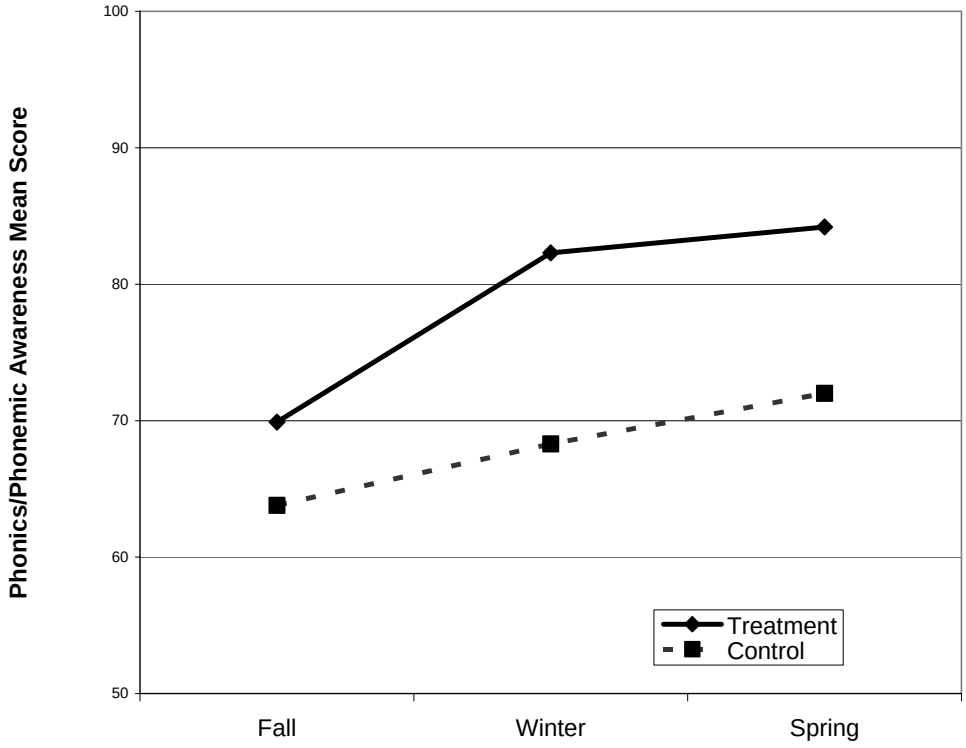

Figure 2. Rate of Change in Phonetic/Phonemic Awareness Skills

Students in the treatment group started out with higher average scores on the fall assessment (average treatment group score 69.9 vs. average control group score 63.8; the difference is statistically significant). The rate of change between fall and winter assessments was greater for the treatment group compared to the control group (average treatment group gain 10.6 vs. average control group gain 4.5; the difference was statistically significant). Although the rate of change between winter and spring assessments was greater for the control group compared to the treatment group (average control group gain 3.6 vs. average treatment group gain .39; the difference was statistically significant), the average score for treatment students at year end is higher than the average score for the control students. Further, despite the treatment students starting out with higher average scores, the gap between the treatment group and the control group nearly doubled by end of the school year (fall gap 6.1 vs. spring gap 11.62).

Overall, these findings suggest that the students in the treatment group improved their phonic and phonemic awareness skills compared to the control group (statistically significant). Further, most of the improvement occurred within the first semester of the school year, when the early program lessons focused on teaching decoding skills in the early lessons.

5.3 Between Group Differences in Summative Assessments

5.3.1 Full Treatment versus Full Control Groups.

In the next set of analyses, we compared the reading achievement differences between students in the treatment and control groups. While these analyses use the available data from all 412 students (treatment = 210 and control = 202), the actual sample size varies by subtest reflecting the specific subtests administered by MAT 8 test level.[4]

First, we computed difference scores on the skills measured by the MAT 8 assessment as the change in students' pre-test and post-test scores (e.g., Fall 2007 to Spring 2008). We then compared the differences between the two groups to estimate the effect of the intervention. In three of the six available measures, there was a trend for the average difference in grade equivalent score to be higher for the treatment group (n = 210) compared to the control group (n = 202). The differences did not reach statistical significance. The results are depicted in Figure 3.

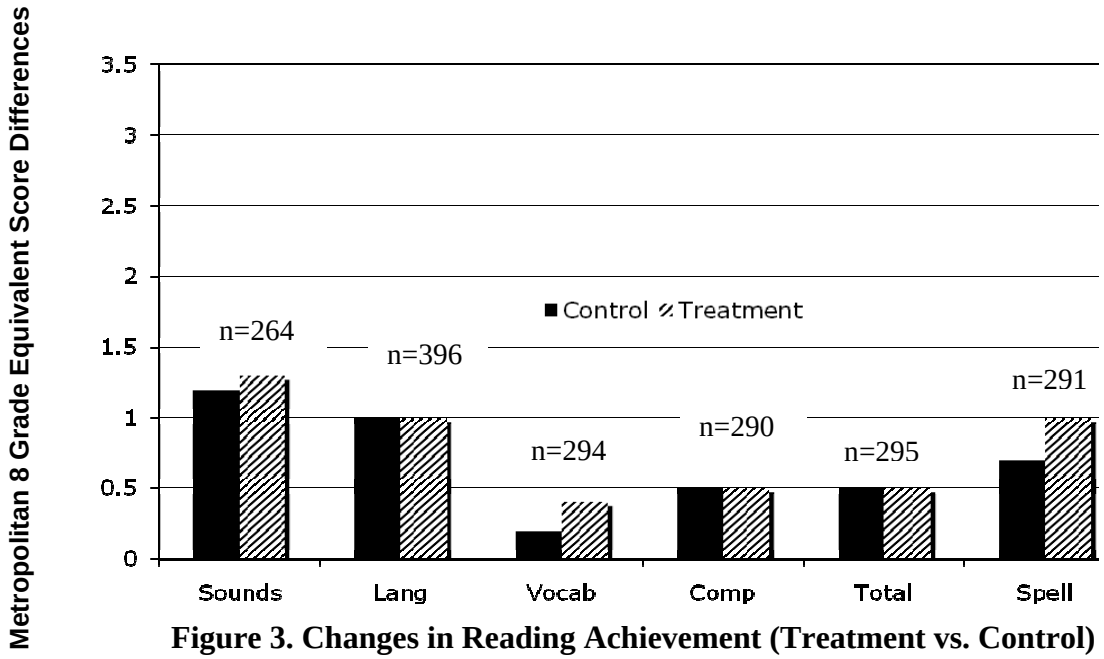

Figure 3. Changes in Reading Achievement (Treatment vs. Control)

[4] Low reading level grade 2 subtests: sounds, language only; all other elementary level subtests: sounds, language, vocabulary, comprehension, total achievement (combined vocabulary and comprehension), spelling; high school level subtests: language, vocabulary, comprehension, total achievement (combined vocabulary and comprehension), spelling.

We explored the lack of significant differences further and found that less than 15% of the treatment students (n=21) received the full treatment (i.e., completed both the MRC program and the FLRT program). We then conducted supplemental one-way ANOVA analyses to examine how treatment fidelity affected reading achievement.

For these analyses, we grouped students into four categories based on the treatment fidelity as follows: control group; low fidelity = treatment students who did not complete MRC or FLRT; medium fidelity = treatment students who completed MRC but not FLRT; and full fidelity = treatment students who completed both MRC and FLRT. [5] These results are depicted in Figure 4.

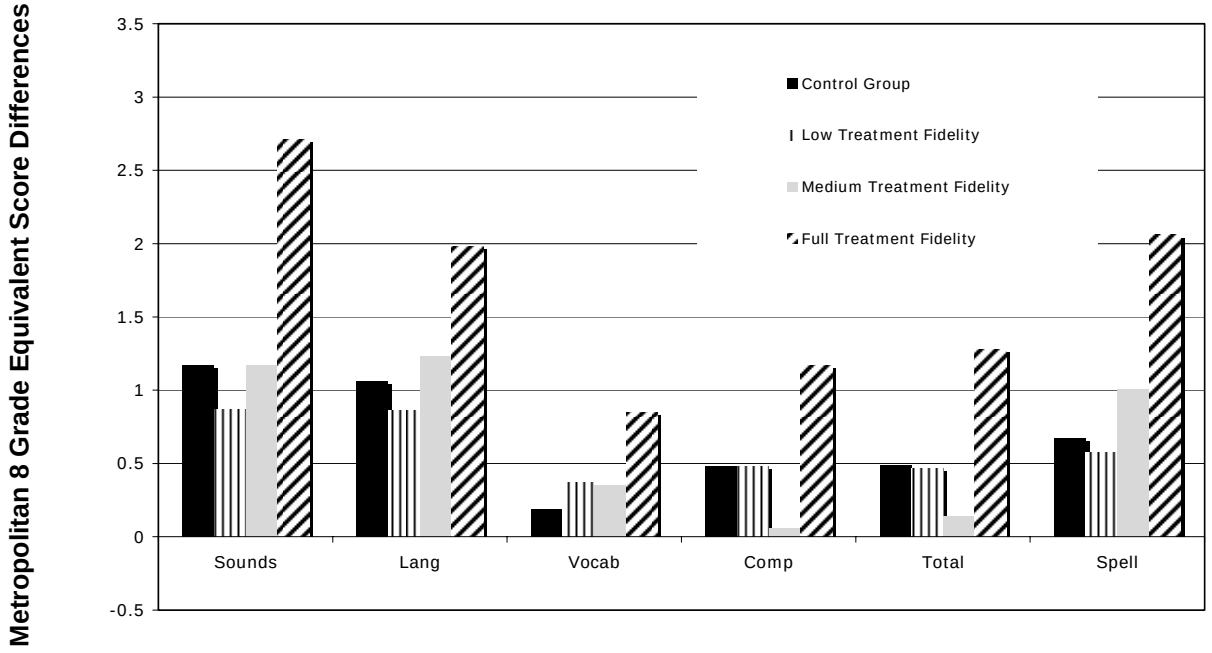

Figure 4. Changes in Reading Achievement By Treatment Fidelity

Notes: Sample size by Group and subtest:
Sounds: Control (n= 130); Low (n=83); Medium (n=9); Full (n=17)
Lang: Control (n= 197); Low (n=102); Medium (n=26); Full (n=20)
Vocab: Control (n= 148); Low (n=61); Medium (n=23); Full (n=18)
Comp: Control (n= 146); Low (n=59); Medium (n=23); Full (n=18)
Total: Control (n= 148); Low (n=62); Medium (n=23); Full (n=18)
Spell: Control (n= 147); Low (n=58); Medium (n=23); Full (n=18)

[5] Students with missing data and students who did not complete a MAT 8 subtest were excluded from analyses. The actual number of cases used for the results are presented in the figures and/or text.

Despite the small sample size, the students who received full treatment fidelity demonstrated statistically significant improvements in five of the six MAT 8 subtests compared to treatment students who did not receive full treatment fidelity and students in the control group. Although the difference in vocabulary scores did not reach statistical significance, the improvement in grade equivalent scores for students who received full treatment fidelity was more than double that of the students in the other treatment groups (.85 vs. .37 and .35) and more than four times that of the control group (.85 vs. .19). These findings suggest that it may be the combination of the two program interventions that results in improved reading achievement: MRC improves reading processing skills and FLRT applies the skills through repeated reading practice.

5.3.2 English Language Learners.

We then considered if the effect of the intervention differed between designated ELL and non-ELL students. Despite the limited number of ELL students who completed the intervention, we repeated the supplemental one-way ANOVA analyses to see if the association between treatment fidelity and reading achievement also existed among the ELL students. As in the previous analysis, we grouped students into four categories based on treatment fidelity as follows: ELL control group; Low fidelity = ELL treatment students who did not complete MRC or FLRT; Medium fidelity = ELL treatment students who completed MRC but not FLRT; and Full fidelity = ELL treatment students who completed both MRC and FLRT. [6] These results are depicted in Figure 5.

[6] Students with missing data and students who did not complete a MAT 8 subtest were excluded from analyses. The actual number of cases used for the results are presented in the figures and/or text.

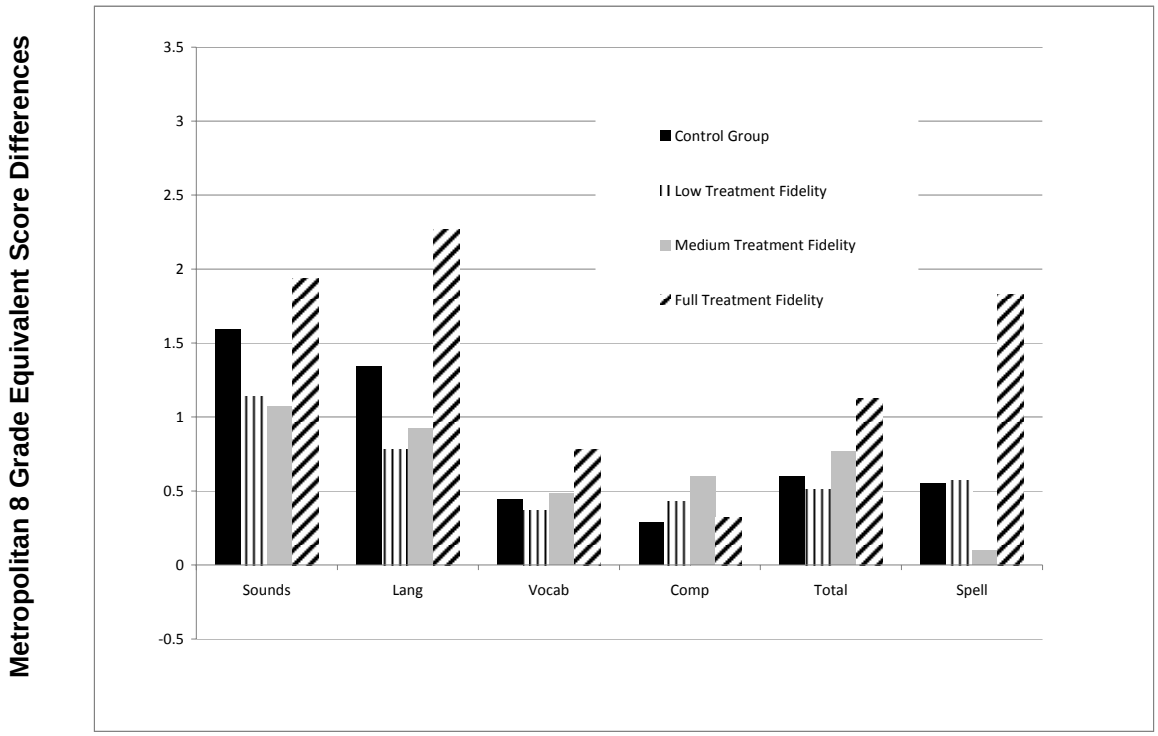

Figure 5. Changes in Reading Achievement of ELL Students By Treatment Fidelity

Notes: Sample size by Group and Subtest:

Sounds:	Control (n= 67); Low (n=50); Medium (n=6); Full (n=8)
Lang:	Control (n= 84); Low (n=61); Medium (n=9); Full (n=10)
Vocab:	Control (n= 53); Low (n=35); Medium (n=6); Full (n=6)
Comp:	Control (n= 52); Low (n=32); Medium (n=6); Full (n=6)
Total:	Control (n= 53); Low (n=35); Medium (n=6); Full (n=6)
Spell:	Control (n= 52); Low (n=31); Medium (n=6); Full (n=7)

ELL students who received the full treatment fidelity demonstrated statistically significant improvements in the spelling subtest of the MAT 8 compared to treatment students who did not receive full treatment fidelity and students in the control group. There was a similar trend in improvement in four of the five remaining skills, although the results did not reach statistical significance. These finding provide some support that the combination of the two program interventions contributes to improved reading achievement for ELL students as well.

5.4 Variations Within The Treatment Group

In the next set of analyses, we examined the factors that affected variations in reading achievement (i.e., changes in pre-test and post-test MAT 8 scores) among students in the treatment group. We began by testing for differences in reading achievement between

elementary and high school students. The average MAT 8 grade equivalent scores at pre-test were significantly higher for high school students than for elementary students (see Table 5).

Table 5. Comparison of Reading Performance at Pre-Test

	Sounds	Language	Vocabulary	Comprehension	Total	Spelling
High school - Pretest GE						
Mean	NA	6.60	6.60	6.50	6.50	6.90
SD	NA	3.10	1.40	2.40	1.20	3.20
Range						
Min	NA	3.50	5.20	4.10	5.30	3.70
Max	NA	9.70	8.00	8.90	7.70	10.10
Elementary - Pretest GE						
Mean	2.20	1.30	2.30	2.30	2.20	2.70
SD	2.60	1.40	1.10	1.30	1.10	1.50
Range						
Min	-0.40	-0.10	1.20	1.00	1.10	1.20
Max	4.80	2.70	3.40	3.60	3.30	4.20

Although the gap in grade level (i.e., 9th grade vs. grades 2-3) may account for the significant differences in pre-test score reading levels, it is important to note that there is a much wider gap between the average reading level and current level for high school students and that of the elementary students. On average, elementary students were at or within one grade level in five reading skills and within two grade levels in language skills. In comparison, high school students were, on average, more than two grade levels below on all skills. Thus, it is possible that the impact of the treatment may differ between the two groups.

To further explore this possibility, we compared the pre-test / post-test difference scores in reading achievement between elementary and high school students. We found that the average difference in MAT 8 grade equivalent scores from pre-test to post-test was significantly higher for elementary students in three skills: vocabulary, total reading achievement, and spelling (see Table 6).

Table 6. Comparison of Change in Reading Performance

High school - Difference GE	Sounds	Language	Vocabulary	Comprehension	Total	Spelling
Mean	NA	0.70	0.10	0.10	0.00	0.60
SD	NA	2.60	1.90	2.30	1.60	2.50
Range						
Min	NA	-1.90	-1.80	-2.20	-1.60	-1.90
Max	NA	3.30	2.00	2.40	1.60	3.10
Elementary - Difference GE						
Mean	1.30	1.20	0.70	0.60	0.80	1.40
SD	2.20	1.50	1.10	1.20	1.00	2.20
Range						
Min	-0.90	-0.30	-0.40	-0.60	-0.20	-0.80
Max	3.50	2.70	1.80	1.80	1.80	3.60

Taken together, these findings suggest that while the elementary treatment students were at-risk for reading failure and in need of prevention support, the reading deficiencies of the high school treatment students required remediation intervention beyond the acquisition of reading skills (e.g., subject area content). For these reasons, remaining analyses were conducted separately for elementary and high school students.

5.4.1 Variations within Elementary Treatment Students.

We began this analysis by examining the association between intervention progress and differences in reading achievement. We divided the treatment students into three levels based on their MRC progress and three groups based on FLRT usage. The three MRC levels were as follows: 1) decoding/ Lessons 1-32 only; 2) syntax, two-syllable words, beginning comprehension/Lessons 33-46; 3) three-syllable words/Lessons 47-61. The three FLRT groups within MRC levels were as follows: 1) no FLRT progress; 2) FLRT progress but has not met goal; 3) met fluency goal at grade level. We then computed the mean difference scores for each category to examine the progress made by each group. For ease of readability, we present a graphical presentation of the results for four core reading skills (i.e., vocabulary, comprehension, total reading achievement, and language) in Figure 6.

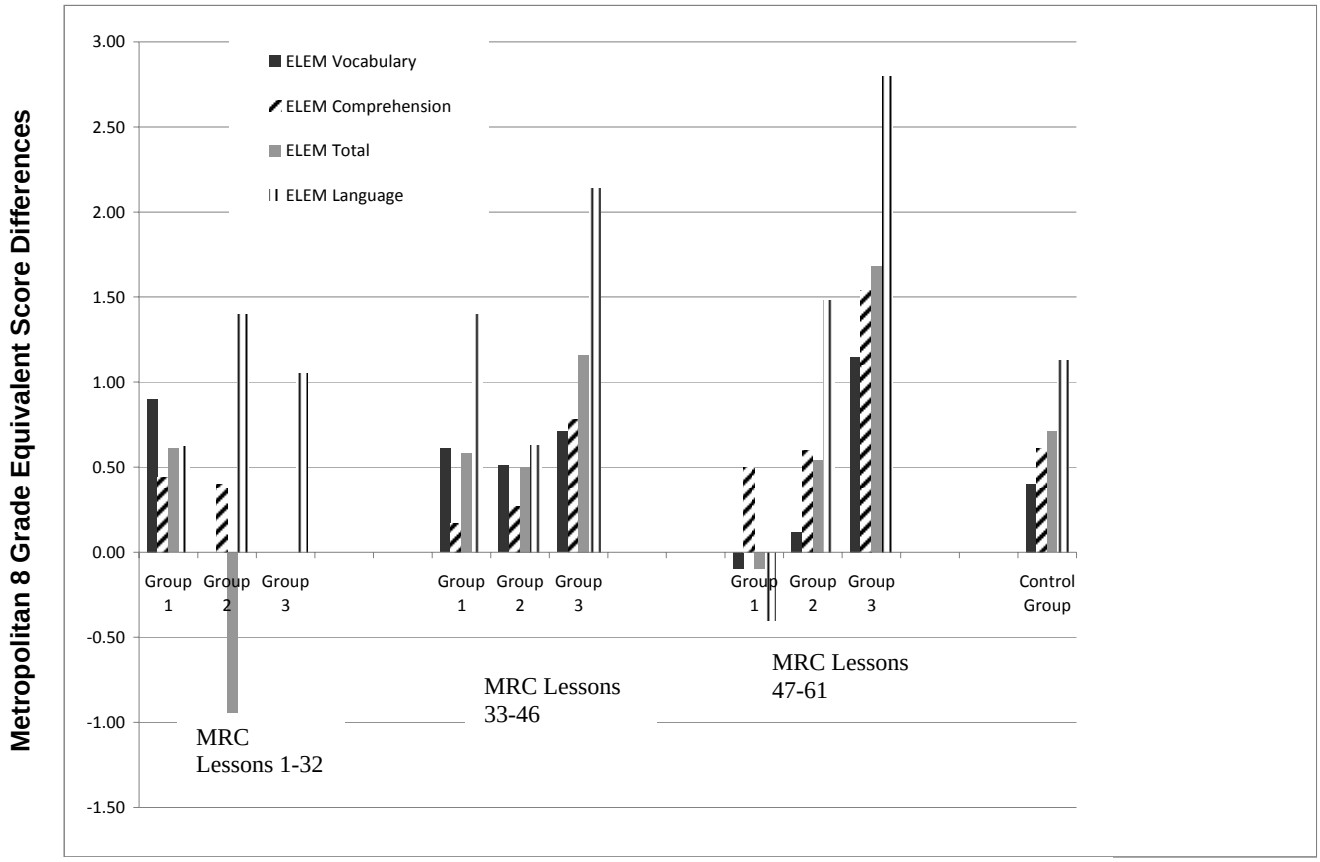

Figure 6. Changes in Reading Scores of Elementary Students as a Function of Intervention Progress

Notes: Group 1 = No FLRT progress
Group 2 = FLRT Progress but has not met goal
Group 3 = Full Treatment MRC and FLRT
Control Group

Students begin working on FLRT after MRC lesson 32, when they have mastered decoding skills. At this point, they are typically reading below grade level and at low reading speeds. The program adjusts the complexity of the reading passages and the reading speed as students' improve their performance. It is possible that students' performance may decline when they first advance to a new level. Thus, we would expect to see consistent gains for those students who are reading fluently at grade level. This is the pattern of results depicted in Figure 6.[7] For comparison purposes, we included the mean scores of the elementary students in the control group.

[7] Difference scores reflect the specific MAT 8 subtests taken by the elementary students. Total reading achievement scores are not available for lowest level grade 2 students (MRC level 1, FLRT Group 3).

In our next analysis, we examined the independent effects of MRC treatment fidelity (i.e., average weekly time on the program, MRC Lessons Achieved) and FLRT improvement (i.e., change in fluency and comprehension) on changes in reading achievement. The results are depicted in Figure 7.

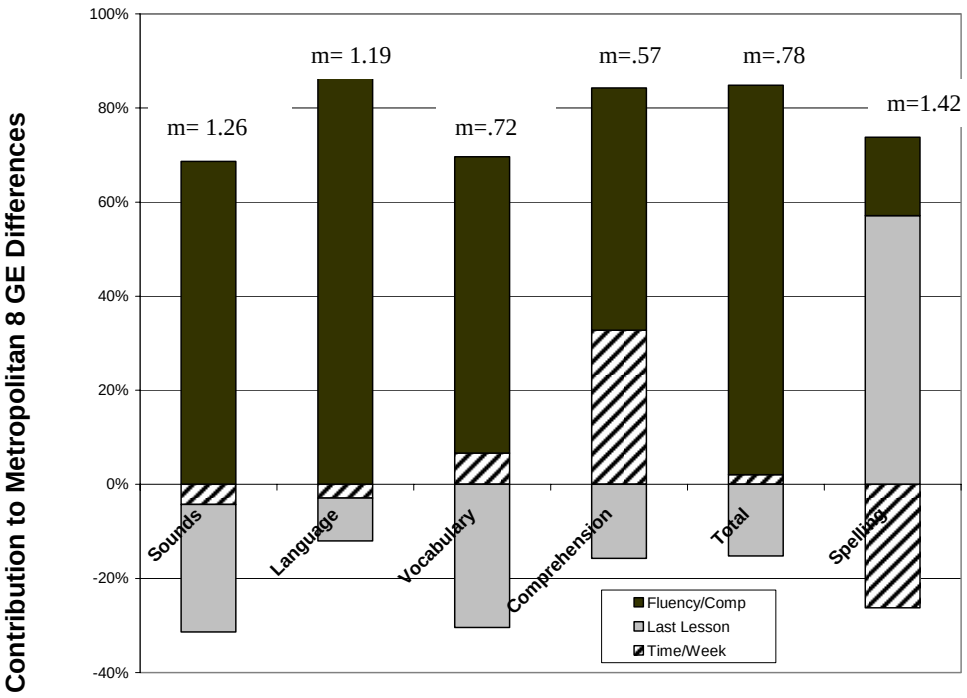

Figure 7. Factors Associated With Changes in Metropolitan 8 Grade Equivalent Scores for Elementary Students

Notes: Sounds n=116; Language n=125; Vocabulary n=77; Comprehension n=75; Total n=78; Spelling n=75

Changes in fluency and comprehension accounted for a statistically significant percentage of the improvement in grade equivalent scores on five of the six subtests. Further, Average Weekly Time made a statistically significant contribution to improvement in reading comprehension grade equivalent scores. Finally, the number of Lessons Achieved made a statistically significant contribution to improvements in spelling grade equivalent scores. One interpretation of the effect is that improved scores on standardized assessments are associated with improved fluency and comprehension skills as taught in FLRT. However, as we saw in previous analyses (see Figures 4 and 6), the highest gains on standardized assessments came from the students who completed both MRC and FLRT, providing further support that it is the combination of the two programs

that contribute to reading achievement, rather than the independent contribution of either program. Simply put, students benefited most by first building a solid base in phonics and phonemic awareness skills and then practicing those skills to improve reading speed and ultimately, reading comprehension.

Taken together, these findings provide additional support that the two program interventions work in tandem to improve reading achievement, with MRC focusing on basic reading skills (e.g., decoding, spelling) and FLRT focusing on practice of more complex reading skills (e.g., fluency, comprehension).

5.4.2 Variations within High School Treatment Students.

Our final analyses examined the factors that contributed to variations in changes to MAT 8 grade equivalent scores among high school students in the treatment group. The data available for quantitative analyses to detect patterns or differences in this group is limited to a total of 38 high school students (compared to 133 elementary students). Of these students, 21 did not complete MRC, 15 completed MRC and made some FLRT progress, and 2 students completed the full treatment. Thus, these results must be considered speculative and interpreted in light of the limitations of the data.

We began by repeating our analysis of the association between intervention progress and differences in reading achievement by dividing the treatment students into three MRC levels and three FLRT groups (see section 5.4.1). Due to the small sample size, we had no data for several of the categories. As in the previous analyses, we then computed the mean difference scores for categories with data available to examine the progress made by each group. For ease of readability, we present a graphical presentation of the results for four core reading skills (i.e., vocabulary, comprehension, total reading achievement, and language) in Figure 8. For comparison purposes, we included the mean scores of the high school students in the control group.

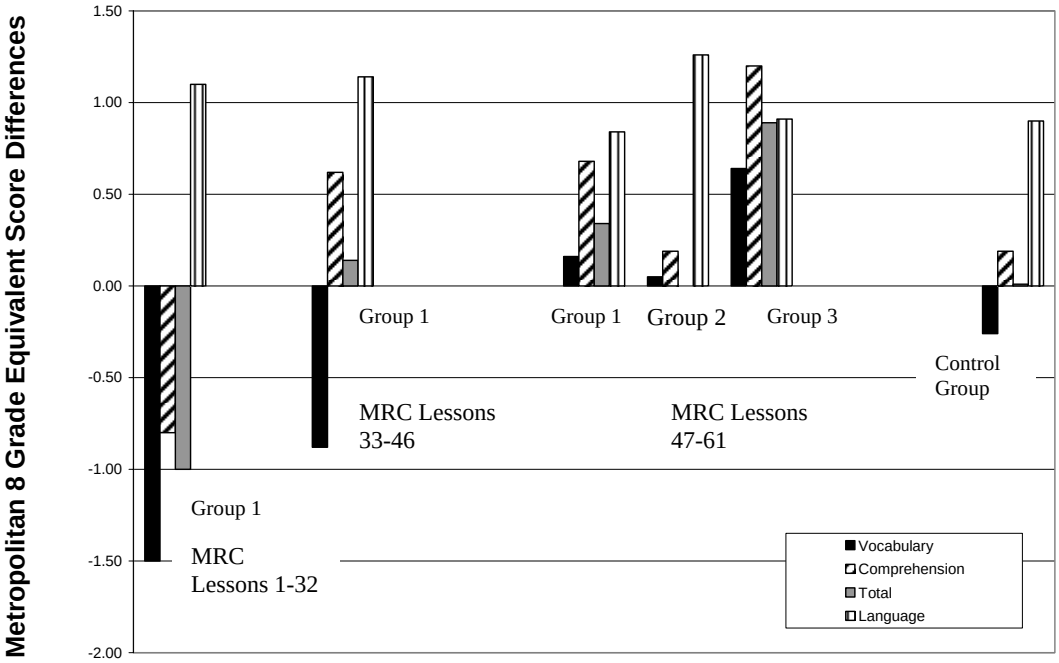

Figure 8. Changes in Reading Scores of High School Students as a Function of Intervention Progress

Notes: Groups 1 = No FLRT progress
Group 2 = FLRT Progress but has not met goal
Group 3 = Full Treatment MRC and FLRT
Control group

The FLRT program provides practice in reading fluency, emphasizing reading for content. Since the content level of the MAT 8 extends beyond decodable text for high school students, we would expect to see improvements in reading achievement only after students made progress using FLRT. This pattern is seen by comparing the performance of students who achieved MRC lessons 1-32 with the performance of students who achieved MRC lessons 33-46.

Overall, students who achieved more than 46 MRC lessons showed improvement in reading achievement, as measured by MAT 8 grade equivalent scores. One intriguing finding is that treatment students showed an increase in language skills regardless of the fluency level achieved.

Despite the limited sample size, we examined the independent effects of MRC treatment fidelity (i.e., average weekly time on the program, MRC Lessons Achieved) and FLRT improvement (i.e., change in fluency and comprehension) on changes in reading achievement by re-estimating

the regression analyses for the high school students. We found a statistically significant and positive association between the number of MRC Lessons Achieved and improvements in vocabulary on the MAT 8 grade equivalent scores. This may reflect the fact that as students reach the later MRC lessons, they are taught how to manage challenging 3-syllable words.

6.0 Student Perspectives on Reading Achievement

While change in performance as measured by standardized assessments is an important indicator of program effectiveness, this approach alone cannot capture the full impact of an intervention. To provide an alternative perspective, we conducted interviews with 14 high school students in the treatment group (9 males, 5 females) at the end of the school year (after students completed the MAT 8 post-test). None of the students were classified English Language Learners; one student was classified Special Education. We compared the average pre-test reading scores and change scores between the interviewees and the students who were not interviewed (see Table 7). The average pre-test language and spelling scores were higher for the interviewees than for the non-interviewed students (statistically significant). There were no other differences between the two groups.

Table 7. Comparison of Change in Reading Performance

	Language	Vocabulary	Comprehension	Total	Spelling
Pre-Test					
Interviewed	7.97	6.44	7.01	6.79	9.57
Not Interviewed	6.12	6.59	6.38	6.41	5.89
Change Score					
Interviewed	-.16	.74	-.03	.08	.42
Not Interviewed	.90	-.02	.11	.02	.80

Interviews were conducted individually and lasted approximately 15 minutes. Parental permission to audiotape the interviews was granted for all but one of the students. During the interview, the researcher asked each student three main questions:

- What was reading like for you at the beginning of the school year?
- What is reading like for you now?
- What do you think changed?

The researcher reviewed the transcribed interviews, to identify recurring themes among the students. A summary of this review and excerpts from student interviews follow.

6.1 Student Perception of Reading Prior to the Intervention.

When asked what reading was like at the beginning of the school year, the majority of the students (10) stated that they did not like reading at all. The following is a typical response to this question:

> I hated to read. My momma always asked me to go get a book to read 'cause I watched too much TV. But I didn't want to read.

Some students expanded on why they did not like reading. Several said that they "read slow" and that they "got bored reading." One student explained:

> I didn't understand a lot of words and I didn't know how to pronounce most of them and I was like it would take a long time for me to read a page and stuff. I didn't want to read out loud in class.

Three students said that they stuttered when they read and that made them uncomfortable. Only one student, classified as special education, said that he liked reading, "Reading was like one of my only talents." However, the pre-test scores for this student did not reflect his perception of his talent, ranging from 2.1 grade equivalent in language to a 3.2 grade equivalent in both comprehension and total reading.

6.2 Student Perception of Reading After the Intervention.

When asked what reading was like for them now, the students unanimously stated that reading was a much better experience. The two most commonly cited reasons were improved reading speed and improved comprehension. One student stated, "I like to read a lot now. It's better, a lot better. I can read really fast and I like to read books a lot more than I used to. I used to not like to read at all." Another student said, "I started understanding those big words I didn't understand at the beginning." Some of the students stated that the intervention improved their performance in other classes. One young man said, "[the intervention] actually does help me because in my other regular class because, for example, the instructions it makes me, yeah, I understand better."

6.3 Student Perception of Changes Resulting from the Intervention. In

response to queries about what changed for them, students provided specific examples about how they knew that their reading skills were improving. For one young woman, it was a change in reading habits:

> Well, a little before we got off Christmas break. My, I used to like, I have a lot of books that I never touched. My mom always buys me books but I don't ever read them. Well now I do. I really noticed that when I thought this book looks really interesting why haven't I ever read it before? Then I started reading it and that's like I realized 'cause I really wasn't that good a reader and I didn't bother to read them.

For one young man, it was recognition by his mother that signaled a change had taken place:

> My mom, she like gives me, like the newspaper to read an article or something sometimes so 'cause she'll be washing dishes or cooking and I'll read it to her and she's like, she noticed that I was, like, getting faster at my reading. She was like, 'Oh, you're getting really good.'

For some students, it was their willingness to read aloud:

> Yeah 'cause I would never read out loud case somebody would talk about me, how I was reading like I'll struggle and I'll always mispronounce a word and now, I don't know, I'd stop at one paragraph or whatever. But now I like read four pages and everybody wants me to keep reading.

The young man who said he really liked to read at the beginning of the year explained:

> I was able to read faster when I was reading out loud. Like when I was reading out loud it was like they would tell me to read something, I had nothing to read at the moment, but they would tell me to read something. I would read it like I had seen it all my life. Like I would read like I already know what's going on.

For some students, it was their performance in other classes that made the greatest impact:

One young man explained, "I just feel better 'cause like it's not as hard. Like in my English class, we had to read a book in a certain time and it was easier to do it. Like before, I probably wouldn't have finished it." Another young man stated that "my grades have improved 'cause I was understanding what I was doing and I would understand the problems. Like in my math class, I would understand and it's helped me a lot."

Another way that students recognized a change in their reading was by comparing their performance to students who were not using the intervention. One young man said,

> …because people in my English class they're not in my reading class and I can see that it's a hard thing, they don't know how to read like it's hard for them to pronounce words and you know, they like lose their place when they're reading, yeah. They're not in reading and I can see that it helped me but they are still struggling over there.

One young man offered the following insight, " I just decided to listen to myself, listen how I kind of read. I would listen to what I'm saying and I guess that's what kind of changed."

6.4 Student Perception of Effective Aspects of the Intervention. Intrigued by the students' responses, we asked them what it was about the intervention that helped them. Following are examples of their comments:

> I liked [*My*] *Reading Coach* 'cause if I didn't get something it would repeat itself so I understood a lot. I liked that. It helped a lot and *Fluent Reading* [*Trainer*] that, I liked how it moved really fast, like it helped me read really fast now.

> Well *My Reading Coach* like he was like, I don't know how to explain it. Like he would help you a lot. … I would mess up sometimes and he would like go slower and like make these faces but yeah it helped and my reading changed and made it fast, really going fast. It helped me.

> Yeah, for some students well actually for everyone, it is actually boring but then when you start understanding what they're telling you, the instructions, it gets kind of fun 'cause you see that you're growing in your reading level.

> [The programs] started where I was and progressed from there and it progressed at a slow enough pace for me to interpret everything right.

6.5 Summary. We examined the individual pre-test and difference scores for interviewees and found that none of the students had finished the intervention. Four students who were close to completion improved their reading comprehension grade equivalent scores between 1.1 to 4.0. When asked how he felt going into his sophomore year, one of these students said, "Confident that I can go through it and just accomplish almost anything. Another student provided an example of how the intervention affected his life outside the classroom:

Student: Like from the reading coach I was, he would use bigger words so when I learned those words I would use them when I talked to my friends.

Researcher: So it changed the way you talked too?

Student: Yeah.

Researcher: What did your friends think about that?

Student: They didn't know some words. They would ask me what it meant.

Researcher: And how did you feel about being the person who could tell them that?

Student: Smart and I felt like different 'cause I could actually teach them something they didn't know. So I felt better and smart.

Even students whose reading scores did not improve told us that the program contributed to a sense of achievement. When asked if anyone noticed a change in his reading, one young man responded:

> Yes [my mother] saw my grades like go up like a lot and it was because of the strengthening program and the Reading Coach because they helped me. The Reading Coach helped me in my English class because my English teacher asks about some words and I did know what they mean and I would be happy.

When asked how the program affected him, another young man said:

> Um, confidence building cause I have confidence in myself now. Like I can read a more challenging book and be like I can read this. It was like before I'd be like no, this is too hard for me I can't read it. And now I can.

The comments by the students suggest that changes were taking place that traditional measures of reading performance did not capture. This may be important to consider in future studies of reading interventions in adolescent populations.

7.0 Concluding Summary

The goal of this study was to examine the effects of a reading intervention comprised of two complementary software products: one that systematically taught reading foundation skills and the other that provided instruction and practice in silent reading fluency and reading comprehension. The results of the study provide empirical support that the intervention made a statistically significant difference in the reading achievement of students in the treatment group compared to students in the control group. Specifically, treatment students improved their phonics and phonemic awareness skills more rapidly and to a higher level than did students in the control group. In addition, students who completed the intervention had statistically significant gains on five of the six measured reading skills compared to control students and treatment students who did not complete the intervention. A similar pattern of results emerged for English Language Learners (ELL) who completed the intervention.

The intervention used in this study offers explicit and systematic instruction in four of the five essential components of reading instruction (National Reading Panel, 2000).[8] Recently, a federally funded evaluation of the Reading First initiative reported that additional instruction time on the five essential components did not result in increased reading comprehension scores.[9] One explanation for the difference in results may be that although Reading First emphasizes instruction in the five essential components as the minimum qualities of an effective reading program, some programs may not provide adequate "explicit instruction" in these skills for struggling readers. [10]

Another explanation for the different results may be the amount of explicit instructional time spent on the five components. In this study, we found a statistically significant association between time spent on the intervention program and improvement in reading comprehension scores among elementary students. The additional instruction time in the national evaluation

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[8] National Institute of Child Health and Human Development. (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (NIH Publication No. 00-4769). Washington, DC: U.S. Government Printing Office.

[9] Institute of Education Sciences (2008). *Reading First impact study: Interim report*. Washington, DC: U.S. Department of Education.

[10] Moats, L. (2007). *Whole-language high jinks: How to tell when "Scientifically-based reading instruction" isn't.* Washington, D.C: Thomas B. Fordham Institute.

amounted to an average increase of 8.56 minutes per day for grade one and 12.09 minutes per day in grade two. In contrast, the treatment students in this study averaged more than 30 minutes per day on the intervention program. It may be that the time spent teaching these skills in most Reading First programs is insufficient to achieve significant results. In future studies, it would be helpful to examine changes in reading performance as a function of time spent in explicit instruction of discrete reading skills.

In addition to examining the effects of the intervention on the performance of elementary students, this study considered the effects of the intervention on high school students. The content in high school academic subjects increases in depth and complexity. As academic expectations of older students rise, the reading performance of many students actually declines.[11] Though many educators feel that decoding instruction is unnecessary for older students, many struggling adolescent readers have difficulty decoding multisyllabic words.[12] One of the students interviewed for this study explained:

> At first [the program] was easy and then it started to get harder. I was saying all these words I never knew in my life and at the beginning I was just typing like they would tell me to spell this really big word. I always felt like it was nothing, I would just sound it out and spell it. And then they started giving me bigger words. I would just sound it out and spell it. I was learning and the bigger words they gave me, the more I learned.

For high school students in the treatment group, those who completed more lessons had a statistically significant gain in vocabulary compared to treatment students who completed fewer lessons. The study provides empirical and student self-report evidence that the intervention contributes to improved reading performance among high school students in addition to that of elementary students. However, the sample size is limited. Additional research is needed both to replicate and extend the finding presented here.

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[11] Peterson,C. L., Caverly, D. C., Nicholson, S. A., O'Neal, S. & Cusenbary, S. (2000). Building Reading Proficiency at the Secondary Level: A Guide to Resources. Austin, TX: Southwest Educational Development Laboratory

[12] Neal, J. C. & Kelly, P. R. (2002). Delivering the promise of academic success through late intervention. Reading Research Quarterly, 18, 101-117.