Appendix A

State and Site Award Data

Appendix A presents additional information on when Reading First Impact Study sample sites first received Reading First awards (Exhibit A.1).

Exhibit A.1: Award Date by Site in Order of Date when Reading First Funds Were First Made Available for Implementation

	Date Initial Reading First Award Was Announced	Date when Reading First Funds Were First Made Available for Implementation
Site 9	03/2003	04/2003
Site 12	04/2003	05/2003
Site 2	06/2003	06/2003
Site 6	05/2003	06/2003
Site 5	02/2003	07/2003
Site 4	05/2003	07/2003
Site 18	06/2003	08/2003
Site 10*	10/2003	08/2003
Site 11*	10/2003	10/2003
Site 17*	08/2003	12/2003
Site 14	01/2004	02/2004
Site 8	01/2004	03/2004
Site 3	03/2004	04/2004
Site 13	01/2004	04/2004
Site 15	10/2003	05/2004
Site 1	05/2004	06/2004
Site 7	05/2004	06/2004
Site 16	03/2004	08/2004

Note:

Sites 10, 11 and 17 "backdated" the point at which schools could begin spending their grant money. It is not an error that the schools appear to have been given their money before their grants were announced.

Source: Reading First District Coordinators

Appendix B

Methods

Chapter 2 describes the general regression discontinuity approach used to estimate the impacts of Reading First. This appendix presents the specific models used to estimate impacts and specification tests of the internal validity of these models. In addition, it describes how the issue of multiple hypothesis testing was addressed, presents the rationale for sample size decision, and provides information about statistical precision.

Part 1: Estimation Methods

The slightly different statistical models used to estimate the impact of Reading First on the three major outcome domains (student reading comprehension, classroom instruction, and student engagement with print) shared most elements. However, because there were some differences in the models for reading comprehension and classroom instruction and student engagement with print, the approach for each is described separately below.

Impact Estimation Method for Reading Comprehension

The statistical model used to estimate RF impacts on student reading comprehension is described by (1) below:

$$Y_{ijkm} = \sum_{mt} \beta_{0m} S_{mk} YR_t + \sum_{m} \beta_{1m} S_{mk} T_k + \sum_{mt} \beta_{2m} S_{mk} R_k YR_t + \sum_{mt} \beta_{3m} S_{mk} \overline{Y_{-1km}}\, YR_t + \sum_{t} \gamma_t Z_{jk} YR_t + \sum_{nt} \theta_n X_{nijk} YR_t + \mu_k + \upsilon_{jk} + \varepsilon_{ijk} \quad (1)$$

where:

Y_{ijkm} = the post-test for student i from classroom j in school k in site m,
S_{mk} = one if school k is in site m and zero otherwise, m = 1 to 18,
T_k = one if school k is a treatment school and zero otherwise,
R_k = the rating for school k (standardized and centered by site),
$\overline{Y_{-1km}}$ = the mean baseline pretest for school k (standardized and centered by site),
YR_t = indicator for follow-up years, 2005 or 2006,
Z_{jk} = a variable indicating when the post-test was given for classroom j in school k (site-centered),
X_{nijk} = demographic characteristic n of student i from classroom j in school k,
μ_k, υ_{jk} and ε_{ijk} = school-level, classroom- level, and student-level random error terms, respectively, assumed to be independently and identically distributed.

The average estimated value of β_{1m} (m = 1, 2, …, 18), weighted by the number of RF schools in each site, is the program impact for the average RF school in the study sample.

The student achievement impact model (Equation 1) deviates from the basic regression discontinuity model described in Chapter 2 in the following ways:

- It is a multi-level model that reflects the nested structure of the data by accounting for three levels of clustering in the estimation of standard errors: clustering of students within classrooms, classrooms within schools, and schools within study sites.
- Baseline covariates are added to the model to improve precision. These covariates include student gender, student age at start of school year,[1] date of the post-test at the classroom level, and a school-level pre-program reading performance measure.[2, 3]
- The rating variable was not included in the model for the one site that assigned schools to Reading First and non Reading First groups randomly.
- In estimating pooled impacts for the combined sample from 2005 and 2006, the covariates for site, rating, pretest, test date, and demographic characteristics were interacted with an indicator for follow-up year (2005 or 2006).

Impacts on Classroom Instruction and Student Engagement with Print

The impacts of Reading First on classroom instruction and student engagement with print were estimated using the following three-level model (with observations at level one, classrooms at level two, and schools at level three):

$$Y_{ijkm} = \sum_{mt} \beta_{0m} S_{mk} YR_t + \sum_{m} \beta_{1m} S_{mk} T_k + \sum_{mt} \beta_{2m} S_{mk} R_k YR_t + \mu_k + \nu_{jk} + \varepsilon_{ijk} \qquad (2)$$

Where:

Y_{ijkm} = the outcome measure for observation i from classroom j in school k in site m,
S_{mk} = one if school k is in site m and zero otherwise, (m= 1,2, …, 18),
T_k = one if school k is a treatment school and zero otherwise,
R_k = the rating for school k (standardized and centered by site),
YR_t = an indicator for follow-up waves spring 2005, fall 2005, or spring 2006,
μ_k, ν_{jk} and ε_{ijk} = school-level, classroom-level, and observation-level random error terms, respectively, assumed to be independently and identically distributed.

The impact estimate is the average estimated value of β_{1m} (m = 1, 2, …, 18) weighted by number of treatment schools in each site.

The impact estimation model for classroom instruction and student engagement with print described by (2) differs from the basic regression discontinuity model described in Chapter 2 as follows:

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[1] Age at start of the school year is each student's age as of September 1 of the given year. For example, age as of September 1, 2005 for the 2005-2006 school year.

[2] Different pre-program performance measures were constructed for early and late award sites. For the 10 early award sites and one late award site (which had no fall 2004 test data due to a hurricane), performance on a state reading test (when available, we used an average of test scores from up to three pre-RF years) was used as a school level pretest measure. For late award sites except for the one without available fall 2004 data, the mean fall 2004 SAT 10 test scores for each school/grade were used as the pretest measure.

[3] As a robustness test, the analysis was conducted without some or all of these additional covariates and the impact estimates stayed virtually unchanged. *Results for these additional tests are available upon request.*

- It is a multi-level model that reflects the nested structure of the data by accounting for three levels of clustering in the estimation of standard errors: clustering of observation days within classrooms, classrooms within schools, and schools within sites.
- A rating variable was not included in the model for the one site that assigned schools to Reading First and non Reading First groups randomly.
- In estimating pooled impacts for the combined sample from 2005 and 2006, the covariates for site and rating were interacted with an indicator for follow-up year (2005 or 2006).[4]

Impact tables throughout the report and appendices contain the actual, unadjusted mean outcomes for Reading First schools in the study sample ("Actual Mean with Reading First") and the best estimate of what would have happened in RF schools absent RF funding ("Estimated Mean without Reading First"), as well as the impact estimates described above.[5]

Part 2: Assessing the Study's Internal Validity

As noted earlier, in developing the study sample, Reading First schools and non-Reading First schools were selected to be as close as possible to their local cut-points for receipt of Reading First funding. This was done to yield two groups of schools that were as similar as possible. Exhibit B.1 presents means for both Reading First and non-Reading First schools included in the study for selected baseline school characteristics. In addition, program impacts were estimated using a linear regression discontinuity model that controls for values of the ratings used to choose schools for program funding. Furthermore, as discussed earlier, estimates of impacts on measures of student reading comprehension control explicitly for school-level baseline measures of reading achievement. This *combination* of sample design and statistical analysis was expected to provide internally valid estimates of program impacts.

Three sets of specification tests were conducted to assess whether this expectation was met. Although none of these tests by itself can *prove* that internal validity was achieved, in combination they provide evidence that this is most likely the case. Each group of tests is described below.

- **Baseline specification tests.** These tests compare baseline characteristics of Reading First and non-Reading First schools through the lens of the linear regression discontinuity analysis. The purpose of these comparisons is to determine whether the *combination* of choosing schools that are close to their local cut-points and analyzing their differences with a linear regression discontinuity model yields estimates of residual differences that generally are not large or statistically significant.

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[4] Only one year of data are available for Student Engagement with Print, so no interactions with the follow-up year were included in the estimation model.

[5] The estimates of what would have happened in RF schools absent RF funding are calculated by subtracting the impact estimates from the RF schools' actual mean values.

Exhibit B.1: Observed Differences in Baseline Characteristics of Schools in the Study Sample: 2002-2003

Characteristic	Actual Mean for Reading First Schools	Actual Mean for Non-Reading First Schools	Difference	Statistical Significance of Difference (p-value)
Students				
Male (%)	52.3	51.6	0.7*	(0.049)
Race (%)				
Asian	3.1	3.3	-0.2	(0.670)
Black	35.6	33.9	1.7	(0.532)
Hispanic	26.7	22.5	4.1*	(0.021)
White	34.2	39.8	-5.6*	(0.006)
American Indian/Alaskan	0.5	0.5	0.0	(0.847)
Free Lunch and Reduced Lunch (%)	74.4	68.9	5.5*	(0.002)
Schools				
Eligible for Title I (%)	97.6	90.7	6.9*	(0.013)
Locale (%)				
Large City	39.2	37.4	1.8	(0.476)
Mid-size City	36.8	34.6	2.2	(0.434)
Other[a]	24.0	28.0	-4.0	(0.286)
Size				
Total Number of Students	474.8	488.7	-13.9	(0.462)
Number of Students in Grade 3	71.6	76.0	-4.4	(0.162)
Student/Teacher Ratio	15.1	15.2	-0.1	(0.613)
Third Grade Reading Performance				
Deviation from State RF Mean Proficiency Rate (%)[b]	-1.3	1.8	-3.0*	(0.019)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *

[a] Other Locale includes urban fringe of a large city, urban fringe of a mid-sized city, large town, small town, and rural.

[b] A school-'s proficiency score is defined as the percentage of third grade students (or fourth or fifth grade when third grade is unavailable) in the school that score at or above the state-defined proficiency threshold on the state's reading assessment. The values in this row represent the average percentage point deviation from the mean proficiency score for the Reading First schools in the state.

EXHIBIT READS: On average, , 52.3 percent of students in Reading First schools and 51.6 percent of students in non-Reading First schools were male. The difference on the percent of male students between Reading First and non-Reading First schools was 0.7 percentage points. The difference was statistically significant at the $p \leq .05$ level (p=.049).

Sources: Data on baseline characteristics are from the Common Core of Data.

Results of the baseline specification tests are presented in Exhibit B.2. These findings were obtained using aggregate school-level baseline characteristics.[6] The first column presents adjusted residual differences between Reading First schools and non-Reading First schools for the same selected baseline characteristics presented in Exhibit B.1. The second column presents *p*-values for each of these residual differences.

[6] Baseline data were available at the school level only.

Exhibit B.2: Estimated Residual Differences in Baseline Characteristics of Schools in the Study Sample: 2002-2003

Characteristic	Estimated Residual Difference	Statistical Significance of Difference (p-value)
Students		
Male (%)	0.9	(0.246)
Race (%)		
Asian	0.9	(0.363)
Black	-7.2	(0.199)
Hispanic	3.3	(0.345)
White	2.8	(0.503)
American Indian/Alaskan	0.2	(0.182)
Free Lunch and Reduced Lunch (%)	-6.0	(0.073)
Schools		
Eligible for Title I (%)	-1.4	(0.802)
Locale (%)		
Large City	4.3	(0.419)
Mid-size City	9.1	(0.108)
Other[a]	-13.4	(0.083)
Size		
Total Number of Students	-0.9	(0.982)
Number of Students in Grade 3	-3.8	(0.558)
Student/Teacher Ratio	0.1	(0.861)
Third Grade Reading Performance		
Deviation from State RF Mean Proficiency Rate (%)[b]	4.3	(0.085)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The "Estimated Residual Difference" is the adjusted residual difference between Reading First schools and non-Reading First schools estimated using the regression discontinuity model, which controls for each school's rating.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

[a] Other Locale includes urban fringe of a large city, urban fringe of a mid-sized city, large town, small town, and rural.

[b] A school's proficiency score is defined as the percentage of third grade students (or fourth or fifth grade when third grade is unavailable) in the school that score at or above the state-defined proficiency threshold on the state's reading assessment. The values in this row represent the average percentage point deviation from the mean proficiency score for the Reading First schools in the state.

EXHIBIT READS: The estimated residual difference on the percent of male students between Reading First and non-Reading First schools was 0.9 percentage points. The difference was not statistically significant at the $p \leq .05$ level (p=.246).

Sources: Data on baseline characteristics are from the Common Core of Data.

None of the residual differences in the exhibit are statistically significant. Hence, there is little evidence of residual differences in these school-level baseline characteristics. Results shown in the exhibit do not provide statistical evidence of substantial bias in impact estimates for the present report. Also, because impact estimates for student reading comprehension control explicitly for observed differences in school-level mean baseline test scores (typically the strongest predictor of future test scores), they provide further protection against bias.

When examining the regression-adjusted baseline residual differences between Reading First schools and non-Reading First schools in Exhibit B.2, refer back to the unadjusted differences in Exhibit B.1. Findings in Exhibit B.1 represent differences that exist even though schools

in the two groups were chosen as close as possible to their local cut-points. Six of the 15 observed differences are statistically significant, three of which are larger and three of which are smaller in magnitude than their regression-adjusted counterparts in Exhibit B.2.

- **Test of sensitivity to outlying values of the rating.** These tests re-estimate program impacts on student reading comprehension, classroom reading instruction, and student engagement with print, after sequentially setting aside pairs of schools from each site, starting with the highest and lowest ratings,[7] then the second highest and lowest ratings, and then the third highest and lowest ratings. If the true conditional relationship between ratings and test scores is nonlinear, the impact estimates would be sensitive to the exclusion of these outermost schools, which have substantial influence on the estimation of slopes for the linear model.

  Exhibits B.3, B.4, and B.5 present findings of the specification tests for impacts in the three outcome domains.[8] The results indicate that estimates are not highly sensitive to the deletion of schools with especially high and low ratings, which is what would be expected if the regression discontinuity model for the study were specified properly.

- **Test of sensitivity to non-linear relationships.** These tests re-estimate impacts using: (1) a site-specific interaction model that allows the outcome/rating slope to differ between Reading First schools and non-Reading First schools (Model 2 in Exhibits B.4–B.6) and (2) a site-specific quadratic model that adds a quadratic function of the rating (Model 3 in Exhibits B.6–B.8) that tested whether the conditional relationship between student achievement and school ratings was curvilinear instead of linear.

  Exhibits B.6, B.7, and B.8 show the specification test results for the three outcome domains. None of the added quadratic terms is statistically significant. In addition, the resulting estimates of the impacts of Reading First do not change appreciably when different functional forms of the rating are used, which indicates that the simple linear model in Equation 1 provides an adequate representation of the data and produces valid estimates of the impact of Reading First on student achievement.

  Baseline specification tests for subgroups of sites. Exhibits B.9 and B.10 show differences in baseline characteristics for schools in the study sample within early award sites and late award sites. The first column in each exhibit presents adjusted residual differences between Reading First schools and non-Reading First schools for the selected baseline characteristics. The second column in each exhibit presents *p*-values for each of these residual differences.

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[7] Only the 11 sites that had 12 or more schools were included in the sample used for these tests, thus allowing up to three pairs of schools to be dropped from analyses.

[8] For ease of explication, the measures created from IPRI data are referred to as the five dimensions of reading instruction (or "the five dimensions") throughout the report. References to the programmatic emphases as required by legislation are labeled as the five essential components of reading instruction.

Exhibit B.3: Sensitivity Tests for Reading Comprehension: Dropping Outermost Pair(s) (2005, 2006)

Grade Level		11-Site Sample[1]	Drop Outermost Pair	Drop Outermost 2 Pairs	Drop Outermost 3 Pairs
Grade 1	Impact	0.91	0.46	3.11	4.96
	SE	2.89	3.03	3.16	4.72
	p-value	(0.752)	(0.880)	(0.326)	(0.293)
Grade 2	Impact	1.28	0.59	1.50	2.96
	SE	2.43	2.67	2.65	3.70
	p-value	(0.598)	(0.824)	(0.571)	(0.424)
Grade 3	Impact	-0.85	-2.01	-1.87	-3.26
	SE	2.19	2.32	2.60	3.78
	p-value	(0.699)	(0.387)	(0.472)	(0.390)
Number of Sites		**11**	**11**	**11**	**11**
Number of Schools		**195**	**173**	**151**	**129**

Notes:

Impact estimates are in scaled score points for the Stanford Achievement Test, 10th Edition (SAT 10).

A two-tailed test of significance was used, and where applicable, statistically significant findings at the p≤.05 level are indicated by *.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

[1] This sample includes 11 of the 18 study sites, and 198 of the 248 study schools.

EXHIBIT READS: The impact of the Reading First program for grade 1 on reading comprehension was 0.91 scaled score points on average for the sample of 195 schools. The estimated impact was not statistically significant at the p≤.05 level (p=.752). The impact of the Reading First program on reading comprehension was 0.46 scaled score points on average for the sample of 173 schools remaining after one pair of schools furthest from the cut-point of the rating variable in each site was dropped. The estimated impact was not statistically significant at the p≤.05 level (p=.880). The impact of the Reading First program on reading comprehension scaled score was 3.11 scaled score points on average for the sample of 151 schools remaining after two pairs of schools furthest from the cut-point of the rating variable in each site were dropped. The estimated impact was not statistically significant at the p≤.05 level (p=.326). The impact of the Reading First program on reading comprehension was 4.96 scaled score points on average for the sample of 129 schools remaining after three pairs of schools furthest from the cut-point of the rating variable in each site were dropped. The estimated impact was not statistically significant at the p≤.05 level (p=.293).

Sources: RFIS SAT 10 administration in the Spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit B.4: Sensitivity Tests for Instruction: Dropping Outermost Pair(s) (2005, 2006)

Grade Level		11-Site Sample[1]	Drop Outermost Pair	Drop Outermost 2 Pairs	Drop Outermost 3 Pairs
Grade 1	Impact	9.41*	9.57*	9.93*	8.73*
	SE	3.08	3.06	3.34	3.76
	p-value	(0.003)	(0.002)	(0.004)	(0.022)
Grade 2	Impact	14.34*	14.73*	13.74*	14.83*
	SE	3.09	3.27	3.56	4.09
	p-value	(<0.001)	(<0.001)	(<0.001)	(<0.001)
Number of Sites		**11**	**11**	**11**	**11**
Number of Schools		**195**	**173**	**151**	**129**

Notes:

Impact estimates are calculated using minutes of instruction in the five dimensions.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the p≤.05 level are indicated by *.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

[1] This sample includes 11 of the 18 study sites, and 198 of the 248 study schools in grade 1 and 194 of the 247 schools in grade 2.

EXHIBIT READS: The impact of the Reading First program for grade 1 on minutes of instruction in the five dimensions was 9.41 minutes on average for the sample of 195 schools. The estimated impact was statistically significant at the p≤.05 level (p=.003). The impact of the Reading First program on minutes of instruction in the five dimensions was 9.57 minutes on average for the sample of 173 schools remaining after one pair of schools furthest from the cut-point of the rating variable in each site was dropped. The estimated impact was statistically significant at the p≤.05 level (p=.002). The impact of the Reading First program on minutes of instruction in the five dimensions was 9.93 minutes on average for the sample of 151 schools remaining after two pairs of schools furthest from the cut-point of the rating variable in each site were dropped. The estimated impact was statistically significant at the p≤.05 level (p=.004). The impact of the Reading First program on minutes of instruction in the five dimensions was 8.73 minutes on average for the sample of 129 schools remaining after three pairs of schools furthest from the cut-point of the rating variable in each site were dropped. The estimated impact was statistically significant at the p≤.05 level (p=.022).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006.

Exhibit B.5: Sensitivity Tests for Student Engagement with Print: Dropping Outermost Pair(s) (2005, 2006)

Grade Level		11-Site Sample[1]	Drop Outermost Pair	Drop Outermost 2 Pairs	Drop Outermost 3 Pairs
Grade 1	Impact	5.59	2.94	3.33	3.31
	SE	4.13	4.30	4.70	4.92
	p-value	(0.178)	(0.495)	(0.480)	(0.502)
Grade 2	Impact	-3.84	-3.97	-5.45	-3.00
	SE	4.12	4.16	4.24	4.51
	p-value	(0.352)	(0.342)	(0.201)	(0.508)
Number of Sites		**11**	**11**	**11**	**11**
Number of Schools		**195**	**173**	**151**	**129**

Notes:

Impact estimates are calculated using percentage of students engaged with print.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the p≤.05 level are indicated by *.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

[1] This sample includes 11 of the 18 study sites, and 195 of the 248 study schools in grade 1 and 193 of the 246 schools in grade 2.

EXHIBIT READS: The impact of the Reading First program for grade 1 on the percentage of students engaged with print was 5.59 percentage points on average for the sample of 195 schools. The estimated impact was not statistically significant at the p≤.05 level (p=.178). The impact of the Reading First program on the percentage of students engaged with print was 2.94 percentage points on average for the sample of 173 schools remaining after one pair of schools furthest from the cut-point of the rating variable in each site was dropped. The estimated impact was not statistically significant at the p≤.05 level (p=.495). The impact of the Reading First program on the percentage of students engaged with print was 3.33 percentage points on average for the sample of 151 schools remaining after two pairs of schools furthest from the cut-point of the rating variable in each site were dropped. The estimated impact was not statistically significant at the p≤.05 level (p=.480). The impact of the Reading First program on the percentage of students engaged with print was 3.31 percentage points on average for the sample of 129 schools remaining after three pairs of schools furthest from the cut-point of the rating variable in each site were dropped. The estimated impact was not statistically significant at the p≤.05 level (p=.520).

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Exhibit B.6: Sensitivity Test of Different Functional Forms of Rating Variable for Reading Comprehension (2005, 2006)

				Model 1	Model 2	Model 3
Grade 1	Impact	Treat	Coeff	2.98	0.48	0.17
			SE	2.99	3.48	3.42
			p-value	(0.319)	(0.890)	(0.960)
	F-test	t*r	F-value		0.89	
			p-value		(0.656)	
		r2	F-value			0.96
			p-value			(0.532)
Grade 2	Impact	Treat	Coeff	1.09	-0.56	-0.18
			SE	2.51	2.77	2.70
			p-value	(0.663)	(0.841)	(0.946)
	F-test	t*r	F-value		1.14	
			p-value		(0.260)	
		r2	F-value			1.36
			p-value			(0.079)
Grade 3	Impact	Treat	Coeff	-1.99	-1.84	-1.89
			SE	2.25	2.63	2.61
			p-value	(0.376)	(0.484)	(0.469)
	F-test	t*r	F-value		0.69	
			p-value		(0.910)	
		r2	F-value			0.61
			p-value			(0.965)

Notes:

Impact estimates are in scaled score points for the Stanford Achievement Test, 10th Edition (SAT 10). Sample includes 17 of the 18 study sites and 238 of the 248 study schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the p≤.05 level are indicated by *.

MODEL1: Y = treat*sites + sites*rating + sites*pretest + others + site
MODEL2: Y = treat*sites + sites*rating + sites*rating*treat + sites*pretest + others + sites
MODEL3: Y = treat*sites + sites*rating + sites*r_sqr + sites*pretest + others + sites

EXHIBIT READS: The impact of the Reading First program for grade 1 on reading comprehension as estimated by Model 1 was 2.98 scaled score points on average. The estimated impact had a standard error of 2.99 scaled score points and was not statistically significant at the p≤.05 level (p=.319). The impact of the Reading First program for grade 1 on reading comprehension as estimated by Model 2 was 0.48 scaled score points on average. The estimated impact had a standard error of 3.48 scaled score points and was not statistically significant at the p≤.05 level (p=.890). In Model 2, the coefficients on the site, rating, and treatment interactions were not jointly statistically significant at the p≤.05 level (F=.98, p=.656). The impact of the Reading First program for grade 1 on reading comprehension as estimated by Model 3 was 0.17 scaled score points on average. The estimated impact had a standard error of 3.42 scaled score points and was not statistically significant at the p≤.05 level (p=.960). In Model 3, the coefficients on the sites and squared rating were not jointly statistically significant at the p≤.05 level (F=.96, p=.532).

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit B.7: Sensitivity Test of Different Functional Forms of Rating Variable for Instruction (2005, 2006)

				Model 1	Model 2	Model 3
Grade 1	Impact	Treat	Coeff	8.69*	10.59*	9.57*
			SE	2.94	3.52	3.41
			p-value	(0.003)	(0.003)	(0.005)
	F-test	t*r	F-value		1.33	
			p-value		(0.095)	
		r2	F-value			1.12
			p-value			(0.291)
Grade 2	Impact	Treat	Coeff	12.50*	10.46*	11.24*
			SE	2.96	3.65	3.56
			p-value	(<0.001)	(0.005)	(0.002)
	F-test	t*r	F-value		0.67	
			p-value		(0.926)	
		r2	F-value			0.57
			p-value			(0.980)

Notes:

Impact estimates are calculated using minutes of instruction in the five dimensions. Sample includes 17 of the 18 study sites and 238 of the 248 study schools in grade 1 and 237 of the 247 schools in grade 2.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

MODEL1: Y = treat*sites + sites*rating + sites*pretest + others + site
MODEL2: Y = treat*sites + sites*rating + sites*rating*treat + sites*pretest + others + sites
MODEL3: Y = treat*sites + sites*rating + sites*r_sqr + sites*pretest + others + sites

EXHIBIT READS: The impact of the Reading First program for grade 1 on instruction as estimated by Model 1 was 8.69 minutes on average. The estimated impact had a standard error of 2.94 minutes and was statistically significant at the $p \leq .05$ level (p=.003). The impact of the Reading First program for grade 1 on instruction as estimated by Model 2 was 10.59 minutes on average. The estimated impact had a standard error of 3.52 minutes and was statistically significant at the $p \leq .05$ level (p=.003). In Model 2, the coefficients on the site, rating, and treatment interactions were not jointly statistically significant at the $p \leq .05$ level (F=1.33, p=.095). The estimated impact of the Reading First program for grade 1 on reading comprehension as estimated by Model 3 was 9.57 minutes on average and had a standard error of 3.41 minutes. The estimated impact was statistically significant at the $p \leq .05$ level (p=.005). In Model 3, the coefficients on the sites and squared rating were not jointly statistically significant at the $p \leq .05$ level (F=1.12, p=.291).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006.

Exhibit B.8: Sensitivity Test of Different Functional Forms of Rating Variable for Student Engagement with Print (2005, 2006)

				Model 1	Model 2	Model 3
Grade 1	Impact	Treat	Coeff	4.79	6.70	5.86
			SE	3.88	4.82	4.62
			p-value	(0.219)	(0.167)	(0.207)
	F-test	t*r	F-value		0.75	
			p-value		(0.745)	
		r2	F-value			0.75
			p-value			(0.748)
Grade 2	Impact	Treat	Coeff	-8.60*	-8.78	-7.73
			SE	3.99	4.82	4.64
			p-value	(0.032)	(0.070)	(0.098)
	F-test	t*r	F-value		1.27	
			p-value		(0.214)	
		r2	F-value			1.17
			p-value			(0.291)

Notes:

Impact estimates are calculated using percentage of students engaged with print. Sample includes 17 of the 18 study sites and 238 of the 248 study schools in grade 1 and 236 of the 246 schools in grade 2.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the p≤.05 level are indicated by *.

MODEL1: Y = treat*sites + sites*rating + sites*pretest + others + site
MODEL2: Y = treat*sites + sites*rating + sites*rating*treat + sites*pretest + others + sites
MODEL3: Y = treat*sites + sites*rating + sites*r_sqr + sites*pretest + others + sites

EXHIBIT READS: The impact of the Reading First program for grade 1 on student engagement with print as estimated by Model 1 was 4.79 percentage points on average. The estimated impact had a standard error of 3.88 percentage points and was not statistically significant at the p≤.05 level (p=.219). The impact of the Reading First program for grade 1 on student engagement with print as estimated by Model 2 was 6.70 percentage points on average and had a standard error of 4.82 percentage points. The estimated impact was not statistically significant at the p≤.05 level (p=.167). In Model 2, the coefficients on the site, rating, and treatment interactions were not jointly statistically significant at the p≤.05 level (F=.75, p=.745). The impact of the Reading First program for grade 1 on student engagement with print as estimated by Model 3 was 5.86 percentage points on average and had a standard error of 4.62 percentage points. The estimated impact was not statistically significant at the p≤.05 level (p=.207). In Model 3, the coefficients on the sites and squared rating were not jointly statistically significant at the p≤.05 level (F=.75, p=.748).

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Findings from the tests in Exhibits B.9 and B.10 suggest that there are very few statistically significant residual differences in each sample. Composite tests of all 15 baseline characteristics for each subgroup of sites indicate that overall, the estimated residual differences are not statistically significant within early award sites or within late award sites. Hence, the isolated differences observed could have occurred by chance and do not necessarily indicate a bias in the linear regression discontinuity model used to estimate impacts. Furthermore, the single most relevant characteristic (student reading performance) for which a statistically significant baseline difference was observed (in early award sites only) is a covariate in all regression discontinuity models used to estimate impacts on student reading comprehension. This variable, which in principal reflects all past differences among schools that are related to future differences in their student test scores, is controlled for explicitly in the impact analysis. Therefore the regression discontinuity model with this covariate should provide unbiased impact estimates.

Exhibit B.9: Estimated Residual Differences in Baseline Characteristics of Schools in the Study Sample: Early Award Sites, 2002-2003

Characteristic	Estimated Residual Difference	Statistical Significance of Difference (p-value)
Students		
Male (%)	0.6	(0.631)
Race (%)		
Asian	0.4	(0.732)
Black	-0.3	(0.965)
Hispanic	-2.8	(0.532)
White	2.4	(0.693)
Amer Ind/Alaskan	0.2	(0.268)
Free Lunch and Reduced Lunch	-11.6	(0.050)
Schools		
Eligible for Title 1 (%)	-2.8	(0.830)
Locale		
Large City	-0.7	(0.865)
Mid-size City	5.3	(0.618)
Other [a]	-4.5	(0.691)
Size		
Total Number of Students	57.1	(0.378)
Number of Students in Grade 3	3.6	(0.708)
Student/Teacher Ratio	0.2	(0.781)
Third Grade Reading Performance		
Deviation from State RF Mean Proficiency Rate (%)[b]	11.2*	(0.0046)
Number of Schools	111	

Notes:

The early RF study sample includes 111 schools from 10 sites located in 7 states. 55 schools are Reading First schools and 56 are non-Reading First schools.

The "Estimated Residual Difference" is the adjusted residual difference between Reading First schools and non-Reading First schools estimated using the regression discontinuity model, which controls for each school's rating.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the p≤.05 level are indicated by *.

[a] Other Locale includes urban fringe of a large city, urban fringe of a mid-sized city, large town, small town, and rural.

[b] A school-'s proficiency score is defined as the percentage of third grade students (or fourth or fifth grade when third grade is unavailable) in the school that score at or above the state-defined proficiency threshold on the state's reading assessment. The values in this row represent the average percentage point deviation from the mean proficiency score for the Reading First schools in the state.

EXHIBIT READS: The estimated residual difference on the percent of male students between Reading First and non-Reading First schools was 0.6 percentage points. The difference was not statistically significant at the p≤.05 level (p=.631).

Sources: Data on baseline characteristics are from the Common Core of Data.

Exhibit B.10: Estimated Residual Differences in Baseline Characteristics of Schools in the Study Sample: Late Award Sites, 2002-2003

Characteristic	Estimated Residual Difference	Statistical Significance of Difference (p-value)
Students		
Male (%)	1.1	(0.240)
Race (%)		
Asian	1.3	(0.359)
Black	-13.2	(0.115)
Hispanic	8.7	(0.089)
White	3.1	(0.577)
Amer Ind/Alaskan	0.1	(0.451)
Free Lunch and Reduced Lunch	-1.1	(0.774)
Schools		
Eligible for Title 1 (%)	-0.3	(0.928)
Locale		
Large City	8.2	(0.320)
Mid-size City	12.1	(0.052)
Other [a]	-20.3*	(0.048)
Size		
Total Number of Students	-46.5	(0.338)
Number of Students in Grade 3	-9.6	(0.265)
Student/Teacher Ratio	0.0	(0.997)
Third Grade Reading Performance		
Deviation from State RF Mean Proficiency Rate (%)[b]	-1.7	(0.611)
Number of Schools	137	

Notes:

The late RF study sample includes 137 schools from 8 sites located in 8 states. 70 schools are Reading First schools and 67 are non-Reading First schools.

The "Estimated Residual Difference" is the adjusted residual difference between Reading First schools and non-Reading First schools estimated using the regression discontinuity model, which controls for each school's rating.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

[a] Other Locale includes urban fringe of a large city, urban fringe of a mid-sized city, large town, small town, and rural.

[b] A school-'s proficiency score is defined as the percentage of third grade students (or fourth or fifth grade when third grade is unavailable) in the school that score at or above the state-defined proficiency threshold on the state's reading assessment. The values in this row represent the average percentage point deviation from the mean proficiency score for the Reading First schools in the state.

EXHIBIT READS: The estimated residual difference on the percent of male students between Reading First and non-Reading First schools was 1.1 percentage points. The difference was not statistically significant at the $p \leq .05$ level (p=.240).

Sources: Data on baseline characteristics are from the Common Core of Data.

Part 3: Approach to Multiple Hypothesis Testing

This section addresses the issue of multiple hypothesis testing. It first summarizes the five core principles that were used as a guide for addressing the issue in the current study, and then describes a two-stage approach for operationalizing these principles.

Principle #1: Qualify tests instead of adjusting them: The present analysis qualifies specific hypothesis tests using composite tests of pooled hypotheses rather than (1) adjusting significance levels (through Bonferroni methods) or (2) adjusting significance thresholds (through Benjamini and Hochberg methods) of specific tests.

Principle #2: Address multiple testing differently for the central research questions of the study and for supplemental analyses. The analysis specifies two tiers of hypotheses: Tier I comprises a very small number of hypotheses about the central research questions of the study, and Tier 2 represents supplemental research questions. Multiple testing is treated separately and differently within the two tiers. Statistical tests of Tier I hypotheses are considered confirmatory. To address the issue of multiplicity within Tier I, the present study tested a reduced set of outcomes by conducting pooled tests of composite hypothesis that represent a set of hypotheses that have been tested separately. The Tier 2 hypothesis tests are allowed to be much larger and less confirmatory. It may or may not be necessary to qualify these findings for multiple testing since they are not confirmatory.

Principle #3: Delineate separate domains that reflect key clusters of constructs represented by the central research questions of a study. Domains comprise broad clusters of outcome constructs that can contain multiple measures, subgroups, or follow-up observations. Domains are defined conceptually, and do not provide narrow "silos" for collecting findings. The central domains for the present study are student reading comprehension, classroom reading instruction, and student engagement with print.

Principle #4: Report analyses to address multiple comparisons in the background of research reports, not in the foreground. For the present study references to the qualifying tests occur in the main text but not in tables.

Principle #5: Use tests for interactions as a composite test (and thus a guide) for focusing on subgroup findings.

Based on the above five principles, the present study uses the following two-stage approach to address multiple hypothesis testing. The first stage involves prioritizing outcomes and subgroups for the impact analysis. The second stage encompasses strategies for conducting composite tests on pooled key outcomes. The core features of each stage are described below.

Stage 1: Creating a Parsimonious List of Outcomes and Subgroups and Prioritizing Key Outcomes

The first stage of the framework involves a process of carefully categorizing and prioritizing the outcomes and subgroups for the impact analysis. The goal of this exercise is to create the shortest possible list of outcomes and subgroups that reflect the most proximal and policy relevant indicators of Reading First's effectiveness. Analytically, the shorter the list, the less likely it is that one would attribute statistical significance to an impact that did not truly occur. These outcomes and subgroups

were selected within distinct measurement domains to correspond to key components of the program's theory of action and the key research questions posed by the program's evaluation.

The impact analysis focuses on two components of the Reading First theory of action: 1) aligning teachers' instructional practices and behaviors with the five dimensions of reading instruction, and 2) improving students' reading achievement.[9] The highest priority outcomes within each of these measurement domains would constitute "Tier 1" outcomes for the impact analysis. For each Tier 1 outcome, the RFIS Team specifies a parsimonious set of subgroups for which impacts are estimated.

Recognizing that a short list of outcomes will almost certainly exclude important policy-relevant indicators of Reading First's effectiveness (a form of Type II error), this first stage of the framework also includes the development of a secondary, or "Tier 2," list of outcomes and subgroups. As discussed below, the present study treats Tier 1 and Tier 2 outcomes and their accompanying subgroups separately, and potentially differently, if or when making adjustments to the standards used for judging statistical significance.

Exhibit B.11 provides a list of the Tier 1 and Tier 2 outcomes defined for each measurement domain for this report.[10] Also displayed are the grade levels and follow-up periods on which the impact analyses focus.

Stage 2: Conducting Composite Tests to Qualify Specific Hypothesis Tests

One approach to qualifying multiple hypothesis tests is to test whether the *overall* effect of treatment on a family of outcomes is significantly different from zero. For example, a policy maker may be interested in the effect of an intervention on test scores in general, rather than on each subject separately. Measurement of such *overall* effects has its roots in the literature on clinical trials and on meta-analysis (O'Brien, 1984; Logan and Tamhane, 2002; and Hedges and Olkin, 1985). The present analysis constructs summary indices that aggregate information over multiple treatment effect estimates within each domain for Tier 1 outcomes. See Exhibit B.12.

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[9] The Reading First theory of action also includes allocating additional resources for districts and schools to purchase reading curricula, materials, and assessments; exposing teachers to professional development and coaching focused on the five dimensions of effective reading programs; and holding districts and schools accountable for improved reading achievement. The present study was not designed to measure the impact of Reading First on these other elements.

[10] Because student engagement with print is an outcome that is distinct from the student reading comprehension or classroom reading instruction domains, it is treated separately.

Exhibit B.11: Outcome Tiers for the Reading First Impact Analysis

			Full Sample		Subgroups (Early/Late Award)	
Tier	**Domain**	**Outcome**	**Year**	**Grade**	**Year**	**Grade**
Tier 1	Reading Comprehension	***Scaled Score***	2005, 2006 Pooled	Separate for Grade 1, 2, 3	2005, 2006 Pooled	Separate for Grade 1, 2, 3
		% At or Above Grade Level	2005, 2006 Pooled	Separate for Grade 1, 2, 3	2005, 2006 Pooled	Separate for Grade 1, 2, 3
	Instruction	***Time on Five Dimensions***	2005, 2006 Pooled	Separate for Grade 1, 2	2005, 2006 Pooled	Separate for Grade 1, 2
		Highly Explicit Instruction	2005, 2006 Pooled	Separate for Grade 1, 2	2005, 2006 Pooled	Separate for Grade 1, 2
		High Quality Practice	2005, 2006 Pooled	Separate for Grade 1, 2	2005, 2006 Pooled	Separate for Grade 1, 2
	Student Engagement with Print	***% Students Engaged with Print***	2005, 2006 Pooled	Separate for Grade 1, 2	2005, 2006 Pooled	Separate for Grade 1, 2
Tier 2	Reading Comprehension	***Scaled Score***	2005	Separate for Grade 1, 2, 3	2005	Separate for Grade 1, 2, 3
			2006	Separate for Grade 1, 2, 3	2006	Separate for Grade 1, 2, 3
		% At or Above Grade Level	2005	Separate for Grade 1, 2, 3	2005	Separate for Grade 1, 2, 3
			2006	Separate for Grade 1, 2, 3	2006	Separate for Grade 1, 2, 3
	Instruction	***Time on Five Dimensions (Combined and for Five Dimensions separately)***	2005	Separate for Grade 1, 2	2005	Separate for Grade 1, 2
			2006	Separate for Grade 1, 2	2006	Separate for Grade 1, 2
		Highly Explicit Instruction	2005	Separate for Grade 1, 2	2005	Separate for Grade 1, 2
			2006	Separate for Grade 1, 2	2006	Separate for Grade 1, 2
		High Quality Practice	2005	Separate for Grade 1, 2	2005	Separate for Grade 1, 2
			2006	Separate for Grade 1, 2	2006	Separate for Grade 1, 2
	Student Engagement with Print	***% Students Engaged with Print***	2005	Separate for Grade 1, 2	2005	Separate for Grade 1, 2
			2006	Separate for Grade 1, 2	2006	Separate for Grade 1, 2

Exhibit B.12: Summary of Impacts and Results of Composite Tests

Outcome Measure	Impact (p-value)			Result of Composite Test
	Grade 1	Grade 2	Grade 3	
Reading Comprehension				
• Standard scaled score	3.57 (p=0.215)	1.41 (p=0.559)	-1.63 (p=0.455)	p=0.668 for composite test across 3 grades and 2 outcomes
• Percent reading at or above grade level	3.15 (p=0.260)	0.12 (p=0.965)	-2.22 (p=0.383)	
Instruction				
• Minutes of instruction in 5 reading dimensions	8.56 (p=0.003)	12.09 (p<0.001)	--	p<0.001 for composite test across 2 grades and 3 outcomes
• Highly explicit instruction	3.65 (p=0.023)	6.98 (p<0.001)	--	
• High quality student practice	0.86 (p=0.559)	3.67 (p=0.012)	--	
Student Engagement with Print				
• Percent of students engaged with print	4.63 (p=0.216)	-8.42 (p=0.030)	--	p=0.710 for composite test across 2 grades and 1 outcome

Notes

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

EXHIBIT READS: The results of the composite test for reading comprehension test scores, across three grades and two outcomes, are not statistically significant (p=0.668).

Source: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR); RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006; and RFIS Student Time-on-Task and Engagement with Print, data collection, fall 2005 and spring 2006.

Reading Comprehension

To qualify the impact estimates for each outcome measure for each grade in the reading comprehension domain, the present analysis ran a composite regression that pooled the sample across grades 1, 2, and 3 and two measures: scaled scores and an indicator of whether or not a student scored at or above grade level. To qualify the six multiple hypotheses tests for these outcomes, the RFIS Team created one parsimonious index. The aggregation improves statistical power to detect effects that go in the same direction within a domain. The summary index is defined to be the equally weighted average of z-score outcome components, with the sign of each measure oriented so that more beneficial outcomes have higher scores.[11]

[11] An alternative is to use seemingly unrelated regression effects for specific outcomes to estimate the covariance of the effects and then to calculate the mean effect size for groups of estimates in a second step. The average z-score index approach is much simpler to work with. The two approaches yield identical treatment effects when there is no item nonresponse and no regression adjustment (Kling, Liebman, and Katz, 2007).

Specifically, the present analysis took the following steps in creating a composite index and conducting the analysis:[12]

1. First, z-scores were created for each outcome component in the reading comprehension domain by subtracting the unadjusted non-RF mean (pooled across years and grade levels) and dividing by its standard deviation (pooled across years and grade levels). Thus, each component of the index has a mean of zero and a standard deviation of one for the non-RF group.
2. If an observation unit has a valid response to at least one component measure of the index, then any missing values of other component measures are imputed as the random assignment group mean. This results in differences between RF and non-RF means of an index being the same as the average of those two groups' means of the components of that index (when the components are divided by their comparison group standard deviation and have no missing value imputation), so that the index can be interpreted as the average of results for separate measures scaled in standard deviation units.
3. The z-scores from each component were averaged to obtain the index and an impact analysis was run on this index using a sample that pooled both years and all grade levels together.

This regression addresses the question whether overall the program "worked" in terms of improving student achievement. This result serves as a "qualifier" to the small number of specific hypothesis tests shown in impact tables.

Classroom Instruction

A similar composite analysis was conducted for the instructional domain. To qualify the impact estimates for each outcome measure for each grade in the instructional domain, the analysis ran a composite regression which pooled the sample across grades and used an index constructed from z-scores for all three instructional outcome measures as the dependent variable. The index of instruction averaged together minutes in the five dimensions of reading instruction, percentage of highly explicit instruction, and percentage of high quality student practice.

The results from this analysis help to answer the research question whether *overall* the Reading First program has an impact on instructional practice.

In addition, program impacts for time spent on each of the five dimensions will be reported separately. Since the impact on total time spent on the five dimensions will already have been reported, any additional qualifying test is not necessary for these analyses.

Student Engagement with Print

A similar composite analysis was conducted for the student engagement with print outcome domain. For this domain impacts are reported for the full sample in grades 1 and 2 as the percentage of students engaged with print. To qualify the two multiple hypotheses tests for these outcomes, the RFIS Team reports the result from a composite regression which pools two grades together and represents the outcome measure in one parsimonious index, created in the same way that the composite index for reading comprehension and instruction was created (see previous pages). This regression addresses the question

[12] The discussion and method presented here draw from Kling, Liebman, and Katz (2007).

whether overall the program "worked" in terms of having an impact on the percentage of students engaged with print. This result serves as a "qualifier" to the small number of specific hypothesis tests shown in impact tables.

Subgroups (by Site Award Subgroup)

Impact estimates are presented for each grade in the early award sites and late award sites separately. For each domain, there are three qualifying tests to supplement the main award group analyses:

1. A pooled regression to test whether the program has any impact (on reading instruction or reading comprehension) in the early award sites overall (pooled across grades and using the aforementioned outcome index).
2. A pooled regression to test whether the program has any impact (on reading instruction or reading comprehension) in the late award sites overall (pooled across grades and using the aforementioned outcome index).
3. A pooled regression to test whether, overall, the program impact (on reading instruction or reading comprehension) is different between early and late sites (pooled across grades and using the aforementioned outcome index).

The results of the qualifying tests are discussed immediately after the results are presented for each site award subgroup. They help shed light on potential differences or similarities between early and late award sites with regard to program impacts on reading comprehension, instruction, and student engagement with print.

For hypothesis tests listed in Tier 2, the RFIS Team did not conduct any additional composite tests to qualify the results. The analyses presented in Tier 1 serve as natural composite tests for these more fine-grained tests.

Part 4: Alternative Weighting Approaches

The impact estimation models described in Part 1 produce 18 site-specific impact estimates. For overall impact estimates, the 18 site-specific impacts are averaged to produce the overall mean impact estimate. Appropriate standard errors are calculated to assess the statistical significance of the averages. Each site's results are weighted in proportion to that site's number of Reading First schools in the study. This approach was selected to summarize impact estimates as clearly as possible; it produces estimates of impacts for the average Reading First school in the study. Since the study team recognized that there are other legitimate methods for weighting the impact estimates, key impact findings were examined to assess their sensitivity to alternative weighting methods.

One alternative is to weight site-specific impact estimates in proportion to each site's number of Reading First students (rather than its number of Reading First schools), which produces impact estimates for the average Reading First student in the study sample.

The second alternative is to specify one treatment indicator for all sites, instead of specifying site-specific treatment indicators and then averaging their coefficients. This is called a *pooled* estimator rather than a weighted estimator, because it pools data for the full sample directly into a single average impact estimate. It should be noted, however, that the pooled estimator, like any other, represents a weighting of impact

estimates across sites. The implicit weights for this strategy are approximately proportional to the precision of impact estimates for each site, which in turn reflect the site's sample size and study design.[13]

The tables below compare estimates of the average impacts of Reading First produced by the three alternative approaches to weighting. Results are presented for estimates of impacts on reading comprehension, instruction in the five dimensions, and percentage of students engaged with print.

Exhibit B.13: Estimated Impacts on Reading Comprehension, by Weighting Approach (2005, 2006)

	Weighting Approach		
Outcome	**Weight by Number of RF Schools per Site**	**Weight by Number of RF Students per Site**	**Weight by Precision**
SAT 10 Scaled Score			
Grade 1			
Impact	3.57	1.42	5.25*
Effect size	0.07	0.03	0.11*
p-value	(0.213)	(0.619)	(0.031)
Grade 2			
Impact	1.41	0.08	3.04
Effect size	0.03	0.00	0.07
p-value	(0.557)	(0.973)	(0.129)
Grade 3			
Impact	-1.63	-1.79	0.90
Effect size	-0.04	-0.04	0.02
p-value	(0.454)	(0.400)	(0.623)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of Reading First on reading comprehension in grade one was 3.57 scaled score points (or 0.07 standard deviations) when weighting by the number of Reading First schools per site. The impact was not statistically significant at the $p \leq .05$ level (p=.213).

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

[13] This alternative strategy weights each site's impact estimate in proportion to its total amount of "free" (non-collinear) variation in treatment status across schools, which is the major factor that determines the precision of these estimates. For detailed explanation and an application of this approach for an experiment, see Cullen et al. (2006).

Exhibit B.14: Estimated Impacts on Instructional Outcomes, by Weighting Approach (2005, 2006)

Outcome	Weighting Approach: Weight by Number of RF Schools per Site	Weight by Number of RF Classrooms per Site	Weight by Precision
Minutes of instruction in the five dimensions combined			
Grade 1			
Impact	8.56*	8.79*	8.52*
Effect size	0.41*	0.42*	0.41*
p-value	(0.003)	(0.002)	(0.001)
Grade 2			
Impact	12.09*	11.75*	12.38*
Effect size	0.57*	0.55*	0.58*
p-value	(<0.001)	(<0.001)	(<0.001)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program for grade 1 on the number of minutes of instruction in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) was 8.56 minutes on average when weighting by the number of Reading First schools per site. This corresponds to an effect size of 0.41. The estimated impact was statistically significant at the $p \leq .05$ level (p=.003).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006

Exhibit B.15: Estimated Impacts on Student Engagement with Print, by Weighting Approach (2005, 2006)

Outcome	Weighting Approach		
	Weight by Number of RF Schools per Site	Weight by Number of RF Students per Site	Weight by Precision
Percentage of Students Engaged with Print			
Grade 1			
Impact	4.63	3.51	3.39
Effect size	0.16	0.12	0.11
p-value	(0.216)	(0.342)	(0.332)
Grade 2			
Impact	-8.42*	-7.83*	-5.82
Effect size	-0.29*	-0.27*	-0.20
p-value	(0.030)	(0.041)	(0.099)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the fall 2005 and spring 2006 STEP data (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program for grade 1 on the percentage of students engaged with print was 4.63 percentage points on average when weighting by the number of Reading First schools per site. This corresponds to an effect size of 0.16. The estimated impact was not statistically significant at the $p \leq .05$ (p=.216).

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006

Part 5: Sample Size

Although regression discontinuity analysis can provide unbiased impact estimates under the conditions met by this study—and thus is comparable to a true experiment in this regard—the quasi-experimental approach requires a much larger sample of schools to provide the same precision as an experiment. To understand this point, consider the following expression for the variance of the regression discontinuity impact estimator, $\hat{\beta}_0$:

$$VAR(\hat{\beta}_0) = \frac{\sigma^2(1-R_1^2)}{\sum_i (Ti-\bar{T})^2 (1-R_2^2)} \qquad (3)$$

where:

σ^2 = the variance of mean student outcomes across schools within treatment groups,

R_1^2 = the square of the correlation between the outcome and rating within treatment groups,

R_2^2 = the square of the correlation between treatment status and the rating,

$\sum_i (Ti-\bar{T})^2$ = the total variation in treatment status across schools in the sample.

The outcome variance reflects the prevailing heterogeneity of student performance across the sample of schools in the study. The total variation in treatment status depends on the number of schools in the sample, given a balanced 50/50 allocation of program and control schools.

The correlation between the outcome and rating in the numerator of Equation 3 reflects how well the rating predicts subsequent student performance. One might label this term a "prediction factor." Its value depends on what variables are used to create the index that rates schools. As can be seen, the better the rating predicts future outcomes the smaller the variance of the impact estimator will be and thus the greater its precision will be. The best index available for this purpose at the study design stage was a summary of recent past student performance.

The correlation between school treatment status and school ratings in the denominator of Equation 3 reflects the underlying structure of the regression discontinuity design (whether it is balanced or unbalanced around the cut-point) and the shape of the distribution of ratings around the cut-point. This term measures the ***collinearity*** that exists between treatment status and ratings. Thus including ratings in the impact estimation model, which is necessary in principle to prevent bias, produces collinearity with the treatment indicator. This collinearity reduces the independent variation in treatment status across schools, which, in turn, reduces the precision of program impact estimators.

If the ***rankings*** of schools (instead of their ratings) are used as the covariate in the impact regression and there are an equal number of schools on each side of the cut-point, then the collinearity correlation squared

equals 0.75.[14] One minus this value equals 0.25, which multiplies the variance of the impact estimator by a factor of four. In experiments the expected correlations between treatment status and rankings or ratings or any other pre-existing characteristics are zero because of randomization. So there is no expected collinearity with treatment status. Thus, if rankings are used as a covariate, the variance of the impact estimator for a regression discontinuity analysis will be four times that for a corresponding experiment. Hence, to achieve the same minimum detectable effect the regression discontinuity analysis would need four times as many schools as the experiment.

If the ***rating*** of schools is used as the covariate for a regression discontinuity analysis of program impacts (which was what was expected) then the exact amount of collinearity between it and the treatment status indicator is not known. However, if this variable were approximately normally distributed and centered on the cut-point Goldberger (1972) proves that the sample for a regression discontinuity analysis must be 2.75 times that for a corresponding experiment to achieve the same precision.[15] In reading through most of the extant literature on regression discontinuity analysis it appears that Goldberger's work is the sole touchstone for gauging this sample multiplier. Others have used his finding as a point of departure but nobody to our knowledge has independently come to a different conclusion.

Rankings are uniformly distributed because they comprise a consecutive set of numbers. Thus a covariate that is uniformly distributed and centered on the cut-point produces a sample size multiplier of four whereas a covariate that is normally distributed and centered on the cut-point produces a sample size multiplier of 2.75. Although there was no way to know at the time when the study was designed exactly how the actual ratings that should be used for a covariate would be distributed, there was no reason to expect that their sample size multiplier would differ markedly from the range of 2.75 to 4.00 established by the two points of reference. Empirical findings presented in Gamse et al. (2004) confirm this expectation. For planning purposes, we chose a design effect of four to help assure adequate statistical power for the RDD.

Based on the preceding analyses and extensive discussions among members of the research team, IES staff, and the project's expert advisory panel, it was decided that a sample of roughly 240 schools was needed, which is four times the sample size planned for the original experimental design. This larger sample size was necessary for the study to achieve a minimum detectable effect size of 0.20 standard deviations. As noted in Chapter 2, initial recruitment efforts produced a sample of 258 schools from one state site and 17 district sites. These 18 sites represent a total of 13 states. Due to refusals, school closings, reconfiguring, or redistricting, 10 schools (4 RF schools and 6 non-RF schools) subsequently dropped out of the study. For results presented in this report, a final analytic sample of 248 schools was used.

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[14] One can easily confirm this finding and its implications for precision by simulating alternative data structures. Doing so also indicates that the collinearity correlation declines somewhat but remains quite large for regression discontinuity designs that have *unequal* numbers of schools on each side of the cut-point. However, such unbalanced designs create other analytic problems that are beyond the scope of the present discussion.

[15] Goldberger, Arthur S. (1972). "Selection Bias In Evaluating Treatment Effects: Some Formal Illustrations" (Discussion Paper 129-72, Madison, WI: University of Wisconsin, Institute for Research on Poverty, June).

Part 6: Statistical Precision

The statistical precision of an impact estimator is its ability to detect true intervention effects when they exist. A common way to represent statistical precision is a minimum detectable effect. This measure indicates the smallest true effect that an estimator has a "good chance" of detecting. The current analysis uses the common convention of defining a minimum detectable effect as the smallest true program effect (impact) that has an 80 percent chance of being found to be statistically significant (i.e., it has 80 percent statistical power) at the 0.05 level of statistical significance for a two-tailed test of the null hypothesis of no effect. When a minimum detectable effect is expressed as a standardized effect size (in standard deviation units), it is usually referred to as a minimum detectable effect size (MDE).

Exhibit B.16 lists the minimum detectable effect (or effect size) for full-sample estimates of program impacts on key study outcomes when the data are pooled across the two school years for which data are currently available. These minimum detectable effects are based on the experience of students and schools in the study sample during the follow-up period to date, and not on the initial assumptions that guided the study design. Hence, the findings in Exhibit B.16 represent the actual precision of the present design as it materialized in the field.[16]

The three panels in the exhibit present minimum detectable effects for the three outcome domains of the present study. The three columns in the exhibit present minimum detectable effects for grades one, two, and three separately.

The top panel focuses on measures of student reading comprehension. Findings in this panel indicate that the present study design and impact estimation model have minimum detectable effects that range from approximately 6 to 8 scaled score points, which corresponds to 0.15 to 0.16 standard deviations or 7 to 8 percentage points. These findings indicate that the present study achieved its goal of providing minimum detectable effect sizes that are no larger than 0.20 standard deviations for estimates of the impacts of Reading First on student reading comprehension.[17]

These findings also indicate that the corresponding minimum detectable effect size for a subgroup of sites that comprise about half of the schools in the study sample is approximately equal to 0.22 standard deviations. In addition, the findings indicate that the minimum detectable difference in effects for two subgroups (each comprising approximately half the schools in the study sample) is approximately 0.31 standard deviations.[18] Thus, the present study has considerably more precision for full-sample estimates of program impacts than for sub-sample estimates or sub-sample differences.

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[16] Because for the present full sample the number of degrees of freedom for estimating the standard error of an impact estimator is well beyond 30, the minimum detectable effect of an estimator equals 2.8 times its standard error. For further discussion see Bloom, H. S. (1995) "Minimum Detectable Effects: A Simple Way to Report the Statistical Power of Experimental Designs," *Evaluation Review*, Vol. 19, No. 5, pp. 547–556.

[17] See Gamse et al. (2004).

[18] The minimum detectable effect size for a subsample comprising half of the schools in the study sample is equal to the square root of two times the minimum detectable effect size for the full study sample. The minimum detectable difference in effect sizes for two subsamples each of which comprises half of the schools in the study sample equals twice the minimum detectable effect size for the full sample.

Exhibit B.16: Minimal Detectable Effects for Full Sample Impact Estimates

	Grade Level		
	Grade 1	Grade 2	Grade 3
Panel 1			
Student Reading Comprehension			
Mean Scaled Score	8.04	6.75	6.08
Effect Size	0.16	0.16	0.15
Percent at or above Grade Level	7.81	7.28	7.11
Panel 2			
Instructional Outcomes			
Instruction in the Five Dimensions Combined			
Minutes	7.87	7.98	N/A
Effect Size	0.38	0.38	N/A
Percentage of Intervals in Five Dimensions with			
Highly Explicit Instruction	4.47	4.80	N/A
High Quality Student Practice	4.12	4.06	N/A
Panel 3			
Student Engagement with Print			
Percentage of Students Engaged with Print	10.44	10.81	N/A

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

Minimal detectable effects are based on the standard errors and standard deviations of the impact estimates for the full sample pooled across two school years of follow-up.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

EXHIBIT READS: The minimal detectable effect of the Reading First program on reading comprehension for a mean scaled score in grade 1 is 8.04 scaled score points. The minimal detectable effect of the Reading First program on reading comprehension for a mean scaled score in grade 2 is 6.75 scaled score points. The minimal detectable effect of the Reading First program on reading comprehension for a mean scaled score in grade 3 is 6.08 scaled score points.

Sources: Data from RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR); RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006; and RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Findings in the second panel of the exhibit indicate that the minimum detectable effect for instructional time spent in the five dimensions of reading instruction is about 8 minutes or about 0.38 standard deviations (in effect size).

Minimum detectable effects for the percentage of instructional intervals in the five dimensions that exhibited highly explicit instruction or that exhibited high quality student practice ranged from about four to five percentage points. The minimum detectable effect on the percentage of students engaged with print was between 10 and 11 percentage points, roughly twice as large as that for the preceding two measures.

On balance, the statistical precision of the present study design and its analytic framework achieve the initial goals of the study's design. The precision is adequate for full-sample impact estimates, which are the primary focus of the present study, and is less adequate for estimating sub-sample impacts or differences in sub-sample impacts.

Appendix C: Measures

Appendix C describes the measures selected for each of the three outcome domains assessed in the RFIS. It begins by describing the selection of assessments for measuring students' reading performance, then describes the development of measures to assess teachers' instructional behaviors in reading as well as students' engagement with print. The appendix also includes relevant information on properties of instruments, data collection procedures and response rates, and copies of instruments.

Part 1: Reading Comprehension

At the heart of this evaluation is a question about the impact of Reading First on the reading achievement of students. The RFIS had initially planned to use a battery of tests to assess students' reading skill across the components of reading instruction targeted in the legislation (phonemic awareness, phonics, fluency, vocabulary, and comprehension), but when the study's design shifted to an RDD, with a much larger number of schools, the planned data collection activities also changed. The RFIS Team, working with its Technical Work Group and staff from the National Center for Education Evaluation/Institute of Education Sciences at the Department of Education, focused its efforts on identifying a single test of reading comprehension.

Reading Comprehension Instrument Selection

The team's priorities in selecting a test for this study included, first, finding a test that directly measured skills related to text comprehension. Other factors included: ease and appropriateness of administration to groups or entire classrooms of students—including appropriateness for fall first grade; modest time demands; use of a norm-referenced test; and consistent reliability and validity. The team also sought a measure that had already been widely used in large-scale studies, and therefore would be more likely to be credible in the research community.

At the outset of the test selection and review process, the team identified 47 assessments of text comprehension that either had been proposed for use by states in their Reading First schools or had been proposed for use in other Department of Education-sponsored evaluations involving preschool and the early elementary grades. From this pool of tests, we identified six test batteries with subtests of reading comprehension that could be group-administered and were valid for fall of first grade.[19] The six test batteries included:

1. ITBS Total Core Battery Reading Subtest;
2. Terra Nova/CTBS Basic Battery Reading Subtest;
3. Gates/MacGinitie Reading Test-3 (GMRT);
4. GRADE (Group Reading Assessment and Diagnostic Evaluation);
5. Stanford Achievement Test—10th Edition (SAT 10); and
6. Stanford Reading First.

[19] See published manuals (Hoover et al., 2003; CTB/McGraw-Hill, 2003; MacGinitie et al., 2000; Williams, 2001; SAT 10, Harcourt Assessment, Inc., 2004; Harcourt Assessment, Inc., 2004).

Five of the six tests have reliability coefficients reported in published manuals of close to 0.90 for the majority of subtests. Because the reliability for Terra Nova Grade 1 was 0.76, and data were not available for the other grade levels, that test was eliminated from consideration. The Stanford Reading First Test was also eliminated, because it had been normed on a relatively small sample according to a conversation with a Harcourt representative in 2004 (< 400 students across several grade levels), whereas the remaining five tests had been normed on samples of 1,000 or more students.

Next, the team reviewed two related aspects of the tests: the number of items and amount of time required. The number of items varies considerably—from approximately 30 to 80, with fewer items typically required for grade 3 tests (although the amount of time required per item increases by grade level). The tests also vary in amount of time required, from 50 minutes for the Stanford Reading First at all three grade levels to 95 minutes for the GRADE in grade 1. The amount of time required was a consideration, but not the deciding factor. The final consideration was the relative frequency of use for the four remaining assessments in schools in the study sample. Of the states and districts that (in Summer 2004) administered standardized reading assessments to children in grades 1, 2, and 3, more used the SAT 10 than any other test (although none did so in fall of grade 1). The study consequently chose the SAT 10 because it both met all the criteria above and because its use might allow the study to collect extant data, which would reduce the testing burden on students and schools. (Where extant data were not available, the study would administer the SAT 10.)

The specific properties of the SAT 10 are summarized in Exhibit C.1 below.

Exhibit C.1: Features of SAT 10: Reading/Listening Comprehension for Spring Administration

	Grade Level		
	Grade 1 Spring (Primary 1)	**Grade 2 Spring (Primary 2)**	**Grade 3 Spring (Primary 3)**
Number of Items	40	40	54
Time in Minutes	50	50	60
Test-Retest Reliability*	.91	.91	.93
Concurrent Validity	To SESAT-2:[1] .63 Form A to B: .87	To Primary 1: .69 Form A to B: .85	To Primary 2: .80 Form A to B: .83
N in Norming Sample	3,392	3,558	2,160

*Reliability is test-retest Kuder-Richardson formula 20 (KR 20)
[1] Stanford Early School Achievement Test.
Sources: Harcourt Assessment, Inc. (2004)

Data Collection and Response Rates

In six sites, the RFIS obtained SAT 10 data directly from state and/or district education officials. In 12 sites, the RFIS collected test data directly. The student assessments were administered in grades 1, 2, and 3, at three timepoints: fall 2004, spring 2005, and spring 2006. To conduct the testing, one site assessment coordinator was hired at each district (local), and that coordinator in turn hired a local team of test administrators. Since the SAT 10 is a standardized test, the requirements of the test publisher for administration were followed. Site assessment coordinators also observed each test administrator in the classroom for quality control and technical assistance. In addition, staff from the home office visited districts during the testing for quality control purposes.

The study team collected classroom rosters prior to administration, and used these rosters to pre-label the student test booklets with the student ID and a strippable name label. Once the test booklet was complete, the test administrator stripped the name label from the booklet (for privacy purposes) and adhered it to a receipt sheet. The test administrator then delivered the completed booklets and the receipt sheet to the site assessment coordinator who was responsible for keeping track of who had been tested and who required make-up testing. A computerized field management system allowed the site coordinators to receive the booklets and also to print out a list by school and grade regarding which students needed makeup testing. Once testing was complete in the district, the site coordinator shipped the hardcopy test booklets to be processed.

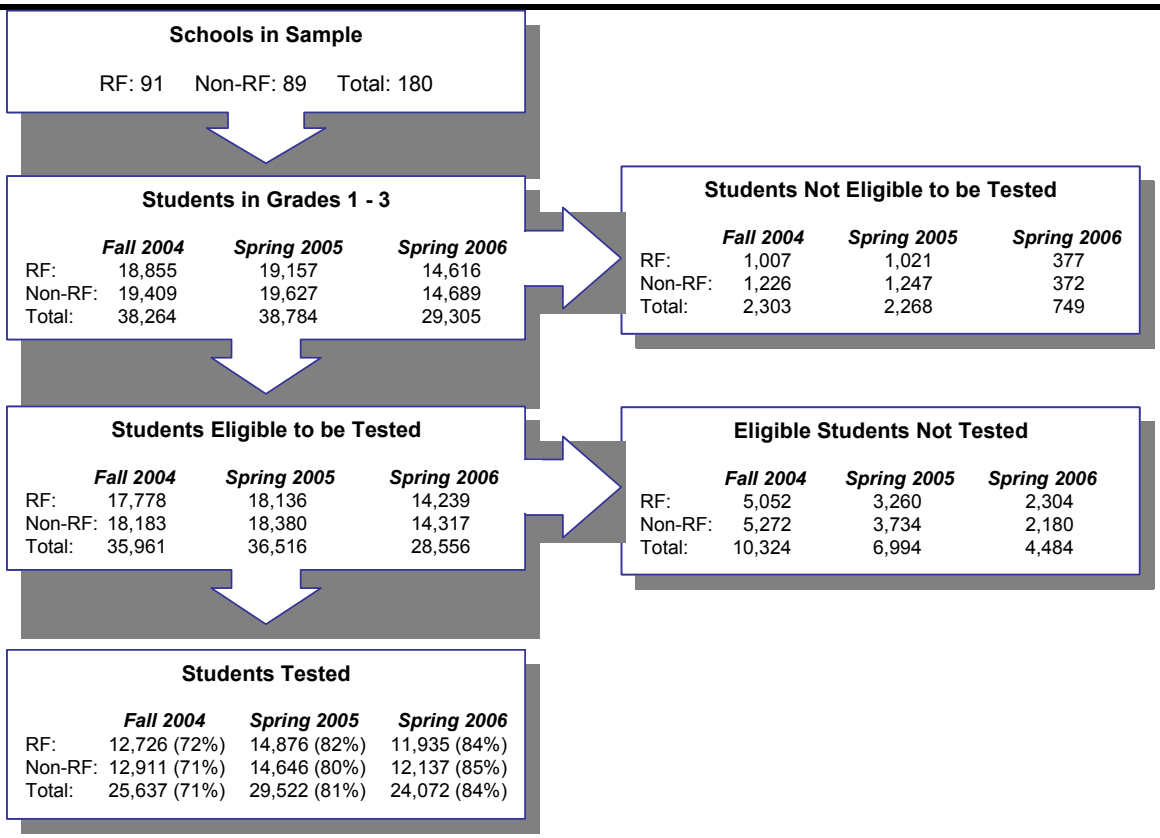
In fall 2004, there were two main factors in maximizing response rates: obtaining parent permission at more than one timepoint, and administering make-up tests for students who missed the originally scheduled testing sessions. In the initial two weeks of student assessment, the RFIS assessed all students present in the classroom who had returned signed permission slips. Study staff worked with school liaisons prior to the scheduled assessment date to obtain as many permission slips as possible.

For those students who returned permission slips after the scheduled assessment day, or were absent, group make-up sessions were held at each school. Students were not eligible for the assessments if they were excluded from testing in accordance with their own school or district policies (generally because they received instruction primarily in a language other than English), and/or needed special accommodations (particularly an exam writer/scribe). The consent rates and resultant response rates were considerably lower than hoped in fall 2004 (75 and 70 percent, respectively, for Reading First and comparison schools). The RFIS obtained a waiver from participating districts and from the Abt Associates IRB to use passive consent in subsequent testing, which increased the effective response rates to 84 and 83 percent, respectively, for Reading First and comparison schools in spring 2005, and to 86 and 85 percent in spring 2006. A flowchart presenting student assessment sample information in the 12 sites in which the RFIS collected test data directly is presented in Exhibit C.2.

In the 2004-05 school year, the study team endeavored to test all students within grades 1, 2, and 3 in the participating schools. However, the fact that some schools had as many as 10 or 12 classrooms per grade level led the study team to sample classrooms within grades in subsequent testing, such that the team assessed an average of three classrooms per grade per school in spring 2006 (and spring 2007). Note that the RFIS tested all students as required by local policy in those schools that routinely administered the SAT 10 reading comprehension as part of state- or district-standardized assessment. In all sites, testing procedures were equivalent for Reading First and for comparison schools. Some sites required classroom teachers to administer tests; other sites relied upon RFIS staff to administer assessments. In the latter sites, the RFIS Team worked with district officials to carry out testing in accordance with local guidelines.

In fall 2004, assessment data were collected for 30,854 students, who represent 71 percent of eligible students in the sample. The response rates for grades 1, 2, and 3 were 70 percent, 70 percent, and 71 percent, respectively. For spring 2005, assessment data were gathered on 43,769 students, or 83 percent of eligible students. The response rates for grades 1, 2, and 3 were 82 percent, 83 percent, and 84 percent, respectively. For spring 2006, assessment data were collected on 36,500 students, or 86 percent of eligible students. The response rates for grades 1, 2, and 3 were 86 percent, 86 percent, and 87 percent, respectively. (See Exhibit C.2.)

Exhibit C.2: Student Assessment Data Collection: Sample Information



Notes:

The information presented in the flowchart represents the 12 sites in which the RFIS collected test data directly. For information on the total number of students assessed (including those in the six sites in which the RFIS obtained student test data from state and/or district education officials), see Exhibit 3.2.

Students were not eligible for assessments if they were excluded from testing in accordance with their own school or district policies (generally because they received instruction primarily in a language other than English), and/or they needed special accommodations beyond those that could be provided through additional time in a group administered testing situation.

Eligible students were not tested if they were absent at the time the test was given and could not be rescheduled, they had transferred out, they had refused to take the test, or the RFIS did not have consent for them to participate in the study.

Source: RFIS SAT 10 administration, fall 2004, spring 2005, and spring 2006

Part 2: Classroom Instruction: The Instructional Practice in Reading Inventory (IPRI)

Background

To measure the impact of Reading First on classroom instruction, the RFIS team conducted classroom observations in both Reading First and non-Reading First (non-RF) classrooms. The primary instrument used to assess instruction was the Instructional Practice in Reading Inventory (IPRI).[20] The RFIS Team was unable to identify an existing observational instrument that fulfilled all of the study requirements; consequently, the RFIS Team developed the IPRI specifically for the RFIS. The IPRI is designed to measure first- and second-grade teachers' use of instructional behaviors informed by scientifically-based reading research (SBRR), as described in the National Research Council's (1998) report (Snow, Burns, and Griffin, 1998) and the National Reading Panel report (National Institute of Child Health and Human Development, 2000). In particular, the IPRI focuses on instruction in the five dimensions of reading instruction emphasized by SBRR (phonemic awareness, decoding/phonics, fluency, vocabulary, and comprehension). Exhibit C.3 gives specific examples of instructional activities associated with each of the five dimensions.

[20] A second instrument used in classroom observations, the Student Time-on-Task and Engagement with Print measure, is described in Appendix C, Part 3.

Exhibit C.3: Examples of Instruction in the Five Dimensions of Reading Instruction	
Phonemic awareness	The teacher is working with a group of four students. The teacher says, "Listen to me. The word is ***hat***. If I take away the /h/ sound at the beginning, I have the word ***at***. Then if I add a /b/ sound to the beginning I get ***bat***. Now you try. The word is ***sat***. If we take away the /s/ sound what word do we have?" [students respond orally]. "That's right, ***at***. Now add a /k/ sound to the beginning. What word? That's right, ***cat***."
	The teacher is working with a pair of students. He asks students to identify the final sound in each of a list of 10 words. The students respond orally to each prompt from the teacher: "***Crack***. What's the last sound in ***crack***? [students respond orally]. Good. Ok: ***Take***. What's the last sound? [students respond orally]. Ok, next: ***kite***. What's the last sound? [students respond orally]. How about ***flight***? [students respond orally]. That's right, /t/, /t/ is the last sound in ***flight***. "
Decoding	A group of 16 students has assembled in front of the classroom blackboard. The teacher writes the letters ***oi*** on the board and says, "Ok, now today we're going to be learning about words that have o, i in them. When you see these vowels together, they make the /***oy***/ sound. Here's an example." The teacher writes a sentence on the board: ***I want Roger to join my club.*** She underlines the letters oi in the word join. "This word is ***join***. 'I want Roger to ***join*** my club. See that ***oi***? What sound does ***oi*** make?" [students respond, some of them incorrectly]. "Ok, listen carefully. Not ***/eye/***… no, ***oi*** makes the ***/oy/*** sound. Everyone try that: ***/oy/***." [students in unison say /oy/]. "Ok, good, now what's this word [she points to **join**]?" The students pronounce **join** correctly. "Excellent, ok, let's try another one." She writes the word ***coin*** on the board. "Boys and girls, look at that ***oi*** in the word. Sound out this word for me."
	Six students are seated with a teacher. Each student has a set of individual magnetic letters and a metal tray. The teacher is asking students to form words that she dictates orally: "Ok, listen to the word, think about the sounds and what letters go with those sounds. Remember that we've been working with the ***/ō/*** sound and its spellings. We know that one way to spell that is with ***o, a***. Try to make the word using your letters. The first word is ***goat***. Use your letters to make the word ***goat***." Students assemble their letters and the teacher checks each student's work. "Good. Everyone used ***o, a*** to spell ***goat***. Ok, let's try another word: ***float***." Students form the word with their letters. "Ok, good! You're doing very well. Now, we also know another way to spell some words with the long ***/ō/*** sound. Remember the silent e rule? It makes the vowel say its name. So, to spell the word ***tote***, Arthur, tell me how we'd write ***tote***?"
Vocabulary	The teacher gives a definition for the word **swift** and uses it in a sentence: "Swiftly? Something that is swift is moving very fast, rapidly. So, remember when we learned about how fast cheetahs can run over land? Well, we might say, 'the cheetah ran ***swiftly*** across the ground, quickly catching up to the tiger.'"
	As they are reading a story in class, students come across the word **debating**, and the teacher discovers that they do not know what it means. The teacher defines **debating** by contrasting it with more familiar words (**chatting** and **talking**). The teacher says, "When two people are **debating** something, it means that they are talking about the reasons to do something and the reasons not to do something—so in our story, John and Sara are **debating** whether or not to go on a picnic. On the one hand, the weather is nice, but on the other hand they are thinking there may be a lot of ants. So they're **debating** what to do. **Chatting** is different than **debating**. When you're **chatting** with someone, you're usually not trying to decide something, you're just talking about things that aren't too serious. You chat more to enjoy the talking, not really to decide something together."

Exhibit C.3: Examples of Instruction in the Five Dimensions of Reading Instruction	
Fluency	Roberto is reading orally from a passage about parrots and their habitat. When he reaches the end of the second paragraph, the teacher asks Roberto to read that same passage aloud again. When Roberto finishes, the teacher asks him to read the passage out loud a third time.
	The teacher assigns four students to pairs and distributes a page-long excerpt from a story they have been reading in class that week. Each pair of students also has a one minute timer. "Ok, now you each have a partner, and I want you to time your partner reading this passage out loud. Readers, you try to read as far as you can in one-minute. Timers, you keep track of the time and tell your partner to stop reading when time runs out. Then circle the last word the reader got to in the passage."
Comprehension	A teacher pauses in the middle of a story about Shackleton's Antarctic Voyage to ask students to reflect on what they have just read and draw some inferences about how one character might be feeling. "What do you think the captain is feeling? Let's see. The story doesn't tell us exactly, but the story says the ship is starting to break apart. I'd certainly be very worried for myself and my crew if my ship were breaking apart! I bet the captain is really worried. Let's see… the story also says the captain 'furrowed his brow.' That means he made his forehead wrinkle or sort of frown. Some people do that when they're worried. That could be a sign that the captain is worried. He certainly has reason to be worried."
	The teacher introduces a comprehension strategy. "One thing you should always do when you read is constantly ask yourself questions about the story. Asking yourself questions is a strategy to help make sure you understand what you just read. Asking questions also helps you think about what might happen next. We're going to practice using this strategy. At the end of every paragraph today, we're going to come up with some questions and write them up here on the board. Some questions we'll be able to answer right away. But we might have other questions, too, and we'll need to read more of the story before we can find out how to answer those questions."

The development of the IPRI relied on several sources, including (1) research on the components of effective elementary grade reading instruction (e.g., Kamil, 2004; National Institute of Child Health and Human Development, 2000; Snow, Burns and Griffin, 1998; Stahl, 2004); (2) reviews of existing instruments (among the instruments reviewed were the following: *The Instructional Content Emphasis (ICE)* [Edmonds and Briggs, 2003]; *Foorman and Schatschneider direct observation system and instruments from the Center for Academic and Reading Skills (CARS)* [Foorman and Schatschneider, 2003]; *English Language Learner Classroom Observation Instrument (ELLCOI)* [Haager et al., 2003]; *Teachers' Instructional Practice (TIP)* [Carlisle and Scott, 2003]; *Utah's Profile of Scientifically-based Reading Research* [Dole, et al., 2001]; *The Classroom Observation Record* [Abt Associates and RMC Research, 2002]; and *Observation Measure of Language and Literacy Instruction (OMLIT)*, developed by Abt Associates as part of the Even Start Classroom Literacy Interventions and Outcomes (CLIO) Study [Goodson et al., 2004]); and (3) research on the development of classroom observation instruments (Vaughn and Briggs, 2003).[21]

[21] For a comprehensive description of the development of the IPRI, see Dwyer et al., 2007.

Overview of the IPRI

The IPRI observation instrument is a booklet containing a series of individual IPRI forms, each of which corresponds to a three-minute observation interval.[22] Observation data for a given reading block are collected via sequentially-ordered IPRI forms that span the entire observation period (e.g., a 60-minute observation would be recorded on 20 sequential forms, one for each successive three-minute interval). During each three-minute interval, observers record any of the teacher's instructional behaviors listed on the IPRI that occur during that interval. At the end of each three-minute interval (signaled by a pre-programmed vibrating wristwatch), observers turn to a new IPRI form and begin another three-minute interval, again recording the presence of targeted behaviors.

Within a given three-minute interval, a particular behavior is coded only once, regardless of how often that behavior occurs within an interval. Recurrences of that same behavior are coded in each subsequent interval. If behavior ***x*** occurs in interval ***n***, the observer circles the code for behavior ***x*** once during interval ***n***. If behavior ***x*** occurs in the next interval, ***n+1***, the observer circles the code for behavior ***x*** during interval ***n+1***.

[22] See Exhibit C.4 for a copy of the IPRI instrument.

Exhibit C.4: Instructional Practice in Reading Inventory (IPRI)

Instructional Practice in Reading Inventory (IPRI)

Part A. Dimensions of Reading

Interval 1 Time: ___ : ___ AM PM

DP Decoding with PRINT (Phonics)

Grouping		T. Instruction: The Teacher. . .		S. Student Practice: The Teacher . . .	
W	Whole class	T1	Describes, explains, identifies or asks S(s) to describe, explain or identify • *sound-symbol pattern* • *decoding rule* • *word structure pattern or rule*	S1	Gives S(s) practice decoding words (PRINT TO SOUND)
L	Lg grp			S2	Gives S(s) practice encoding words (manipulating letters or writing, not copying) (SOUND TO PRINT)
S	Sm grp			S3	Asks student(s) to orally spell word(s)
P	Pair				
I	Individual				
		T2	Shows how to apply a rule or pattern to whole word example(s)		
Support		T3	Identifies word(s) that contrast with or do not follow pattern or rule		
TM	Tchr Manipulatives	T4	***If S makes mistake:***		
V	Picture, Object		Reminds S of pattern or rule and has S produce or repeat correct response		
ST	Sentence(s)/Text			GH	**Grammar or Handwriting is part of lesson**
SM	Std Manipulatives	**PA**	**Includes Phonemic Awareness example**	**OR**	**Student Oral Reading is part of lesson**

CP Comprehension of Connected Text

Grouping		T. Instruction: The Teacher. . .		S. Student Practice: The Teacher . . .	
W	Whole class		***Before reading text:***		***During or after reading text passage:***
L	Lg grp	T1	Conducts pre-reading activity(ies)	S1	Asks students to answer literal recall questions about specific details in the text
S	Sm grp	T1a	Previews vocabulary prior to lesson (Go to Vocab)		
P	Pair		***Before, during, or after reading text passage:***		
I	Individual	T2	Describes or explains—or asks Ss to describe or explain—one or more comprehension strategies	S2	Asks students to identify or describe genre
		T2a	Specifies what the strategy is called		
Support		T2b	Specifies why the strategy is helpful		
		T2c	Specifies when in the reading process the strategy is used		
V	Picture, Object		***During or after reading text passage:* Shows how to apply strategy**		***During or after reading text passage:* Gives S(s) practice applying strategy**
O	Text Organizer		Using cues to support interpretation or make predictions about text:		Using cues to support interpretation or make predictions about text:
		T3a1	Pictures	S3a1	Pictures
C	Connected text	T3a2	Text cues (e.g., headers, captions)	S3a2	Text cues (e.g., headers, captions)
E	Expository	T3b	Answer inferential questions based on text	S3b	Answer inferential questions based on text
N	Narrative	T3c	Make predictions based on text	S3c	Make predictions based on text
CD	Can't determine	T3d	Summarize, retell, sequence text or identify main idea(s)	S3d	Summarize, retell, or sequence text or identify main idea(s)
		T3e	Make text-text connections	S3e	Make text-text connections
		T3f	Work with story or expository structure	S3f	Work with story or expository structure
		T3g	Use mental imagery to support interpretation of text	S3g	Use mental imagery to support interpretation of text
		T3h	Generate own questions about text	S3h	Generate own questions about text
		T3i	Answer own questions about text	S3i	Answer own questions about text
		T3j	Review passage to check or clarify understanding	S3j	Review passage to check or clarify understanding
		T3k	Check accuracy of prediction or inference	S3k	Check accuracy of prediction or inference
		T4	Teaches vocabulary during or after reading text passage (Go to Vocab)	S4	Asks S(s) to justify their response with evidence
		T5	***If S response is incorrect or incomplete:*** Assists S in using strategy(ies)	S5	Sets up independent practice for Ss to apply comprehension strategy(ies) (student work product or response required)
		HD	**Helps student(s) Decode word(s)**	**GH**	**Grammar or Handwriting is part of lesson**
		OR	**Student Oral Reading is part of lesson**	**SR**	**Student Silent Reading is part of lesson**
		TOR	**Teacher orally reads as students listen**		

Instructional Practice in Reading Inventory (IPRI)

Interval 1

VD Vocabulary Development

Grouping		T. Instruction: The Teacher. . .		S. Student Practice: The Teacher . . .	
W	Whole class	T1	Asks S(s) to give meaning of word	S1	Asks S(s) to apply understanding of word meaning
L	Lg grp	T2	Gives synonym	S2	Gives S(s) opportunity to practice word learning strategy(ies) (e.g., context, word structure, root meanings)
S	Sm grp	T3	Goes beyond synonym with definition and/or examples		
P	Pair	T4	Pinpoints word meaning with contrasting examples		
I	Individual	T5	Pinpoints word meaning by clarifying or extending Ss' partially correct response:		
Support		T5a	Extension/clarification includes synonym	**List vocabulary words:**	
V	Picture, Object	T5b	Extension/clarification includes definition and/or example		
P	Physical Demo.	T5c	Extension/clarification includes contrasting example	**GH**	**Grammar or Handwriting is part of lesson**
M	Word Map	**HD**	**Helps student(s) Decode word(s)**	**OR**	**Student Oral Reading is part of lesson**

PA Phonemic / Phonological Awareness (Sounds, NO PRINT)

Grouping		T.	Instruction: The Teacher. . .	S.	Student Practice: The Teacher . . .
W	Whole class		***Demonstrates or models:***		***Gives S(s) chance to practice:***
L	Lg grp	T1a	Oral work with syllables	S1a	Oral work with syllables
S	Sm grp	T1b	Oral blending or segmenting with onset-rimes	S1b	Oral blending or segmenting with onset-rimes
P	Pair	T1c	Oral blending or segmenting with phonemes	S1c	Oral blending or segmenting with phonemes
I	Individual	T1d	Phoneme isolation	S1d	Phoneme isolation
		T1e	Phoneme categorization/identity (same/different sound in words)	S1e	Phoneme categorization/identity (same/different sound in words)
		T1f	Phoneme deletion, addition, substitution	S1f	Phoneme deletion, addition, substitution
Support		T2	Contrasts two phonemes to pinpoint target sound		
MK	Tchr Manip or Kin	T3	Pinpoints what S(s) did incorrectly with sound(s) and gives correct response with or without students		
SM	Manipulatives				
SK	Kinesthetic	T4	Introduces printed letters corresponding to sounds		

FB Fluency Building With Connected Text

Grouping		T.	Instruction & Student Practice: The Teacher. . .
W	Whole class	T1	Sets up or prompts S(s) to practice repeated or timed readings with a listener
L	Lg grp		
S	Sm grp		***Listens to Ss practice repeated oral readings:***
P	Pair	T2a	With text that was not modeled
I	Individual	T2b	With same text that was modeled by fluent reader
Support			***Listens to Ss practice timed oral readings:***
C	Connected text	T3a	With text that was not modeled
W	Written record	T3b	With same text that was modeled by fluent reader

Part B. Other Instruction												
	OR	Oral Reading	SP	Spelling	AS	Assessment			TR	Transition	MB: Managing Behavior:	
	SR	Silent Reading	WE	Written Expression					AM	Academic Mgmt	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	
	TOR	Teacher Oral Reading	OL	Other Language Arts	NL	Non-literacy instruction			NI	Non-instructional		

Part C. Instructional Errors	**Part D.** Small group changes	T working with new small group: YES

Structure of the IPRI Instrument

Each IPRI form has four distinct parts: Part A, Part B, Part C, and Part D. Part A is divided into five color-coded sections that correspond to the five dimensions of reading instruction: phonemic awareness, decoding/phonics, fluency, vocabulary, and comprehension, respectively. Within each of these five sections are microcodes, specifically tailored to each of the five dimensions, which denote the following areas of interest:

- the size of the student grouping to which instruction is delivered;
- the use of any instructional support materials (e.g, manipulatives, pictures);
- the teacher's use of explicit instruction;
- the teacher's provision of practice opportunities for students; and
- the teacher's delivery of any corrective feedback or expansion of student responses.

For example, within the phonemic awareness row, the IPRI microcodes for grouping are "whole class, large group, small group, pair, or individual"; for the use of various types of instructional supports, "teacher manipulative or kinesthetic, student manipulatives, kinesthetics"; and for corrective feedback, "teacher pinpoints what student(s) did incorrectly with sound(s) and gives correct response with or without students." For the use of explicit instruction and the provision of practice opportunities for students, these areas of interest are often denoted by the combination of two or more microcodes. So, for example, if a teacher "demonstrates or models oral blending or segmenting with phonemes" *in conjunction with* "gives student(s) chance to practice oral blending or segmenting with phonemes," it would be counted as explicit instruction.

Part B of the IPRI contains codes to capture instruction or other activity outside the five dimensions, including:

- Oral reading by students; [23]
- Oral reading by teacher alone (without student accompaniment);
- Silent reading;
- Spelling;
- Written expression;
- Other language arts;
- Assessment;
- Non-literacy instruction;
- Non-instruction;
- Academic management;
- Transitions between activities;
- Interruptions to instruction for the purpose of managing student behavior.

[23] Oral reading under Part B is marked when the teacher has not clearly indicated the instructional purpose of the oral reading. If, however, oral reading is used to advance instruction in one of the five targeted dimensions of reading instruction (e.g., comprehension), then the oral reading is coded within the corresponding row in Part A of the IPRI.

Part C records teachers' instructional errors that are not subsequently self-corrected. Part D records whether the teacher worked with a different small group of students than in any previous part of the observation.[24]

Training and Inter-rater Reliability of Classroom Observers

Prior to each wave of data collection, field staff based in each of the RFIS sites attended a centralized, multi-day training on the IPRI and associated data collection protocols. The training curriculum included extensive practice coding a series of videotaped clips of real-time and unscripted classroom instruction that were filmed in RF and non-RF classrooms. The film clips were created specifically for the RFIS, and were edited to illustrate the codes included on the IPRI. Candidate observers conducted a live observation in a first or second grade classroom during the training session and received ongoing feedback, multiple opportunities for review, tutoring and other support throughout the training.[25]

One component of this training was that observers were required to pass two of three formal inter-rater reliability tests; each videotape used for reliability purposes was approximately 30 minutes in length. To calculate observers' percent agreement with the master coding of each reliability tape, the RFIS Team used a procedure that reduces inflation in inter-rater reliability estimates due to chance agreement (see Kelly, 1977, cited in Suen and Ary, 1989). The inflation due to chance agreement is especially severe when some events (or codes) occur infrequently, as is the case with the IPRI.[26] As a result, observers were credited only for codes that occurred at least once in the reliability tape. In sum, if a behavior occurred at all during a 30-minute tape, observers were credited (or penalized) for correctly coding instances of the behavior and for correctly abstaining from coding behaviors that did not occur. Observers were not credited for abstaining from, nor penalized for, marking behaviors that never occurred throughout the entire reliability tape.

For each potential observer, percent agreement with the master codes was calculated for each code individually; then agreement was aggregated across codes within the five sections in Part A and across codes within Part B. Finally, an aggregate overall percentage agreement across the five sections in Part A and codes within Part B was calculated. A report summarizing all of these measures of agreement (by individual code, by dimension, and overall) was prepared for each potential observer so that s/he (and the study team) could diagnose which codes had proven particularly troubling. Overall percent agreement was used to judge whether or not each observer had met the criterion for employment on the study. Only observers who successfully coded two of three videotaped reliability tests were hired. The mean overall percent agreement for observers was 88 percent (n=155 observers) in spring 2005 (for spring 2005 data collection). The mean overall percent

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[24] Minor changes were made to the IPRI after the spring 2005 data collection and prior to the fall 2005 wave of data collection; these changes included elaborating upon some micro-behaviors within each of the five dimensions.

[25] For a detailed description of the classroom observer training, see Dixon et al. (2007).

[26] During each observation interval, an IPRI form contains 142 possible codes; typically, only a small subset of the behaviors occur during a given interval. Thus, most of the possible codes are infrequent within a single interval. Including all 142 codes per interval in the calculation of percent agreement severely inflates inter-rater reliability.

agreement for observers was 90 percent (n=154 observers) in fall 2005 (for fall 2005 and spring 2006 data collection).

Data Collection

Observations were conducted in each of 1,378 to 1,579 or more first- and second-grade classrooms for two consecutive days during each classroom's designated reading block. During the 2004-05 school year, the RFIS conducted two days of classroom observation in spring 2005. In the following study year, a second round of observations was added, so that observers conducted observations for two consecutive days in the fall, and then again for two consecutive days in the spring. The increased number of observations reflects a decision by the National Center on Education Evaluation/Institute of Education Sciences at the Department of Education to collect more data, both in terms of the number of observations and in terms of when during the year data could be collected.

Observation scheduling was arranged by RFIS field supervisors via communication with each participating school's study liaison.[27] Observers coded during the entire scheduled observation period, even when teachers appeared to be offering non-reading-related instruction. In those instances when reading instruction appeared to continue beyond the scheduled reading block, observers observed for up to an additional 30 minutes. Throughout observations, IPRI observers followed the actions and behaviors of classroom teachers. In classrooms with more than one adult present, observers determined beforehand who was the official teacher of record and which adult would be delivering that day's reading instruction. The individuals responsible for delivering instruction were then followed for the observations whether or not they were the official teacher of record. Observations were rescheduled when the classroom teachers were absent or ill, although long-term substitutes replacing a teacher on an extended leave of absence (e.g., maternity, disability) were observed.

The 248 schools in the RFIS study sample included 2,091 first and second grade classrooms in spring 2005, 1,989 classrooms in fall 2005, and 2,008 classrooms in spring 2006. Of these, 1,917 classrooms met eligibility requirements for classroom observations in spring 2005, 1,822 in fall 2005, and 1,827 in spring 2006. Classrooms were considered eligible to be in the study sample if they were not special education or English as a Second Language classes, if more than 75 percent of the students were in the target grades, and if the class was taught by the regular teacher or a long-term substitute.

Of the eligible classrooms, the RFIS selected a final sample of 1,639 classrooms in spring 2005, 1,384 in fall 2005, and 1,386 classrooms in spring 2006. Classrooms were sampled within schools, if, within each site as a whole, the number of classrooms exceeded an average of three classrooms per grade. Each classroom in the sample was expected to be observed two times during each of the three waves of data collection. The RFIS completed 96 percent of the expected classroom observations in spring 2005, and 100 percent in fall 2005 and spring 2006. A flow chart of information on the RFIS IPRI sample and response rates is presented in Exhibit C.5.

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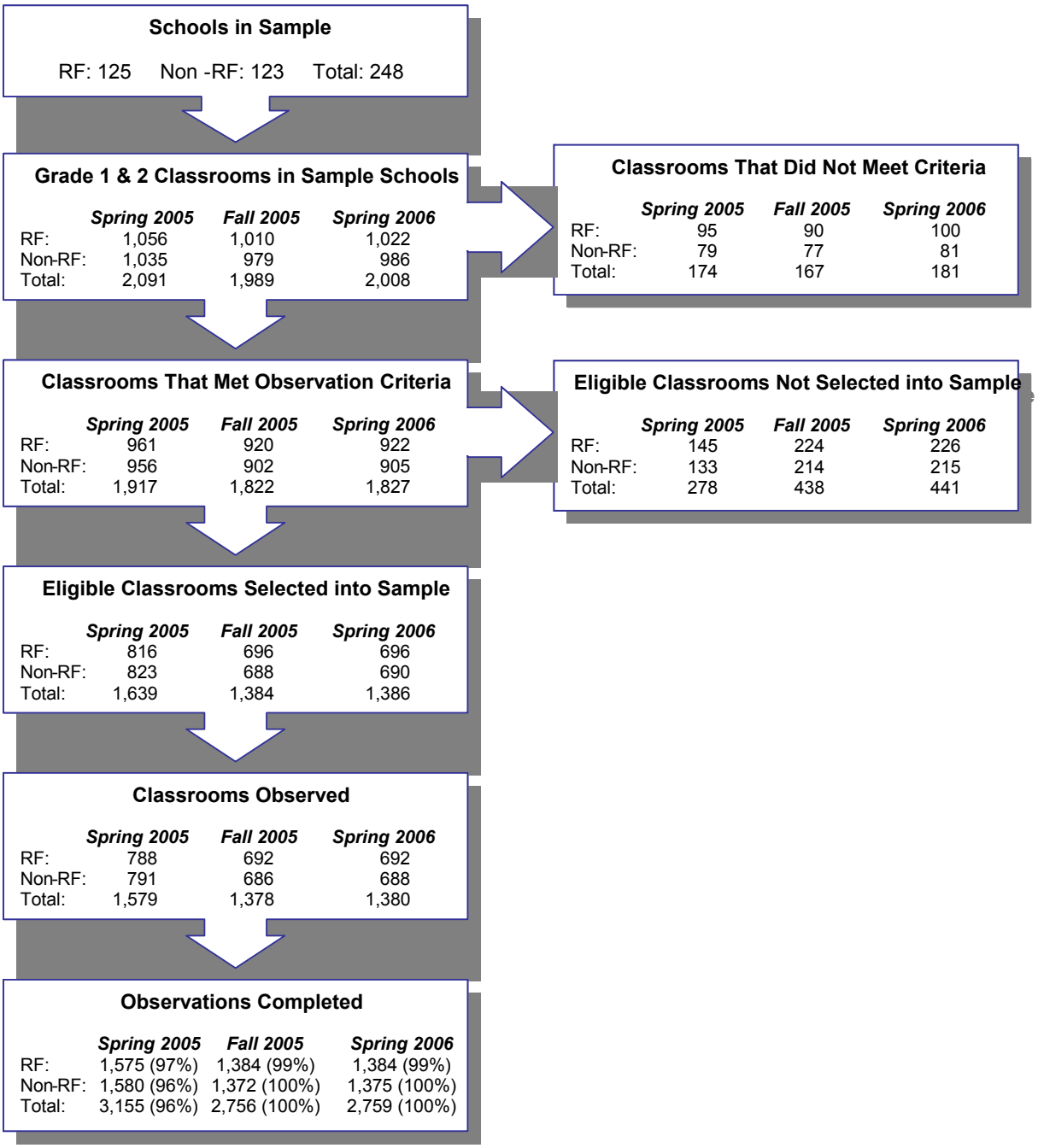
[27] In schools that did not have a designated "reading block," the RFIS Team asked the school's study liaison when observers would be able to see typical reading, literacy, and/or language arts instruction in classrooms. In cases where reading instruction was delivered in two discrete blocks interrupted by other instruction or activities (e.g., lunch, recess, math instruction), field staff observed both blocks.

Exhibit C.5: IPRI Data Collection: School, Classroom, and Observation Sample Information



Notes:

Classrooms were considered ineligible to be in the study sample if they were special education or English as a Second Language classes, if fewer than 75 percent of the students were in the target grade, or if the class was taught by someone other than the regular teacher or a long-term substitute.

Classrooms were sampled within schools if, across a site as a whole, the number of classrooms exceeded an average of three classrooms per grade.

Source: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, spring 2006

During each data collection wave (spring 2005, fall 2005, and spring 2006), IPRI experts (from the training staff) served as quality control monitors for questions that arose in the field. Quality control monitors visited each site and accompanied a random selection of observers into scheduled classroom observations. The monitors reviewed the observation coding with the observers, addressing coding discrepancies and questions.[28] Throughout the data collection period, observers could direct questions to the monitors and to other RFIS staff. Questions and answers were aggregated and disseminated to all observers via an RFIS observer website and regular mailings.

Creation of Analytic Variables

To test whether or not instruction in RF classrooms differed from that in non-RF classrooms, the study team created eight measures of classroom instruction from the IPRI data. The number of measures was deliberately limited so that the analysis would be parsimonious, and would thereby restrict the number of statistical tests required. The measures were:

- Time spent in instruction in each of the five targeted dimensions of reading instruction separately:
  - phonemic awareness;
  - phonics/decoding;
  - vocabulary;
  - fluency;
  - comprehension;
- Time spent in instruction in the five dimensions combined;
- Proportion of instruction in the five dimensions that was highly explicit—that includes teacher modeling, clear explanations, and the use of examples;
- Proportion of instruction in the five dimensions that provided students with high quality practice opportunities—that includes, for example, teachers giving students the opportunity to practice word learning strategies (e.g., context, word structure, and meanings).

Before describing these measures in more detail, we first describe the transformation of raw interval data into more meaningful metrics.

Transformation of IPRI Observation Intervals Into Minutes

The IPRI contains multiple successive three-minute intervals, each of which could potentially record a large number of instructional behaviors, if the behaviors had indeed been observed. Each behavior on the IPRI is deemed to have occurred or not occurred in each observed interval (e.g., behavior was present [checked or coded] or not [unchecked]). Across the entire set of intervals comprising a classroom observation, the IPRI yields raw data in terms of the number (or proportion) of observed intervals in which a given behavior was observed. The raw data do not directly measure the duration of particular instructional activities or behaviors. In order to describe classroom instruction with a more interpretable metric, raw intervals were transformed into minutes of instruction via the process described below.

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[28] Study protocols required observers to leave as is any codes marked during the observation. This procedure allowed the RFIS study team to collect a sample of paired observations for use in determining field-based reliability.

For each and every interval, observers recorded instruction in one of the five dimensions (hereafter referred to as "dimensions")[29] or in other activity/instruction not in one of the five dimensions (hereafter referred to as "non-dimension activities"). These latter activities are included in "Part B" described above. Consequently, every observation interval contains *at least* one of the following codes that categorizes the types of instruction the teacher provided during that interval:

- Phonemic awareness;
- Phonics/decoding;
- Vocabulary;
- Fluency;
- Comprehension;
- Oral reading by children;[30]
- Oral reading by teacher;
- Silent reading;
- Spelling;
- Written expression;
- Other language arts;
- Assessment;
- Non-literacy instruction;
- Non-instruction;
- Academic management; and/or
- Transitions between instructional activities.

The allocation of time within the three-minute intervals occurred at the broader level—that is, at the level of dimension and non-dimension activities. When only one dimension or non-dimension activity was observed in an interval, the conversion process was straightforward—all three minutes of the interval were assigned to the dimension or non-dimension activity observed.

When *two* activities were recorded in an interval, however, the process of converting intervals into minutes was less straightforward. From the raw data, there was no direct way to determine the proportion of the three minute interval that the teacher had devoted to each of the two recorded activities. Therefore, the study team developed an estimation process to allocate minutes of that interval to each of the two activities. The RFIS collected supplemental data on the actual duration of instructional activities recorded on the IPRI, and used those supplemental data to inform mathematical simulations of the outcomes of different estimation procedures.

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[29] For purposes of calculating minutes of instruction in a particular dimension, the micro-level codes corresponding to aspects of instruction *within* each of the five dimensions were collapsed. For example, a teacher who had exhibited two different "decoding" codes within an interval was designated as having delivered decoding instruction within that interval.

[30] Note that the IPRI distinguishes oral reading for its own sake from oral reading in service to a larger instructional purpose. For example, oral reading that occurred to advance a lesson in comprehension was classified as being part of the overarching comprehension instruction and was not counted as oral reading for purpose of analysis. In contrast, oral reading that occurred outside the context of one of the five dimensions of reading instruction was classified for analytic purposes as Oral Reading.

Dividing the minutes of the interval equally. Initially, the RFIS Team considered allocating one-half of the three-minutes of an interval to each of the two activities observed. Under this procedure, if comprehension and decoding were observed in the same interval, for instance, then each would be assigned 1.5 minutes of the three-minute interval. Although this approach provides a good estimate of the true number of minutes spent in the two activities for intervals in which the two observed activities were of similar duration, for intervals in which activities were of unequal duration, however (e.g., one activity was 2.6 minutes and the other .4 minutes), this approach underestimates the amount of time in the longer activity and overestimates the amount of time spent in the shorter one.

Dividing the minutes of the interval according to their relative frequency of occurrence. The study team also explored an estimation method that allocates time to each of two activities within a given interval in direct proportion to the relative frequency with which the two activities occurred, on average, within the school in which the observation had been conducted. If, on average, comprehension was present in 30 percent of the intervals collected across all observations within a school, whereas fluency instruction was present in 10 percent of all intervals collected in the school, then comprehension was three times as likely to occur as fluency instruction. Then for each interval in which comprehension and fluency were the two activities recorded, comprehension would receive 75 percent of the three minutes (or 2.25 minutes) and fluency would receive 25 percent of the three minutes (one-third the amount of time as comprehension, or .75 minutes).

The RFIS Team used supplemental data on the true duration of instructional activities to simulate the precision of this estimate. The simulations suggested that the proportionally-weighted approach provided a close estimate of the true minutes spent in activities for intervals in which two activities were of unequal duration, but, conversely, it produced biased estimates of the true minutes spent in activities for intervals in which the two activities observed were of similar duration. Thus, the strengths and drawbacks of this approach were mirror opposites of those in the first approach (i.e., dividing the minutes equally among the two activities in an interval).

The RFIS Team decided that an average of the two estimations would minimize the biases introduced by using either of the two transformation approaches in isolation.

Dividing the minutes of the interval by taking the average of the equally and proportionally weighted approaches. For each interval with two instructional activities recorded, a three-step estimation process was used:

1. The minutes were allocated *equally* between the two activities (1.5 minutes to each).
2. The minutes were allocated *according to their relative frequency* of occurrence across all observations within school.
3. The *average* of the two estimates produced was calculated for each of the two activities.

Using the example cited above (an interval with only comprehension and fluency instruction, comprehension would be allocated 1.88 minutes, or the mean of the equally weighted and proportionally weighted approach [1.5 and 2.25, respectively]). Fluency would be allocated 1.12 minutes (the mean of 1.5 and .75 minutes).

Three or more activities occurring in the same interval. When three or more instructional activities were observed in a single interval, the three minutes of the interval were divided equally among the activities. This distribution strategy was followed rather than the estimation process used

for two-activity intervals because the number of minutes assigned to any given activity type would be limited to one minute or less. Thus, the amount of bias introduced by using this estimation approach was likely to be small.

Analytic Variables

The study team constructed six variables based on the amount of time devoted to instruction in the five dimensions of reading instruction: one variable for the amount of time spent in each of the five dimensions separately, plus a sixth variable for the total amount of time spent in the five dimensions combined.

Also of interest were the degree to which instruction in RF and non-RF schools was highly explicit, and the degree to which instruction offered students meaningful opportunities to practice developing reading skills. To examine these outcomes, two additional variables were constructed: the percentage of instruction in the five dimensions in which at least one instance of highly explicit instruction occurred; and the percentage of instruction in the five dimensions in which at least one instance of high quality student practice occurred. These two variables are defined below.

Percentage of intervals of instruction in the five dimensions that included at least one instance of highly explicit instruction. "Highly explicit instruction" is defined differently in each dimension of reading instruction, based on research published in the National Research council report (Snow, Burns, and Griffin, 1998) as well as more recent research (e.g., Graves, Gerston and Haager, 2004; Gunn et al., 2002 for specific examples of highly explicit instruction in phonemic awareness, and Foorman and Torgesen, 2001, Graves, Gerston and Haager, 2004, for specific examples of highly explicit instruction in phonics). Exhibit C.6 lists the specific citations for examples of highly explicit instructional strategies for each of the five components of reading instruction targeted by the legislation.[31] The specific instructional strategies, or combinations of strategies used together, that were considered to be "highly explicit" are presented in Exhibit C.6. This variable was created by dividing the number of intervals that included one or more "highly explicit" instructional practices by the number of intervals that included instruction in one or more of the five dimensions.

Percentage of intervals of instruction in the five dimensions that included at least one instance of high quality student practice. "High quality student practice" is also defined differently in each dimension of reading instruction, based on research published in the National Reading Panel report (National Institute of Child Health and Human Development, 2000) as well as more recent research (e.g., Armbruster, Lehr and Osborn, 2003 for specific examples of high quality student practice in phonemic awareness, and Rasinski and Oswald, 2005, for specific examples of high quality student practice in phonics). Exhibit C.6 lists the specific citations for examples of high quality student practice for each of the five dimensions of reading instruction targeted by the legislation. The specific instructional strategies, or combinations of strategies used together, that were considered to be "high quality student practice" are presented in Exhibit C.6. This variable was created by dividing the number of intervals that included one or more instance of "high quality student practice" by the number of intervals that included instruction in one or more of the five dimensions.

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[31] No codes in the fluency dimension were classified as "highly explicit" instruction. Helping beginning readers build fluency inherently rests on providing students high quality practice opportunities, rather than delivering explicit instruction in how to read fluently. As a result, codes in the fluency section were used only in the construction of the high quality student practice variable.

Exhibit C.6: Composite of Classroom Constructs
Minutes spent in instruction in each of the five dimensions of reading instruction
Number of minutes spent in any teacher instruction or student practice activity on the IPRI that was in the five dimensions of reading instruction emphasized in Reading First: • Phonemic awareness • Phonics/decoding • Vocabulary • Fluency • Comprehension • All five dimensions combined
Percentage of observation intervals with instruction in the five dimensions of reading instruction with one or more instance of highly explicit instruction
An observation interval was coded as containing instruction in the five dimensions of reading instruction and at least one instance of highly explicit instruction if one or more of the following teacher activities (or combination of activities) were observed during instruction in one of the four reading dimensions that included highly explicit instructional activities. **Phonemic Awareness**:[32] • Teacher demonstrates or models oral blending or segmenting with phonemes *in conjunction with*: – Giving students practice in oral blending or segmenting with phonemes • Teacher demonstrates or models phoneme isolation *in conjunction with*: – Giving students practice in phoneme isolation • Teacher demonstrates or models phoneme categorization/identity (same/different sounds in words) *in conjunction with*: – Giving students practice in phoneme categorization/identity • Teacher demonstrates or models phoneme deletion, addition, or substitution *in conjunction with*: – Giving students practice in phoneme deletion, addition, or substitution • Teacher contrasts two phonemes to pinpoint a target sound • Teacher pinpoints what students did incorrectly and gives correct response **Phonics/decoding:**[33] • Teacher identifies words that contrast with or do not follow pattern or rule • Teacher reminds students of pattern or rule and has students produce or repeat correct response, if a student makes a mistake • Teacher describes, explains, or identifies, or asks students to describe, explain, or identify a sound-symbol pattern, decoding rule, or a word structure pattern or rule *in conjunction with*: – Showing students how to apply a rule or pattern to a whole word example, *and* – Giving students chance to practice decoding words • Teacher describes, explains, or identifies, or asks students to describe, explain, or identify a sound-symbol pattern, decoding rule, or a word structure pattern or rule *in conjunction with*: – Showing students how to apply a rule or pattern to a whole word example, and – Giving students practice encoding words by manipulating or writing letters

[32] Ball and Blachman (1991); Bus and van Ijzendoorn (1999); Foorman et al. (1998); Graves et al. (2004); Gunn et al. (2002); Hatcher et al. (2004); McCutchen et al. (2002); Torgesen et al. (1999).

[33] Foorman et al. (1998); Foorman and Torgesen (2001); Graves et al. (2004).

Exhibit C.6: Composite of Classroom Constructs

Highly explicit instruction (continued)

Vocabulary:[34]

- Teacher goes beyond synonym with definition and/or examples
- Teacher pinpoints word meaning by giving contrasting examples
- Teacher pinpoints word meaning by clarifying or extending a partially correct student response
- Teacher pinpoints word meaning by clarifying or extending a partially correct student response with a synonym, definition, example, or contrasting example

Teacher uses a picture, object, or physical demonstration to illustrate word meaning in conjunction with any other vocabulary instructional behaviors including those above and the following:

- Teacher asks students to give meaning of word
- Teacher gives synonym
- Teacher asks students to apply understanding of word meaning
- Teacher gives students opportunity to practice word learning strategies (e.g., using context, word structure, or root meanings)

Comprehension:[35]

Before, during, or after reading a text passage, teacher describes or explains, or asks students to describe or explain one or more comprehension strategies by specifying:

- What the comprehension strategy is called, *and*
- Why the comprehension strategy is helpful, *and*
- When in the reading process the comprehension strategy is used

During or after reading a text passage, teacher shows how to apply strategy by modeling how to:

- Answer inferential questions based on text
- Make predictions based on text
- Summarize, retell, sequence text, or identify the main idea(s)
- Make text-to-text connections
- Generate own questions about text
- Answer own questions about text
- Review passage to check or clarify understanding
- Check accuracy of prediction or inference
- Work with story or expository structure

If a student response is incorrect or incomplete, teacher assists student in using strategy(ies)

Percentage of observation intervals with instruction in the five dimensions of reading instruction with one or more instance of high quality student practice

An observation interval was coded as containing instruction in the five dimensions of reading instruction *and* at least one instance of high quality student practice if one or more of the following teacher activities (or combination of activities) were observed during instruction in one of the five dimensions.

Phonemic Awareness:[36]

- Teacher gives students practice in oral blending or segmenting with phonemes while working with pairs or small groups
- Teacher gives students practice in phoneme isolation while working with pairs or small groups
- Teacher gives students practice in phoneme categorization/identity (same/different sounds in words) while working with pairs or small groups
- Teacher gives students practice in phoneme deletion, addition, or substitution while working with pairs or small groups

[34] Brett et al. (1996); Graves et al. (2004); Kamil (2004); McKeown et al. (1985); Tomesen and Aarnoutse (1998).

[35] Crowe (2005); Kamil (2004); Mason (2004); O'Connor et al. (2002); Rosenshine et al. (1996).

[36] Ambruster et al. (2003); National Institute of Child Health and Human Development (2000).

Exhibit C.6: Composite of Classroom Constructs

High quality student practice (continued)

Phonics/decoding:[37]

- Teacher gives students practice encoding words by manipulating or writing letters

Vocabulary:[38]

- Teacher gives students the opportunity to practice word learning strategies (e.g. context, word structure, and root meanings)

Fluency:[39]

- Teacher gives students the opportunity to repeat oral readings with same text that was modeled by a fluent reader

Comprehension:[40]

During or after reading a text passage, teacher gives students practice in applying strategy by having students:

- Generate own questions about text
- Answer own questions about text
- Review passage to check or clarify understanding
- Work with story or expository structure *in conjunction with*:
  - Using a text organizer for support
- Check accuracy of prediction or inference
- Justify their response with evidence

[37] Rasinski and Oswald (2005).

[38] Ambruster et al. (2003); National Institute of Child Health and Human Development (2000).

[39] Graves et al. (2004); O'Connor et al. (2002); Stahl (2004); Therrien (2004).

[40] Kamil (2004); Mason (2004); Reutzek and Hollingsworth (1991); Taylor et al. (2002).

Field Reliability of the IPRI

In each wave of data collection, experienced IPRI trainers were paired with a random sample of classroom observers to collect data necessary to measure the field-based reliability of the IPRI.[41] In contrast to determining the accuracy of an individual observer for purposes of training and hiring, the purpose of field-based inter-rater reliability (IRR) estimates is to assess the reliability of the instrument itself. Researchers often characterize the reliability of an observation instrument by estimating an intra-class correlation (ICC), defined here as the proportion of variance associated with observers relative to the total variance in the collected data. That is, the team sought to characterize the proportion of variance in the observation data due to each of three sources:

- inter-observer differences
- inter-classroom differences
- random measurement error

The RFIS Team used several approaches to attempt to capture the degree of error that can be attributed to observers themselves (as opposed to random measurement error or other forms of systematic measurement error). These approaches included: (1)(a) calculating a pseudo intraclass correlation (ICC) by running an unconditional Hierarchical Linear Model (HLM), and (b) correlating Observer A's and Observer B's codes across multiple intervals within an observation and then averaging these correlations across pairs of observers, and (2) calculating a generalizability coefficient within the generalizability framework (Cronbach et al., 1972 as cited in Brennan, 2001).

Using a Pseudo Intraclass Correlation to Describe Inter-rater Reliability

In the context of measuring inter-rater reliability of the IPRI based on paired field observations, consider the following model:

$$X_{cr} = \mu + \nu_c + \nu_r + \nu_{cr} \qquad (1)$$

In (1), X_{cr} is the outcome measure for classroom *c*, as rated by observer *r*; μ is the mean outcome across classrooms; and ν_c, ν_r, and ν_{c4} are independent error terms associated with the variance across classrooms, systematic measurement error introduced by the observers, and random measurement error; each with a mean of 0 and variances of σ_c, σ_r, and σ_{cr}. Using this model, we can define the proportion of the total measurement variance that is due to the systematic measurement error introduced by the observers ρ_1 and the proportion of the true variance across classrooms ρ_2 as follows:

$$\rho_1 = \frac{\sigma_r^2}{\sigma_c^2 + \sigma_r^2 + \sigma_{cr}^2} \qquad (2)$$

$$\rho_2 = \frac{\sigma_c^2}{\sigma_c^2 + \sigma_r^2 + \sigma_{cr}^2} \qquad (3)$$

[41] Half of the field observers were paired with co-observers in spring 2005. In subsequent waves, field observers were paired with co-observers either in fall 2005 or in spring 2006; the majority of field observers were paired for observation once during the 2005-06 school year.

(2) indicates the proportion of error that can be attributed to variation across individual observers (observers may vary in their skill at using the IPRI). An examination of (3) shows that to the extent that variance attributable to observers (σ_r^2) is low, the proportion of variance due to true variance across classrooms is high (assuming that random measurement error is small); as ρ_1 decreases, ρ_2 increases. Thus, the lower the ICC, the higher the reliability of the IPRI.

Ideally, intra-class correlations are calculated using a fully crossed design, such that each of a set of *R* observers observes each of *C* classrooms. In a fully-crossed design, the variance associated with individual observers can be estimated separately from the systematic error associated with individual classrooms. However, a fully-crossed design was not possible in the context of the RFIS, which used 150 observers to record instruction in approximately 1,400 classrooms during each round of data collection. Instead, joint observations were conducted in a sample of classrooms by two observers, one a master observer and the other a member of the field staff. No individual observed more than a small subset of the total number of classrooms. Thus, these data do not allow separate estimate variation due to rater or classroom alone.

The RFIS Team obtained pseudo-ICC estimates using field IRR samples as if they were fully crossed. Such estimates provide a biased estimate of the actual error due to observers, because they also include some of the error associated with inter-classroom differences; however, the estimates are conservative, attributing *more* error to observers than they would in a fully-crossed design. Therefore, if the pseudo-ICC estimates of inter-observer error are low, despite the fact that they include error associated with the individual classrooms, we can be confident that the true amount of error due to differences between observers is even lower—and thus that the IPRI is a reliable instrument.

Most study classrooms were jointly observed for about 30 three-minute intervals, although some joint observations covered fewer and others covered more intervals. In order to construct a fully balanced sample, for each wave of the field IRR samples, the study team (i) dropped classrooms that were observed for fewer than 25 intervals; and (ii) included only the first 25 observation intervals from classrooms that were observed for more than 25 intervals.[42] As a result, the reliability was calculated with 65 classrooms from spring 2005, 62 classrooms from fall 2005, and 36 classrooms from spring 2006 data collections to assess field-based IRR. (See Exhibit C.7.)

For each of the analytic variables created from IPRI data, the team calculated reliability estimates by estimating the variance terms in equations 2 and 3 (σ_c, σ_r, and σ_{cr}) and by running an unconditional HLM with the field IRR samples for each observation wave. Each HLM was a two-level model with observer (A or B) nested within classroom, for each classroom that had been co-observed. Next ρ_1 and ρ_2 were calculated using these estimates. Corresponding results are presented in Exhibit C.7 and indicate that ICC-based reliability estimates (ρ_2) are consistent across the three observation waves, ranging from 0.868 to 0.91, for example, for the number of minutes spent on the five dimensions combined.

[42] The 25-interval threshold attempts to balance two sometimes competing constraints: (i) minimizing the number of classrooms that would be dropped due to lack of observations and (ii) maximizing the number of observation intervals that could be used to assess IRR.

Exhibit C.7: Unconditional HLM Models to Estimate Pseudo-ICCs (ρ1) and True Variance Across Classrooms (ρ2)

	Spring 2005 (n=65)		Fall 2005 (n=62)		Spring 2006 (n=36)	
Outcome	ρ_1	ρ_2	ρ_1	ρ_2	ρ_1	ρ_2
Number of Minutes Spent on Decoding	0.046	0.930	0.025	0.959	0.059	0.914
Number of Minutes Spent on Comprehension	0.049	0.927	0.079	0.888	0.025	0.959
Number of Minutes Spent on Vocabulary	0.038	0.941	0.067	0.904	0.049	0.926
Number of Minutes Spent on Phonemic Awareness	0.111	0.849	0.25	0.684	0.030	0.952
Number of Minutes Spent on Fluency Building	0.170	0.779	0.069	0.901	0.075	0.893
Number of Minutes Spent on Five Dimensions Combined	0.061	0.912	0.096	0.868	0.058	0.915
Proportion of Intervals in the 5 Dimensions Containing Highly Explicit Instruction	0.281	0.654	0.327	0.604	0.375	0.551
Proportion of Intervals in the 5 Dimensions Containing High Quality Student Practice	0.265	0.670	0.274	0.662	0.303	0.632

Note:

The HLM model utilized for this analysis includes an intercept and three independent random error terms that are associated with the variance across classes, systematic measurement error introduced by the raters, and random measurement error. Definitions of ρ_1 and ρ_2 can be found in the text.

EXHIBIT READS: The proportion of variance due to differences between observers for Number of Minutes Spent on Decoding was .046 for the 65 co-observed classrooms from spring 2005. The proportion of variance due to differences between classrooms for Number of Minutes Spent on decoding was .930 for the 65 classrooms from spring 2005.

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, spring 2006

An alternative way of obtaining a pseudo ICC estimate is by simply correlating the two observers' codes *within* a given observation and *across* the multiple intervals with that observation, and averaging these correlations across the pairs of coders. Similar to the unconditional HLM model, using this method with the co-observation data attributes more error to the observers than it should. This method is also complicated when one observer reports that a specific IPRI code never occurred during an entire observation, but the other observer reports that the same code occurred (at least once); in this case, the correlation coefficient is not defined (these observations were not included in this analysis). In contrast, if both observers agreed that a particular IPRI code never occurred, we imputed the correlation coefficient to be one since these cases could be regarded as perfect agreement. Exhibit C.8 presents estimates of this pseudo ICC with the number of observations used for the calculations. As expected, these results are very similar to the ones from the unconditional HLM model in Exhibit C.7.

Exhibit C.8: Average Correlation Between Paired Observers' Codes Across Classrooms

Outcome	Spring 2005		Fall 2005		Spring 2006	
	Average Correlation	N[1]	Average Correlation	N[1]	Average Correlation	N[1]
Decoding	0.869	65	0.815	60	0.835	32
Comprehension	0.866	65	0.890	62	0.841	35
Vocabulary	0.829	65	0.836	60	0.811	34
Phonemic Awareness	0.990	55	0.976	60	0.963	34
Fluency Building	0.946	50	0.963	55	0.955	36
Any Instruction in One of the Five Dimensions	0.845	65	0.836	61	0.807	35
Highly Explicit Instruction	0.579	63	0.649	57	0.590	35
High Quality Student Practice	0.679	60	0.764	52	0.710	24

Note:

[1] The effective N is shown for the calculation of the average correlation between observer and co-observer codes. Co-observations in which *only* one of the observers reported that the outcome of interest occurred in every interval (or did not occur in any of the intervals) are excluded from the analysis as for such cases, the correlation coefficient could not be calculated. Co-observations in which both of the raters reported that the outcome of interest occurred in every interval (or did not occur in any of the intervals) are included in the analysis with a correlation coefficient of 1.

EXHIBIT READS: The average correlation between paired observers' codes across classrooms for decoding was .869 in spring 2005 (n=65), .815 in fall 2005 (n=60), and .835 in spring 2006 (n=32).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, spring 2006

Using a Generalizability Coefficient to Measure Inter-rater Reliability

Recall that the previous approach of using a pseudo-ICC to measure the field-based reliability of the IPRI assumes that the field IRR samples are fully crossed. One way to account for the fact that the field IRR samples are not fully crossed and still be able construct an estimate of field based reliability is to calculate a generalizability coefficient using the generalizability framework. The generalizability framework can be defined as a "theory that liberalizes classical theory by employing ANOVA methods that allow an investigator to untangle multiple sources of error" to describe the reliability of a measurement (Cronbach, et al., 1972, as cited in Brennan 2001.)

In field IRR samples, each classroom (c) is observed by a different set of two observers (or raters, [r]) simultaneously during a number of intervals (i). In the generalizability framework, discussed in detail by Brennan (2001), this set-up could be regarded as a ***G study (r: c) * i*** design with n_c that were observed by 2 observers (n_r=2) for 25 intervals (n_i=25).[43] The main and interaction effects for this model can be depicted as:

Let X_{cri} denote the outcome (an IPRI item) recorded in classroom *c* by rater *r* at interval *i*. Utilizing the effects presented in Exhibit C.9, we can describe this outcome as follows:

$$X_{cri} = \mu + \nu_c + \nu_i + \nu_{r:c} + \nu_{ci} + \nu_{ri:c} \tag{4}$$

Exhibit C.9: Main and Interaction Effects in a (r: c)*i Design

Model	Main Effects	Interaction Effects
(r: c) * i	***i, c, r:c***	***ci, ri:c***

Here, μ is the grand mean in the population and ν terms represent the five main and interaction effects listed in Exhibit C.9 (*i, c, r:c, ci, ri:c*). Using (5), one can decompose the total variance observed in the outcome into five independent variance components associated with the effects as follows:

$$\begin{aligned}\sigma^2(X_{cri}) &= \sigma^2(\nu_c) + \sigma^2(\nu_i) + \sigma^2(\nu_{r:c}) + \sigma^2(\nu_{ci}) + \sigma^2(\nu_{ri:c}) \\ &= \sigma^2(c) + \sigma^2(i) + \sigma^2(r:c) + \sigma^2(ci) + \sigma^2(ri:c)\end{aligned} \tag{5}$$

Using this general framework, a measure of the IRR for a single *random* rater (n_r = 1) observing a single *fixed* classroom (n_c = 1) can be calculated using a ***D-study*** **(R:C)** * *i* design. This design is sufficient if one wants to estimate a general IRR across all possible pairs of raters, such that the correlation between a pair of raters estimates the reliability of a single rater, and it is not necessary to generalize across all classrooms. Under a D-study, the IRR estimate is given by the generalizability coefficient, $E\rho^2$, defined in equation (6):

$$E\rho^2 = \frac{\sigma^2(\tau)}{\sigma^2(\tau) + \sigma^2(\delta)} = \frac{\sigma_{\mathrm{i}}^2 + \sigma_{\mathrm{ci}}^2}{\sigma_{\mathrm{i}}^2 + \sigma_{\mathrm{ci}}^2 + \sigma_{\mathrm{ri:c}}^2} \tag{6}$$

[43] Note that here an interval is regarded as the object of measurement.

In (6), $\sigma^2(\tau)$ and $\sigma^2(\delta)$ denote the universe score variance and variance of the relative error respectively. Exhibit C.10 demonstrates the formulas that could be used to calculate the variance components of the generalizability coefficient $\mathrm{E}\rho^2$. Technically, $\mathrm{E}\rho^2$ can be interpreted as an intra-class correlation coefficient, which approximates the expected value of the squared correlation between the observed outcome and the universe ("true") outcome for a classroom. In this context, the universe outcome can be defined as the expected value of the mean outcomes for every instance of the measurement procedure (i.e., the mean of the outcomes coded by all possible sets of two observers) of a classroom. Alternatively, $\mathrm{E}\rho^2$ can also be seen as the ratio of variance of the universe outcome to the variance of the observed outcome. The difference between the pseudo ICCs described earlier and the generalizability coefficient $\mathrm{E}\rho^2$ is that $\mathrm{E}\rho^2$ takes into account the fact that each classroom was observed by a different set of two observers during co-observations, whereas the former simply ignores this fact.

Exhibit C.11 presents estimates of the generalizability coefficient calculated using the three waves of the IPRI field IRR data. These estimates of reliability are slightly lower than the reliability estimates determined by calculating pseudo ICC estimates shown in Exhibits C.7 and C.8. One possibility for these estimates being slightly lower is that the generalizability coefficient accounts for the fact that the sample is not fully crossed.

Overall, the various methods of estimating IRR using observation and co-observation data provide consistent results. The reliability estimates for the five dimensions (decoding, comprehension, vocabulary, phonemic awareness, and fluency building) are consistent across all methods. The estimates for highly explicit instruction and high quality student practice measures are lower, a finding that might reflect the fact these measures attempt to capture micro behaviors that are harder for observers to recognize and code accurately.

Exhibit C.10: Calculating Variance Components for a (r: c)*i Design

α	df(α)	T(α)	SS(α)	MS(α)	$\hat{\sigma}^2(\alpha) \equiv \hat{\sigma}^2_\alpha$
i	n_i-1	$n_c n_r \sum_i \overline{X}_i^{\,2}$	T(i)- T(μ)		$\frac{MS(i) - MS(ci)}{n_c n_r}$
c	n_c-1	$n_i n_r \sum_c \overline{X}_c^{\,2}$	T(c)- T(μ)		$\frac{MS(c) - MS(r:c) - MS(ci) +}{n_i n_r}$
r: c	$n_c(n_r-1)$	$n_i \sum_c \sum_r \overline{X}_{r:c}^{\,2}$	T(r: c)- T(c)	$\frac{SS(\alpha)}{df(\alpha)}$	$\frac{MS(r:c) - MS(ri:c)}{n_i}$
ci	$(n_c-1)(n_i-1)$	$n_r \sum_c \sum_i \overline{X}_{ci}^{\,2}$	T(ci)-T(c)-T(i)+ T(μ)		$\frac{MS(ci) - MS(ri:c)}{n_r}$
ri: c	$n_c(n_r-1)(n_i-1)$	$\sum_c \sum_r \sum_i X_{cri}^{\,2}$	T(ri: c)- T(ci) – T(r:c)+ T(c)		$MS(ri:c)$

Notation:

α: any of the main and interaction effects

df(α): degrees of freedom for effect α

T (α): sum of squared mean scores for effect α

$T(\mu) = n_r n_c n_i \overline{X}^2$

SS (α): sum of squares for α

MS (α): mean squares for α

$\hat{\sigma}^2(\alpha)$: estimated variance component for effect α

X_{cri} : outcome of interest for class *c* as rated by rater *r* in interval *i*

Exhibit C.11: Generalizability Coefficients Estimated from the Co-Observation Data

Outcome	Spring 2005 (n=65) $E\rho^2$	Fall 2005 (n=62) $E\rho^2$	Spring 2006 (n=36) $E\rho^2$
Decoding	.859	.820	.807
Comprehension	.863	.881	.820
Vocabulary	.812	.769	.796
Phonemic Awareness	.802	.822	.792
Fluency Building	.706	.826	.827
Five Dimensions Combined	.841	.843	.799
Highly Explicit Instruction	.577	.610	.545
High Quality Student Practice	.625	.574	.443

EXHIBIT READS: The generalizability coefficients for Decoding are .859 for spring 2005, .820 for fall 2005, and .807 for spring 2006.

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, spring 2006

Part 3: Student Time-on-Task and Engagement with Print (STEP)

The Student Time-on-Task and Engagement with Print (STEP) instrument[44] was designed to capture information about student engagement during reading instruction as part of the Reading First Impact Study's (RFIS) classroom observation data collection. The STEP is focused on student behavior; it complements the Instructional Practice in Reading Inventory (IPRI) measure, which focuses on teacher behaviors.

The STEP was designed to collect aggregate, not individual level, data on the percentage of students in classrooms during the scheduled reading block who are on-task and/or interacting with print. The STEP instrument combines a dichotomous "on-task/off-task" rating with additional indicators for student engagement with print.

The data collected with the STEP instrument do not measure the amount of time students are on-task or the amount of time students are engaged with print. Rather, across all students in the classroom, the STEP instrument yields data on the percentage of students who, at a particular point in time, are on-task and engaged with print.

During each wave of classroom observation data collection, one observer per school was assigned to collect student engagement data in each classroom being observed by IPRI observers. STEP observations took place during the reading block in each classroom. While each classroom was observed twice for the IPRI, each classroom was observed once for the STEP.

Each STEP observation consists of data on student engagement from three sweeps of a classroom. Specifically, for each sweep, at an interval of six minutes, an observer classifies every student in the classroom as either on- or off-task, and, if the student is on-task, whether the student is:

a) reading connected text (e.g., a paragraph, story, or longer passage); and/or
b) reading isolated text (letters, words, or sentences in isolation); and/or
c) writing; or
d) none of the above (i.e., not engaged with print).

A student can be marked as on-task without being engaged with print (but a student cannot be off-task and engaged with print). An on-task student can also be engaged with more than one type of print (e.g., the student is writing on a worksheet that contains isolated text, such as a list of words). The observer records student behavior for each student in each observed classroom three times.

Between sweeps, the observer waits until six minutes have elapsed before beginning the next sweep. After the third sweep, the observer moves on to the next classroom in the sample. The observation protocol is summarized in Exhibit C.13.

[44] See Exhibit C.12 for a copy of the STEP instrument.

Exhibit C.12: Student Time-on-Task and Engagement with Print (STEP) Instrument

Student Time-on-Task and Engagement with Print (STEP)

BARCODE HERE BARCODE HERE

Classroom ID		AbtClassID	
School ID		School Name	
Observer ID		Observer Name	
Date			
Grade		Room number	
Total # of students			
Time observation began		Time observation ended	

Anything unusual?

Sources consulted:

Foorman, B.R. & Schatschneider, C. (2003). Measurement of teaching practices during reading/language arts instruction and its relationship to student achievement. In S. Vaughn and K.L. Briggs (Eds.), Reading in the classroom: Systems for the Observation of Teaching and Learning (pp. 1-30). Baltimore, MD: Paul H. Brooks.

Kim, A., Briggs, K.L., & Vaughn, S. (2003). The classroom climate scale. In S. Vaughn and K.L. Briggs (Eds.), Reading in the classroom: Systems for the Observation of Teaching and Learning (pp. 83-109). Baltimore, MD: Paul H. Brooks.

Vaughn, S. (2005). Personal communication (May, 2005).

Shanahan, T. (2005). Personal communication (May, 2005)

Version 3.1 9/26/05 RFIS Fall 2005 Field Version

Student Time-on-Task and Engagement with Print (STEP)

Instructions:

STEP observations are focused on the students not on the teacher.

Enter the classroom and start your countdown watch (set for 3:00 minute intervals). Begin walking casually around the room looking at what students are doing during the acclimation phase. Let students become accustomed to you walking around the room. Do not impede teacher or student movement but do not sit in one location during the acclimation period. Do not block IPRI observer's view of the teacher. Do not interact with students. If a student makes eye contact with you, look away – do not smile or otherwise acknowledge the student. If a student talks to you, smile and respond firmly, "I'm working, I can't talk with you right now."

After 6 minutes (beginning with the second buzz of your watch), begin **Sweep 1**:
If the whole class is in transition, circle Y at the top of the Sweep 1 column and wait for Sweep 2;
If the whole class is listening the to the teacher read aloud a story (not following along in their own texts), circle Y at the top of Sweep 1 column and wait for Sweep 2. Otherwise:

a) Select a student to be Pupil 1. Record whether or not P1 is on or off task.
b) If P1 is On Task, record whether or not P1 is Reading Connected Text, Reading Isolated Text, or Writing (or none of these three); If P1 is Off-Task do not fill in any of the three remaining columns for that student.
c) Go on to the next student (P2). Repeat above steps for P2, P3, etc.
d) When you have finished with all students in the classroom, draw a solid line underneath the last pupil. Only students who are in the classroom should be counted in any Sweep.

Six minutes (two watch buzzes) after the start of Sweep 1, begin **Sweep 2**. Do not try to observe children in the same order that you observed during Sweep 1. That is, do not try to locate the same individual student who was P1 in Sweep 1. Instead, move around the room in a systematic fashion to observe each child once per sweep.

Repeat for **Sweep 3**.

After Sweep 3 is complete, go to the next classroom. Be sure to use a new STEP for each classroom observed.

On-task behavior is any behavior in which a child appears to be:

- Paying attention to the teacher (if teacher is delivering instruction) or attending to work that is in front of him/her;
- Not interfering with other students' work or the teacher's instruction.
- Talking with other students about an instructional activity in which both students are engaged (e.g. working productively on a group project);
- Participating in a whole class routine such as the pledge of allegiance

Off-task behaviors include:

- Not paying attention to the teacher when appropriate
- Looking around or gazing at an activity in which student is not engaged; "blank stares"
- Crying or head down with eyes covered on desk.
- Wandering aimlessly without a goal or to going to get new materials or put old materials away
- Conflict with students or teacher
- Playing, teasing, roughhousing with other students, distracting other students
- Play behavior (playing with boardgames, blocks, dolls, action figures, legos, etc.)
- Snack/meal times or transitions (e.g., lining up to use the rest room)

Reading Connected Text:
Eyes are on a book, story, passage, or child is turning to next page of story. Even if student is momentarily looking at pictures that accompany a story, code as reading connected text unless book has no text. However, if student is flipping quickly through a book without pausing to read words on the page, do not code as Reading Connected Text.

Reading Isolated Text:
Working with flashcards, looking at letters or words in isolation, completing a worksheet with isolated letters, words, sentences. Reading isolated sentences not part of a coherent, connected passage.

Writing:
Student has pen, pencil, crayon or other writing implement in hand and is writing or copying text, either isolated or connected. If student is drawing pictures do not code "Writing."

Version 3.1 9/26/05 RFIS Fall 2005 Field Version

Student Time-on-Task and Engagement with Print (STEP)

SWEEP 1				
Whole Class Transition?			Y N	
Whole Class Listening to Story?			Y N	
Pupil	On Task?	Reading Connected Text	Reading Isolated Text	Writing
01	Y N	❑	❑	❑
02	Y N	❑	❑	❑
03	Y N	❑	❑	❑
04	Y N	❑	❑	❑
05	Y N	❑	❑	❑
06	Y N	❑	❑	❑
07	Y N	❑	❑	❑
08	Y N	❑	❑	❑
09	Y N	❑	❑	❑
10	Y N	❑	❑	❑
11	Y N	❑	❑	❑
12	Y N	❑	❑	❑
13	Y N	❑	❑	❑
14	Y N	❑	❑	❑
15	Y N	❑	❑	❑
16	Y N	❑	❑	❑
17	Y N	❑	❑	❑
18	Y N	❑	❑	❑
19	Y N	❑	❑	❑
20	Y N	❑	❑	❑
21	Y N	❑	❑	❑
22	Y N	❑	❑	❑
23	Y N	❑	❑	❑
24	Y N	❑	❑	❑
25	Y N	❑	❑	❑
26	Y N	❑	❑	❑
27	Y N	❑	❑	❑
28	Y N	❑	❑	❑
29	Y N	❑	❑	❑
30	Y N	❑	❑	❑

Version 3.0 8/26/05 RFIS Fall 2005 Field Version

Student Time-on-Task and Engagement with Print (STEP)

SWEEP 2				
Whole Class Transition?			Y N	
Whole Class Listening to Story?			Y N	
Pupil	On Task?	Reading Connected Text	Reading Isolated Text	Writing
01	Y N	❑	❑	❑
02	Y N	❑	❑	❑
03	Y N	❑	❑	❑
04	Y N	❑	❑	❑
05	Y N	❑	❑	❑
06	Y N	❑	❑	❑
07	Y N	❑	❑	❑
08	Y N	❑	❑	❑
09	Y N	❑	❑	❑
10	Y N	❑	❑	❑
11	Y N	❑	❑	❑
12	Y N	❑	❑	❑
13	Y N	❑	❑	❑
14	Y N	❑	❑	❑
15	Y N	❑	❑	❑
16	Y N	❑	❑	❑
17	Y N	❑	❑	❑
18	Y N	❑	❑	❑
19	Y N	❑	❑	❑
20	Y N	❑	❑	❑
21	Y N	❑	❑	❑
22	Y N	❑	❑	❑
23	Y N	❑	❑	❑
24	Y N	❑	❑	❑
25	Y N	❑	❑	❑
26	Y N	❑	❑	❑
27	Y N	❑	❑	❑
28	Y N	❑	❑	❑
29	Y N	❑	❑	❑
30	Y N	❑	❑	❑

Version 3.0 8/26/05 RFIS Fall 2005 Field Version

Student Time-on-Task and Engagement with Print (STEP)

SWEEP 3				
Whole Class Transition?			Y N	
Whole Class Listening to Story?			Y N	
Pupil	On Task?	Reading Connected Text	Reading Isolated Text	Writing
01	Y N	❑	❑	❑
02	Y N	❑	❑	❑
03	Y N	❑	❑	❑
04	Y N	❑	❑	❑
05	Y N	❑	❑	❑
06	Y N	❑	❑	❑
07	Y N	❑	❑	❑
08	Y N	❑	❑	❑
09	Y N	❑	❑	❑
10	Y N	❑	❑	❑
11	Y N	❑	❑	❑
12	Y N	❑	❑	❑
13	Y N	❑	❑	❑
14	Y N	❑	❑	❑
15	Y N	❑	❑	❑
16	Y N	❑	❑	❑
17	Y N	❑	❑	❑
18	Y N	❑	❑	❑
19	Y N	❑	❑	❑
20	Y N	❑	❑	❑
21	Y N	❑	❑	❑
22	Y N	❑	❑	❑
23	Y N	❑	❑	❑
24	Y N	❑	❑	❑
25	Y N	❑	❑	❑
26	Y N	❑	❑	❑
27	Y N	❑	❑	❑
28	Y N	❑	❑	❑
29	Y N	❑	❑	❑
30	Y N	❑	❑	❑

Version 3.0 8/26/05 RFIS Fall 2005 Field Version

Exhibit C.13: Prototypical STEP Observation in One Classroom

Classroom A	Duration (minutes)	Sample Clock Time	Activity
Rest period 1	6	8:00-8:06	Observer waits for children to acclimate
Sweep 1	3	8:06-8:09	Observer records data on each student in classroom
Rest period 2	3	8:09-8:12	Observer waits
Sweep 2	3	8:12-8:15	Observer records data on each student in classroom
Rest period 3	3	8:15-8:18	Observer waits
Sweep 3	3	8:18-8:21	Observer records data on each student in classroom
Switch classes	6	8:21-8:27	Observer exits Classroom 1 and moves to next classroom
Total time per classroom	**27 min**	Time is approximate (travel time between classrooms may be shorter or longer than 6 minutes)	

Note:

The duration of a sweep varies depending on how long it takes the observer to record data on all students in the classroom, but never exceeds three minutes. Exactly six minutes separate the start of one sweep and the start of another.

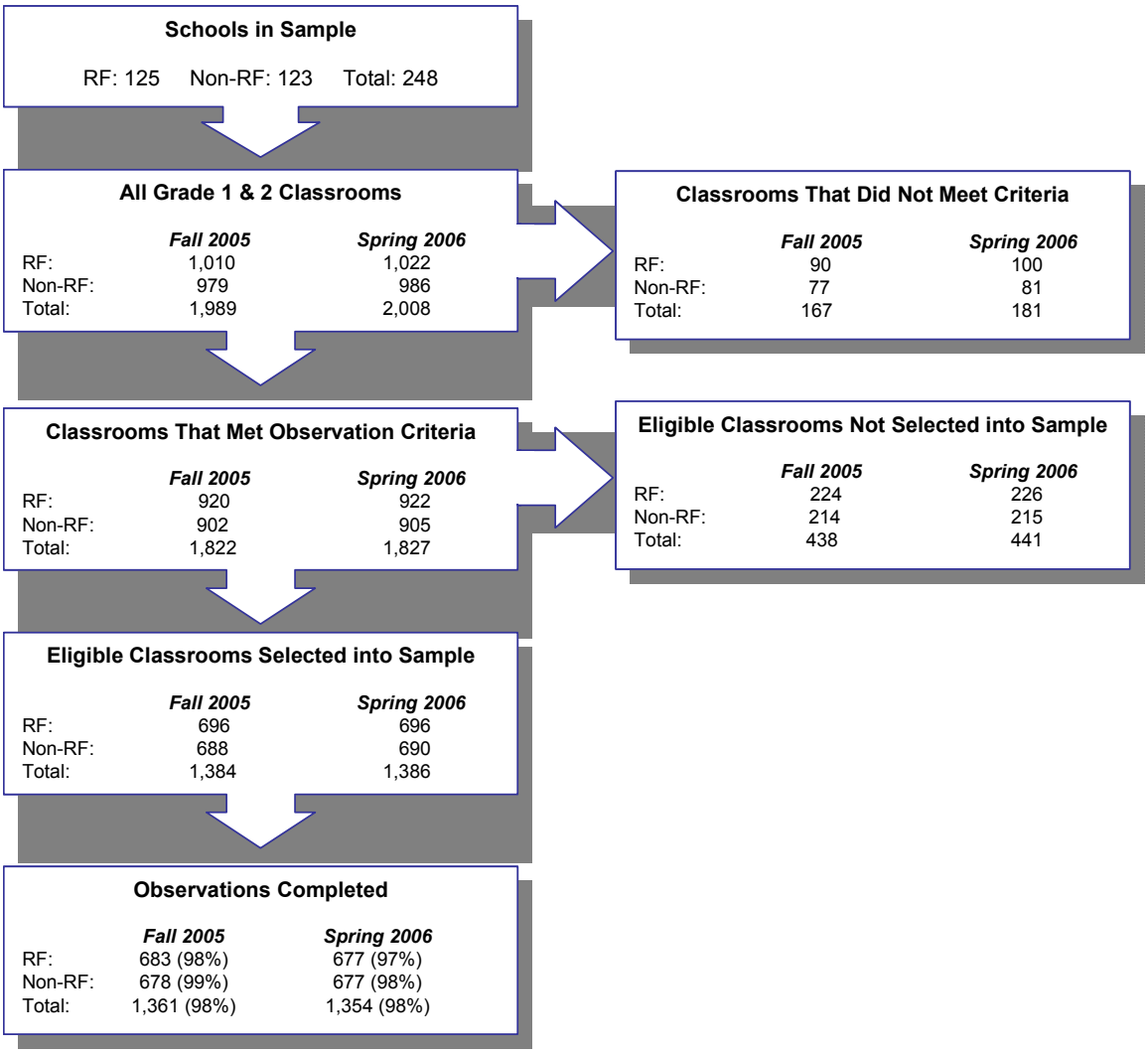
Under certain circumstances, observers skipped a scheduled sweep. First, if at the time of a scheduled sweep, more than one-half of the students in the classroom were transitioning from one activity to another (e.g., students were rotating between activity "centers"), the observer skipped that sweep. Second, if at the time of a scheduled sweep, the whole class was listening to the teacher read aloud, and the students themselves did not have access to the printed text, the observer skipped that sweep.[45]

Data Collection and Response Rates for Fall 2005 and Spring 2006

The STEP was added to the classroom observation data collection battery beginning in fall 2005, reflecting a decision by IES staff (Institute for Education Sciences, U.S. Department of Education) overseeing the RFIS to augment the teacher-focused data collection (using the IPRI) with a student-focused measure. STEP observations were done in grade 1 and 2 classrooms in both fall 2005 and spring 2006 by trained field staff who had successfully completed the requirements of the classroom observation training. As described above, during two consecutive days of classroom observations, STEP observations were completed once in each classroom, yielding one STEP record per classroom. In fall 2005, STEP observations were completed in 1,361 first and second grade classrooms, which represents a 98 percent completion rate for expected observations. In spring 2006, 1,354 first and second grade classrooms, or 98 percent of expected observations, were conducted. A flow chart of the sampling process and STEP response rates is presented in Exhibit C.14.

[45] These protocols were implemented because pilot-testing of the instrument revealed that on- and off-task judgments were difficult to make reliably under these two circumstances.

Exhibit C.14: STEP Data Collection: School, Classroom and Observation Sample Information



Notes:

Classrooms were considered ineligible to be in the study sample if they were special education or English as a Second Language classes, if fewer than 75 percent of the students were in the target grade, or if the class was taught by someone other than the regular teacher or a long-term substitute.

Classrooms were sampled within schools if, across a site as a whole, the number of classrooms exceeded an average of three classrooms per grade.

2,715 STEP observations were completed in fall 2005 and spring 2006; of these, 2,659 had usable data for analyses.

Source: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006

Analytic Variables

The RFIS Team focused on the percentage of students engaged with print as the primary analytic variable derived from the STEP data to be used in impact analyses. This variable was created for each classroom by first summing the number of students in each sweep who were on-task and who were either reading connected text, reading isolated text, or writing. The percentage of students engaged with print for each sweep was then calculated as the number of students engaged with print divided by the total number of students that the observer rated in the sweep (i.e., the number of students in the classroom at the time the sweep was conducted). The percentage of students engaged with print for each sweep was then averaged across the number of sweeps available for that classroom.[46]

STEP Reliability

For reasons of parsimony, results from the fall 2006 STEP training are presented below. Observers were trained on the STEP measure using a combination of still photographs and 3-second video clips of first and second grade students during reading instruction.[47] Trainees viewed five practice sequences, containing both still photographs and short video clips. A sixth sequence of video clips (hereafter, the "test tape") was used to assess the average inter-rater reliability of observers' judgments about student engagement.

The test tape was designed to simulate a single "sweep," and it included three-second clips of 15 first- or second-grade students. Two master coders had viewed and scored the test tape to arrive at a set of master codes for each student on the tape.

Percent agreement was calculated for each trainee with the master codes for each code (i.e., On-Task, Reading Connected Text, Reading Isolated Text, Writing), and then a mean percent agreement was calculated across trainees for each code. Next, overall percent agreement was calculated by aggregating across codes.

As shown in Exhibit C.15 below, observers achieved an average of 89 percent agreement across all codes appearing in the test tape. Seventy-five percent of the observers scored at least 86 percent overall agreement. Observers had the lowest average agreement about whether or not a student was Reading Isolated Text (77 percent), and they achieved the highest level of agreement when judging that a student was Writing (96 percent).[48] These differences reflect that fact that the video cameras could zoom in and capture students' expressions more effectively than they could discern the specific types of text with which students were engaged. During actual data collection, observers could move around the classrooms to determine whether students were engaged with specific types of text.

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[46] For the pooled dataset (fall 2005 and spring 2006), 69 percent of classrooms had 3 sweeps of data; 24 percent had 2 sweeps of data; 5 percent had 1 sweep of data; and 2 percent were missing STEP data.

[47] Classroom reading instruction was filmed in both Reading First and non-RF classrooms for the purpose of creating a training resource for the RFIS.

[48] In fall 2005, similar results were obtained from the previous group of observers. They achieved, on average, 87 percent agreement across all codes appearing in the test tape. Seventy-five percent of the trainees scored at least 84 percent overall agreement. Trainees had the lowest average agreement on the Reading Isolated Text code (75 percent), and the highest level of agreement (95 percent) on the Writing code. (The test tape featured only one student who was engaged in Writing.)

Exhibit C.15: Percent Correct by Code and Overall for STEP Reliability Tape, Fall 2006

	Percent Agreement				
		Student Is …			
	On Task	Reading Connected Text	Reading Isolated Text	Writing	Overall
Mean	92	92	77	96	89
Minimum	60	67	50	75	73
25th percentile	87	92	67	92	86
50th percentile	93	92	75	100	90
75th percentile	100	92	83	100	92
Maximum	100	100	100	100	100

Notes:

The number of observers tested on this tape is 130.

EXHIBIT READS: Observers in the fall 2006 training achieved an average of 92 percent agreement on whether a student was on-task; 92 percent agreement on whether a student was reading connected text; 77 percent agreement on whether a student was reading isolated text; 96 percent agreement on whether a student was writing; and 89 percent agreement across all codes appearing in the test tape.

Appendix D: Additional Exhibits for Main Impact Analyses

In the first part of this appendix, separate impact estimates are presented for each follow-up year. (The estimates presented in the main body of the report are for impact estimates pooled across years or data collection waves.) The differences in impacts between the two years are not statistically significant across outcome domains for those data collected in both years. Impact estimates are provided for reading comprehension and instructional outcomes. Student achievement data are reported for each estimated impact in both scaled scores and percent at or above grade level for appropriate years across the nine exhibits in this Appendix.

The second part of this appendix presents a brief discussion of student achievement results over time.

Part 1: Separate Impact Estimates for Each Follow-up Year

Exhibit D.1: Estimated Impacts on Reading Comprehension: Spring 2005, Scaled Score

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Effect Size of Impact	Statistical Significance of Impact (p-value)
All Sites					
Grade 1					
Average Scaled Score	541.2	538.9	2.2	0.05	(0.524)
Corresponding Grade Equivalent	*1.7*	*1.7*			
Corresponding Percentile	*43*	*41*			
Grade 2					
Average Scaled Score	583.5	582.4	1.2	0.03	(0.654)
Corresponding Grade Equivalent	*2.5*	*2.4*			
Corresponding Percentile	*38*	*38*			
Grade 3					
Average Scaled Score	607.4	609.9	-2.5	-0.06	(0.306)
Corresponding Grade Equivalent	*3.2*	*3.3*			
Corresponding Percentile	*38*	*39*			

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005 and 2006 SAT-10 test scores (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean reading comprehension score for first-graders with Reading First was 541.2 scaled score points. The estimated mean without Reading First was 538.9 scaled score points. The impact of Reading First on grade one reading comprehension was 2.2 scaled score points (or 0.05 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.524).

Sources: RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit D.2: Estimated Impacts on Reading Comprehension: Spring 2005, Percent At or Above Grade Level

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Statistical Significance of Impact (p-value)
All Sites				
Percent At or Above Grade Level				
Grade 1	43.8	41.6	2.2	(0.529)
Grade 2	38.0	38.0	0.0	(0.996)
Grade 3	36.0	39.3	-3.3	(0.255)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed average percent of first-graders reading at or above grade level with Reading First was 43.8 percentage points. The estimated average percent without Reading First was 41.6 percentage points. The impact of Reading First on the percent of first grade students reading at or above grade level was 2.2 percentage points, which was not statistically significant at the $p \leq .05$ level (p=.529).

Sources: Data from RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit D.3: Estimated Impacts on Reading Comprehension: Spring 2006, Scaled Score

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Effect Size of Impact	Statistical Significance of Impact (p-value)
All Sites					
Grade 1					
Average Scaled Score	545.7	540.4	5.3	0.11	(0.152)
Corresponding Grade Equivalent	1.8	1.7			
Corresponding Percentile	46	42			
Grade 2					
Average Scaled Score	585.3	583.7	1.6	0.04	(0.620)
Corresponding Grade Equivalent	2.5	2.5			
Corresponding Percentile	40	38			
Grade 3					
Average Scaled Score	609.5	610.0	-0.5	-0.01	(0.860)
Corresponding Grade Equivalent	3.3	3.3			
Corresponding Percentile	39	39			

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located are in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005 and 2006 SAT-10 test scores (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean reading comprehension score for first-graders with Reading First was 545.7 scaled score points. The estimated mean without Reading First was 540.4 scaled score points. The impact of Reading First on grade one reading comprehension was 5.3 scaled score points (or 0.11 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.152).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit D.4: Estimated Impacts on Reading Comprehension: Spring 2006, Percent At or Above Grade Level

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Statistical Significance of Impact (p-value)
All Sites				
Percent At or Above Grade Level				
Grade 1	47.3	43.0	4.3	(0.217)
Grade 2	39.9	39.6	0.3	(0.926)
Grade 3	39.9	40.8	-0.9	(0.801)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed average percent of first-graders reading at or above grade level with Reading First was 47.3 percentage points. The estimated average percent without Reading First was 43.0 percentage points. The impact of Reading First on the percent of first grade students reading at or above grade level was 4.3 percentage points, which was not statistically significant at the $p \leq .05$ level (p=.217).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit D.5: Estimated Impacts on Time Spent in Instruction in Five Dimensions of Reading Instruction: Spring 2005

Construct	Actual Mean with Reading First	Estimated Mean without Reading First	Impact (minutes)	Effect Size of Impact	Statistical Significance of Impact (p-value)
Number of minutes spent in instruction in:					
Five dimensions combined					
Grade 1	59.23	50.34	8.89*	0.43*	(0.007)
Grade 2	58.43	45.30	13.13*	0.62*	(<0.001)
Each of the five dimensions					
Phonemic Awareness					
Grade 1	1.64	0.76	0.88*	0.33*	(0.004)
Grade 2	0.42	0.30	0.13	0.10	(0.381)
Phonics					
Grade 1	21.02	18.05	2.97	0.22	(0.141)
Grade 2	14.01	10.71	3.30*	0.31*	(0.042)
Vocabulary					
Grade 1	7.03	5.48	1.55	0.23	(0.072)
Grade 2	10.45	8.74	1.71	0.20	(0.130)
Fluency					
Grade 1	5.26	3.72	1.53	0.25	(0.180)
Grade 2	5.13	2.81	2.32*	0.42*	(0.014)
Comprehension					
Grade 1	24.29	22.19	2.10	0.15	(0.349)
Grade 2	28.40	22.86	5.54*	0.34*	(0.023)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

Due to insufficient variation in the random effects between schools in the three-level RDD model estimating the impact of Reading First on the amount of time spent on phonemic awareness instruction in second grade classrooms, the school-level effects were fixed.

EXHIBIT READS: The observed mean amount of time spent in instruction in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) in first grade classrooms with Reading First was 59.23 minutes. The estimated mean amount of time without Reading First was 50.34 minutes. The impact of Reading First on the amount of time spent in instruction in the five dimensions was 8.89 minutes (or 0.43 standard deviations), which was statistically significant at the $p \leq .05$ level (p=.007).

Source: RFIS Instructional Practice in Reading Inventory, spring 2005

Exhibit D.6: Estimated Impacts on Instructional Outcomes: Spring 2005

Construct	Actual Mean with Reading First	Estimated Mean without Reading First	Impact (percent)	Effect Size of Impact	Statistical Significance of Impact (p-value)
Percentage of intervals in five dimensions with:					
Highly Explicit Instruction					
Grade 1	29.71	22.38	7.33*	0.41*	(0.003)
Grade 2	31.97	25.01	6.96*	0.36*	(0.007)
High Quality Student Practice					
Grade 1	21.31	22.05	-0.74	-0.04	(0.749)
Grade 2	22.91	18.93	3.98	0.22	(0.079)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed percentage of observation intervals with instruction in the five dimensions and at least one instance of highly explicit instruction in first grade classrooms with Reading First was 29.71 percent. The estimated percentage without Reading First was 22.38 percent. The impact of Reading First on the percentage of observation intervals with instances of highly explicit instruction was 7.33 percentage points (or 0.41 standard deviations), which was statistically significant at the $p \leq .05$ level (p=.003).

Source: RFIS Instructional Practice in Reading Inventory, spring 2005

Exhibit D.7: Estimated Impacts on Time Spent in Instruction in Five Dimensions of Reading Instruction: Fall 2005 and Spring 2006

Construct	Actual Mean with Reading First	Estimated Mean without Reading First	Impact (minutes)	Effect Size of Impact	Statistical Significance of Impact (p-value)
Number of minutes spent in instruction in:					
Five dimensions combined					
Grade 1	59.49	50.92	8.57*	0.41*	(0.011)
Grade 2	60.25	49.11	11.13*	0.52*	(0.001)
Each of the five dimensions					
Phonemic Awareness					
Grade 1	2.32	1.69	0.63	0.24	(0.099)
Grade 2	0.42	0.27	0.15	0.12	(0.238)
Phonics					
Grade 1	21.56	16.99	4.57*	0.34*	(0.012)
Grade 2	14.04	9.97	4.06*	0.38*	(0.011)
Vocabulary					
Grade 1	8.22	8.08	0.14	0.02	(0.883)
Grade 2	12.29	9.89	2.39	0.27	(0.053)
Fluency					
Grade 1	4.13	3.23	0.90	0.15	(0.170)
Grade 2	3.75	4.20	-0.44	-0.08	(0.521)
Comprehension					
Grade 1	23.27	20.92	2.35	0.16	(0.259)
Grade 2	29.75	24.81	4.95*	0.30*	(0.030)

Notes:

The complete RFIS study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean amount of time spent in instruction in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) in first grade classrooms with Reading First was 59.49 minutes. The estimated mean amount of time without Reading First was 50.92 minutes. The impact of Reading First on the amount of time spent in instruction in the five dimensions was 8.57 minutes (or 0.41 standard deviations), which was statistically significant at the $p \leq .05$ level (p=.011).

Sources: RFIS Instructional Practice in Reading Inventory, fall 2005 and spring 2006

Exhibit D.8: Estimated Impacts on Instructional Outcomes: Fall 2005 and Spring 2006

Construct	Actual Mean with Reading First	Estimated Mean without Reading First	Impact (percent)	Effect Size of Impact	Statistical Significance of Impact (p-value)
Percentage of intervals in five dimensions with:					
Highly explicit instruction					
Grade 1	29.76	27.86	1.90	0.11	(0.316)
Grade 2	31.33	24.11	7.22*	0.37*	(<0.001)
High quality student practice					
Grade 1	17.99	16.21	1.79	0.11	(0.284)
Grade 2	16.44	12.94	3.50*	0.19*	(0.035)

Notes:

The complete RFIS study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed percentage of observation intervals with instruction in the five dimensions and at least one instance of highly explicit instruction in first grade classrooms with Reading First was 29.76 percent. The estimated percentage without Reading First was 27.86 percent. The impact of Reading First on the percentage of observation intervals with instances of highly explicit instruction was 1.90 percentage points (or 0.11 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.316).

Sources: RFIS Instructional Practice in Reading Inventory, fall 2005 and spring 2006

Exhibit D.9: Differences Across Study Years for Reading Comprehension and Instructional Outcomes: 2004-2005 to 2005-2006[1]

Outcome Domain	Outcome	Grade	p-value
Reading Comprehension	SAT 10 Scaled Score	Grade 1	(0.472)
		Grade 2	(0.910)
		Grade 3	(0.568)
	Percent Reading At or Above Grade Level	Grade 1	(0.642)
		Grade 2	(0.953)
		Grade 3	(0.555)
	Index	Grade 1	(0.541)
		Grade 2	(0.936)
		Grade 3	(0.549)
Instruction	Minutes in Five Dimensions	Grade 1	(0.945)
		Grade 2	(0.669)
	Highly Explicit Instruction	Grade 1	(0.082)
		Grade 2	(0.937)
	High Quality Student Practice	Grade 1	(0.376)
		Grade 2	(0.863)
	Index	Grade 1	(0.725)
		Grade 2	(0.810)

Notes:

The complete RFIS study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

Because the RFIS collected data on student engagement with print only in 2005-06, there are no year-to-year differences.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

[1] For reading comprehension, 2004-2005 data included SAT 10 scores from spring 2005; 2005-2006 data included SAT 10 scores from spring 2006. For instructional outcomes, 2004-2005 data included IPRI scores from spring 2005; 2005-2006 data included IPRI scores from fall 2005 and spring 2006.

EXHIBIT READS: The difference in reading comprehension between grade 1 SAT 10 scaled scores in 2005 and 2006 was not statistically significant at the $p \leq .05$ level (p=0.472).

Sources: RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR); RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006.

Part 2: Student Achievement Trends Over Time

Exhibits D.10 and D.11 present student achievement trends over time for schools in the RFIS study sample. Data on mean SAT 10 scores are presented at two time points—spring 2005 and spring 2006—separately for Reading First and non-Reading First schools across the 248 schools in the 18 sites in the RFIS study sample.

For each year and grade, three mean scaled score values were calculated. **The Actual Mean with Reading First** value is simply that; it is the actual unadjusted mean for the Reading First schools in the study sample. The **Estimated Mean without Reading First** value represents the best estimate of what would have happened in Reading First schools absent Reading First funding. The Actual Mean for Non-Reading First schools value is the unadjusted mean for the non-Reading First schools in the study sample.[49]

The Estimated Mean without Reading First is the counterfactual and in the absence of Reading First represents the best estimate of what would have happened in the treatment schools—if they had not been selected as Reading First schools. The Actual Mean with Reading First and the Estimated Mean without Reading First values are identical to the values shown in the impact tables in Chapter 4 and appendices D and G. Calculation of the counterfactual accounts for each school's rating and prior achievement, both of which were generally higher in non-RF schools, as RF grants were awarded to schools with greatest need within each site. The Actual Mean for Non-Reading First schools value does not take into account either (1) the criteria (or rating) used to determine their RF status or (2) any pre-RF differences in student achievement.

In Exhibit D.10, the first row shows mean scaled scores on the SAT 10 for grade 1 in spring 2005. From left to right, the table displays the actual (or unadjusted) mean for RF schools (541.2), then the estimated mean in the absence of RF (538.9), and in the third column, the actual (or unadjusted) mean for non-RF schools, (542.5). Note that this exhibit does **not** display the estimated ***impact*** of Reading First, which is the presented in the main body of the report (i.e., 2.2 scaled score points, representing the difference between the values in columns 1 and 2).

Exhibit D.10 also includes the corresponding grade equivalent and national percentile for each scaled score mean value.[50] The remaining rows in the table show values for grade 1 (spring 2006), grade 2 (spring 2005 and spring 2006), and grade 3 (spring 2005 and spring 2006).

The scaled score means displayed in Exhibit D.10 are graphed in Exhibit D.11. Because the SAT 10 scaled score range is continuous across grades, all values can be shown on a single set of axes. For each grade, the vertical bars represent the average scaled score for RF schools (unadjusted), schools in the absence of RF (estimated), and non-RF schools (unadjusted); a light bar represents the mean for spring 2005, and a darker shaded bar represents the mean for spring 2006. Mean values for grade one are the first set of vertical bars, mean values for grade two are the middle set of bars, and mean values

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[49] All means are weighted by the number of Reading First schools in each site, which is the same weighting scheme used for the impact estimates presented in the interim report.

[50] Calculations of mean values were done for scaled scores only. Average scaled scores for Reading First schools and non-Reading First schools were converted to grade equivalents and national percentiles. It is not appropriate to perform arithmetic calculations with grade equivalents or percentiles.

for grade three are the last set of bars. In all but one case, scaled score means improved from spring 2005 to spring 2006 for each grade and for each group of schools.[51]

Exhibit D.10: SAT 10 Reading Comprehension Means: Spring 2005 and Spring 2006

	Actual Mean with Reading First	Estimated Mean without Reading First	Actual Mean for Non-Reading First Schools
All Sites			
Grade 1			
Spring 2005			
Scaled Score	541.2	538.9	542.5
Corresponding Grade Equivalent	*1.7*	*1.7*	*1.7*
Corresponding Percentile	*43*	*41*	*44*
Spring 2006			
Scaled Score	545.7	540.4	545.8
Corresponding Grade Equivalent	*1.8*	*1.7*	*1.8*
Corresponding Percentile	*46*	*42*	*46*
Grade 2			
Spring 2005			
Scaled Score	583.5	582.4	586.7
Corresponding Grade Equivalent	*2.5*	*2.4*	*2.5*
Corresponding Percentile	*38*	*38*	*41*
Spring 2006			
Scaled Score	585.3	583.7	586.0
Corresponding Grade Equivalent	*2.5*	*2.5*	*2.5*
Corresponding Percentile	*40*	*38*	*40*
Grade 3			
Spring 2005			
Scaled Score	607.4	609.9	610.7
Corresponding Grade Equivalent	*3.2*	*3.3*	*3.4*
Corresponding Percentile	*38*	*39*	*40*
Spring 2006			
Scaled Score	609.5	610.0	613.9
Corresponding Grade Equivalent	*3.3*	*3.3*	*3.5*
Corresponding Percentile	*39*	*39*	*43*

Notes:

The complete Reading First Impact Study (RFIS) sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test scores were not available.

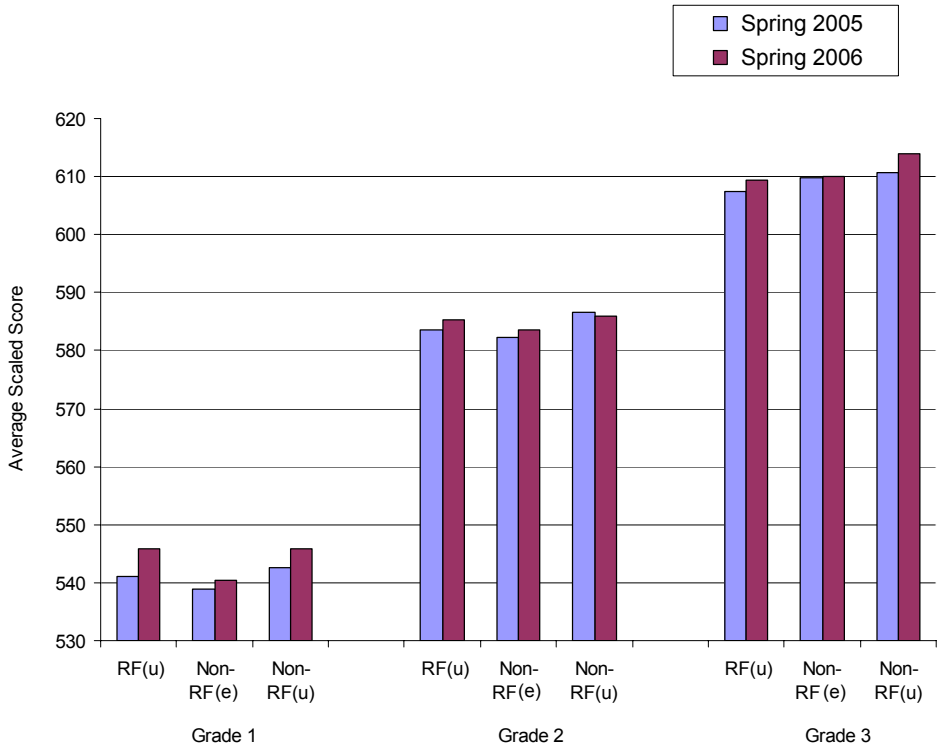
Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values. The actual mean for non-Reading First schools is the observed average for non-Reading First schools in the study sample.

EXHIBIT READS: On average, for first-graders in the spring of 2005, the observed mean reading comprehension score with Reading First was 541.2 scaled score points. The estimated mean without Reading First was 538.9 scaled score points. The observed mean in non-Reading First schools was 542.5 scaled score points.

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

[51] Mean scaled score values for second grade in Non-Reading First Schools (unadjusted) declined from 586.7 to 586.0 scaled score points.

Exhibit D.11: SAT 10 Reading Comprehension Means: Spring 2005 and Spring 2006



Notes:

The complete Reading First Impact Study (RFIS) sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test scores were not available.

For each grade, the vertical bars represent the average scaled score for RF schools (unadjusted), schools in the absence of RF (estimated), and non-RF schools (unadjusted).

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Appendix E: Confidence Intervals for Main Impact Estimates

Appendix E presents 95 percent confidence intervals for main impacts in relevant metrics. (Confidence intervals are reported for all main impact estimates in the body of the text in effect sizes only.) Confidence intervals for estimated impacts are reported for reading comprehension, instructional outcomes, and student engagement with print. Data are reported across these areas for pertinent study years.

Exhibit E.1: Confidence Intervals for Estimated Impacts on Reading Comprehension: Spring 2005 and 2006; Scaled Score

	Impact	Standard Error	Confidence Interval
All Sites			
Reading Comprehension Scaled Score			
Grade 1	3.57	2.87	-2.06 – 9.20
Grade 2	1.41[a]	2.41	-3.31 – 6.13
Grade 3	-1.63	2.17	-5.89 – 2.63

Notes:

The complete Reading First Impact Study (RFIS) sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

A 95% confidence interval was used.

[a] Due to estimation variation and rounding, the estimated pooled sample impact is sometimes slightly bigger than the impacts for 2005 and 2006 separately.

EXHIBIT READS: The estimated impact of the Reading First program for grade 1 on reading comprehension scaled scores was 3.57 points with a standard error of 2.87 scaled score points. The 95% confidence interval for the estimated impact ranged from -2.06 points to 9.20 points.

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit E.2: Confidence Intervals for Estimated Impacts on Reading Comprehension: Spring 2005 and 2006; Percent At or Above Grade Level

	Impact	Standard Error	Confidence Interval
All Sites			
Percent Reading At or Above Grade Level			
Grade 1	3.15	2.79	-2.32 – 8.62
Grade 2	0.12	2.60	-4.98 – 5.22
Grade 3	-2.22	2.54	-7.20 – 2.76

Notes:

The complete Reading First Impact Study (RFIS) sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

A 95% confidence interval was used.

[a] Due to estimation variation and rounding, the estimated pooled sample impact is sometimes slightly bigger than the impacts for 2005 and 2006 separately.

EXHIBIT READS: The estimated impact of the Reading First program for grade 1 on the percentage of students reading at or above grade level was 3.15 percentage points with a standard error of 2.79 percentage points. The 95% confidence interval for the estimated impact ranged from -2.32 percentage points to 8.62 percentage points.

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already used the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit E.3: Confidence Intervals for Estimated Impacts on Instructional Outcomes: Spring 2005, Fall 2005, and Spring 2006

	Impact	Standard Error	Confidence Interval
Panel 1	***(minutes)***		
Number of minutes of instruction in five dimensions combined			
Grade 1	8.56*	2.81	3.05 – 14.08
Grade 2	12.09*	2.85	6.50 – 17.68
Panel 2	***(percent)***		
Percentage of intervals in five dimensions with			
Highly Explicit Instruction			
Grade 1	3.65*	1.60	0.52 – 6.77
Grade 2	6.98*	1.72	3.62 – 10.34
High Quality Student Practice			
Grade 1	0.86	1.47	-2.02 – 3.75
Grade 2	3.67*	1.45	0.83 – 6.50

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

A 95% confidence interval was used.

EXHIBIT READS: The estimated impact of the Reading First program for grade 1 on the amount of time spent in instruction in the five dimensions was 8.56 minutes with a standard error of 2.81 minutes. The estimated impact was statistically significant at the $p \leq .05$ level. The 95% confidence interval for the estimated impact ranged from 3.05 minutes to 14.08 minutes.

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006

Exhibit E.4: Confidence Intervals for Estimated Impacts on Time Spent in Instruction in the Five Dimensions: Spring 2005, Fall 2005, and Spring 2006

	Impact (minutes)	Standard Error	Confidence Interval
Number of minutes of instruction in:			
Phonemic Awareness			
Grade 1	0.72*	0.30	0.14 – 1.30
Grade 2	0.15	0.11	-0.06 – 0.35
Phonics			
Grade 1	3.90*	1.59	0.79 – 7.02
Grade 2	3.85*	1.33	1.23 – 6.47
Vocabulary			
Grade 1	0.65	0.73	-0.79 – 2.09
Grade 2	2.14*	0.99	0.21 – 4.07
Fluency			
Grade 1	1.09	0.68	-0.25 – 2.42
Grade 2	0.65	0.61	-0.55 – 1.86
Comprehension			
Grade 1	2.29	1.79	-1.23 – 5.80
Grade 2	5.26*	1.96	1.42 – 9.10

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

A 95% confidence interval was used.

EXHIBIT READS: The estimated impact of the Reading First program for grade 1 on the amount of time spent in instruction in phonemic awareness was 0.72 minutes with a standard error of 0.30 minutes. The estimated impact was statistically significant at the $p \leq .05$ level. The 95% confidence interval for the estimated impact ranged from 0.14 minutes to 1.30 minutes.

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006

Exhibit E.5: Confidence Intervals for Estimated Impacts on Student Engagement with Print: Fall 2005 and Spring 2006

Construct	Impact (percent)	Standard Error	Confidence Interval
Percentage of student engagement with print			
Grade 1	4.63	3.73	-2.69 – 11.94
Grade 2	-8.42*	3.86	-15.98 – -0.86

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and one state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

A 95% confidence interval was used.

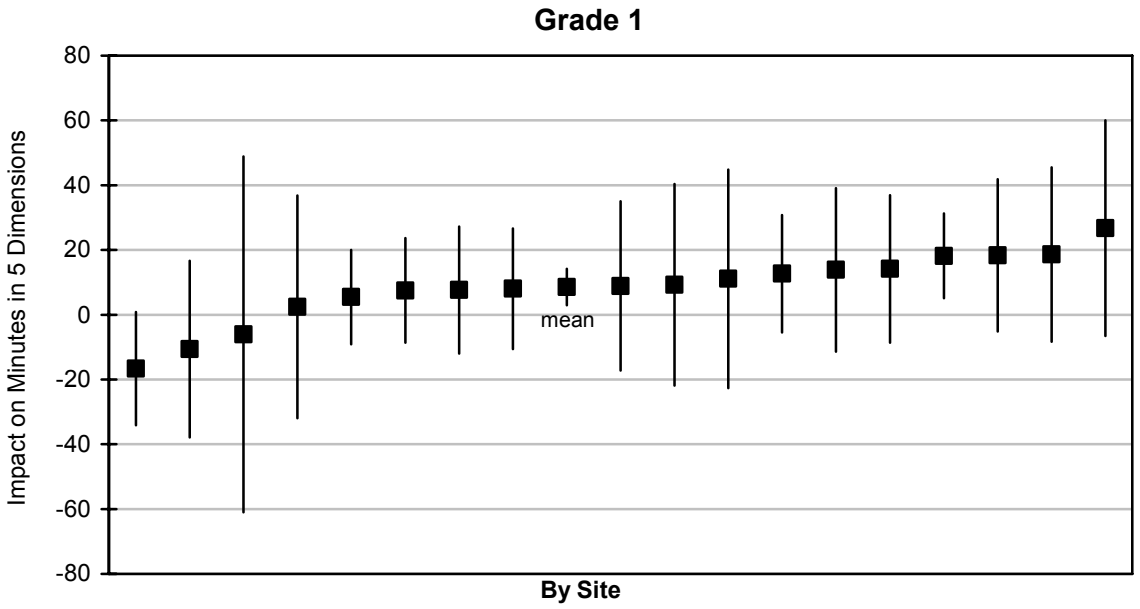
EXHIBIT READS: The estimated impact of the Reading First program for grade 1 on the percentage of students engaged with print was 4.63 percentage points with a standard error of 3.73 percentage points. The 95% confidence interval for the estimated impact ranged from -2.69 percentage points to 11.94 percentage points.

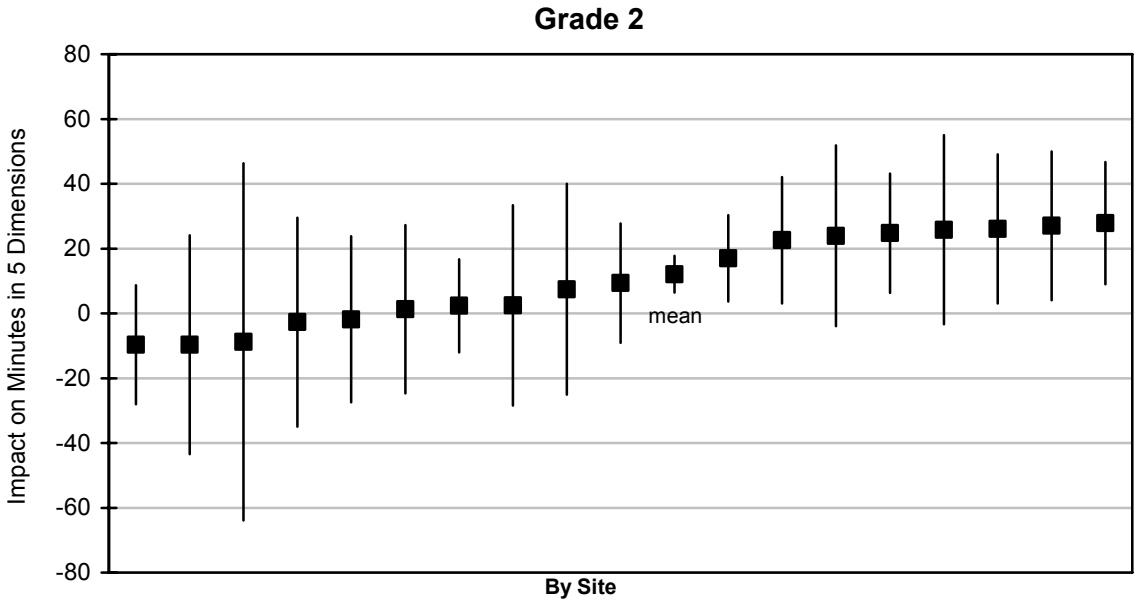
Source: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006

Appendix F: Graphs of Site-By-Site Impact Estimates

Appendix F provides the site-by-site variation in estimated program impacts on minutes of instruction in the five dimensions and student engagement with print (impact estimates in the main body of the report are presented only for reading comprehension outcomes and not for other outcome domains). The two exhibits herein are entitled "Fixed Effect Impact Estimates for Instruction, by Site, by Grade" and "Fixed Effect Impact Estimates for Student Engagement with Print, by Site, by Grade" respectively.

Exhibit F.1: Fixed Effect Impact Estimates for Instruction, by Site, by Grade





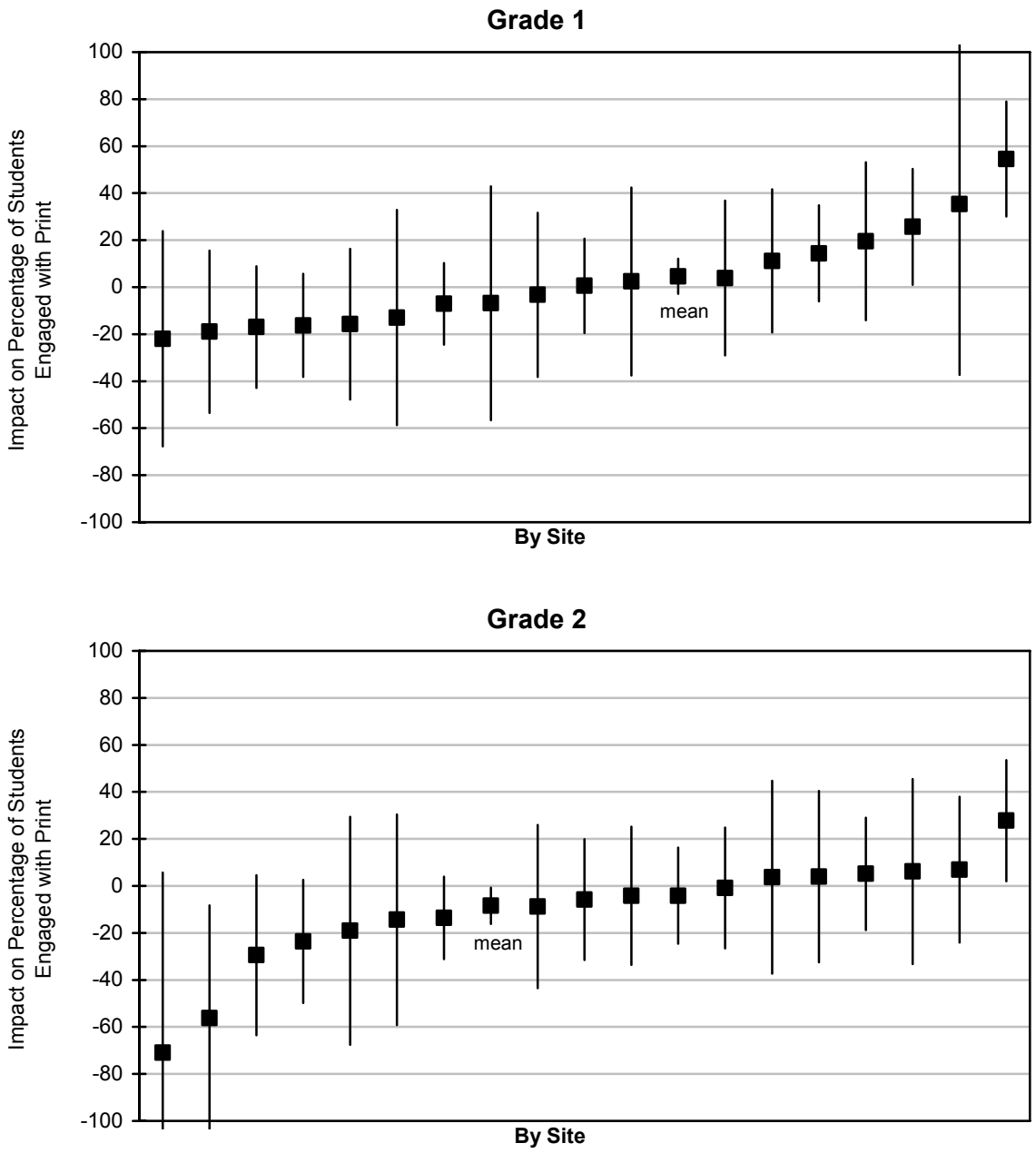
Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

Source: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006

Exhibit F.2: Fixed Effect Impact Estimate for Student Engagement with Print, by Site, by Grade



Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

Source: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006

Appendix G: Additional Exhibits for Subgroup Analyses

This appendix provides impact estimates for all outcomes separately by award group across follow-up years for all three outcome domains (impact estimates presented in the main body of the report are for the pooled full sample and not by award group). Reported data include award group differences in estimated impacts as well as estimated impacts by award group across relevant years for reading comprehension, instructional outcomes, and student engagement with print. Results for reading comprehension are reported in both scaled scores and percent at or above grade level.

Exhibit G.1: Estimated Impacts on Reading Comprehension by Award Group: Spring 2005; Scaled Score

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Effect Size of Impact	Statistical Significance of Impact (p-value)
Early Award Sites					
Grade 1					
Average Scaled Score	544.2	544.8	-0.6	-0.01	(0.931)
Corresponding Grade Equivalent	*1.7*	*1.7*			
Corresponding Percentile	*45*	*45*			
Grade 2					
Average Scaled Score	586.1	590.8	-4.6	-0.11	(0.350)
Corresponding Grade Equivalent	*2.5*	*2.6*			
Corresponding Percentile	*41*	*44*			
Grade 3					
Average Scaled Score	610.2	618.1	-7.9	-0.20	(0.129)
Corresponding Grade Equivalent	*3.4*	*3.7*			
Corresponding Percentile	*40*	*48*			
Late Award Sites					
Grade 1					
Average Scaled Score	538.8	534.0	4.8	0.10	(0.194)
Corresponding Grade Equivalent	*1.7*	*1.6*			
Corresponding Percentile	*41*	*37*			
Grade 2					
Average Scaled Score	581.5	575.9	5.6*	0.13*	(0.044)
Corresponding Grade Equivalent	*2.4*	*2.3*			
Corresponding Percentile	*37*	*32*			
Grade 3					
Average Scaled Score	605.2	603.6	1.6	0.04	(0.502)
Corresponding Grade Equivalent	*3.1*	*3.1*			
Corresponding Percentile	*36*	*35*			

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005 and 2006 SAT-10 test scores (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean reading comprehension score for first-graders with Reading First in the early award sites was 544.2 scaled score points. The estimated mean without Reading First was 544.8 scaled score points. The impact of Reading First was -0.6 scaled score points (or -0.01 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.931).

Sources: RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.2: Award Group Differences in Estimated Impacts on Reading Comprehension: Spring 2005; Scaled Score

	Difference in Impact (Early - Late)	Effect Size of Difference	Statistical Significance of Differences (p-values)
All Sites			
Average Scaled Score			
Grade 1	-5.3	-0.11	(0.478)
Grade 2	-10.2	-0.24	(0.071)
Grade 3	-9.4	-0.24	(0.095)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005 and 2006 SAT-10 test scores (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference in impact between early and late award sites in grade 1 was -5.3 scaled score points. The effect size of the difference was -0.11 standard deviations. The estimated difference was not statistically significant at the $p \leq .05$ level (p=.478).

Sources: RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.3: Estimated Impacts on Reading Comprehension by Award Group: Spring 2005; Percent At or Above Grade Level

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Statistical Significance of Impact (p-value)
Early Award Sites				
Percent At or Above Grade Level				
Grade 1	45.9	48.5	-2.6	(0.708)
Grade 2	40.4	48.6	-8.2	(0.163)
Grade 3	39.1	49.0	-9.9	(0.110)
Late Award Sites				
Percent At or Above Grade Level				
Grade 1	42.2	35.9	6.3	(0.077)
Grade 2	36.2	29.9	6.3*	(0.028)
Grade 3	33.6	31.9	1.7	(0.537)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed average percent of first-graders reading at or above grade level with Reading First in the early award sites was 45.9 percentage points. The estimated average percent without Reading First was 48.5 percentage points. The impact of Reading First on the percent of students reading at or above grade level was -2.6 percentage points, which was not statistically significant at the $p \leq .05$ level (p=.708).

Sources: RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.4: Award Group Differences in Estimated Impacts on Reading Comprehension: Spring 2005; Percent At or Above Grade Level

	Difference in Impact (Early - Late)	Statistical Significance of Difference (p-value)
All Sites		
Percent At or Above Grade Level		
Grade 1	-8.8	(0.251)
Grade 2	-14.5*	(0.026)
Grade 3	-11.6	(0.086)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference in impact between early award and late award sites for the grade 1 was -8.8 percentage points. The difference was not statistically significant at the $p \leq .05$ level (p=.251).

Sources: RFIS SAT 10 administration in the spring of 2005, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.5: Estimated Impacts on Reading Comprehension by Award Group: Spring 2006; Scaled Score

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Effect Size of Impact	Statistical Significance of Impact (p-value)
Early Award Sites					
Grade 1					
Average Scaled Score	549.6	550.0	-0.4	-0.01	(0.944)
Corresponding Grade Equivalent	*1.8*	*1.8*			
Corresponding Percentile	*50*	*50*			
Grade 2					
Average Scaled Score	588.4	593.5	-5.1	-0.12	(0.376)
Corresponding Grade Equivalent	*2.6*	*2.7*			
Corresponding Percentile	*42*	*46*			
Grade 3					
Average Scaled Score	614.2	619.9	-5.7	-0.14	(0.254)
Corresponding Grade Equivalent	*3.5*	*3.8*			
Corresponding Percentile	*44*	*49*			
Late Award Sites					
Grade 1					
Average Scaled Score	542.7	533.0	9.7*	0.20*	(0.031)
Corresponding Grade Equivalent	*1.7*	*1.6*			
Corresponding Percentile	*44*	*37*			
Grade 2					
Average Scaled Score	582.8	576.3	6.5	0.15	(0.078)
Corresponding Grade Equivalent	*2.4*	*2.3*			
Corresponding Percentile	*38*	*33*			
Grade 3					
Average Scaled Score	605.7	602.4	3.4	0.08	(0.314)
Corresponding Grade Equivalent	*3.1*	*3.0*			
Corresponding Percentile	*36*	*34*			

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005 and 2006 SAT-10 test scores (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean reading comprehension score for first-graders with Reading First in the early award sites was 549.6 scaled score points. The estimated mean without Reading First was 550.0 scaled score points. The impact of Reading First was -0.4 scaled score points (or -0.01 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.944).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.6: Award Group Differences in Estimated Impacts on Reading Comprehension: Spring 2006; Scaled Score

	Difference in Impact (Early - Late)	Effect Size of Difference	Statistical Significance of Difference (p-value)
All Sites			
Average Scaled Score			
Grade 1	-10.2	-0.21	(0.181)
Grade 2	-11.6	-0.27	(0.089)
Grade 3	-9.0	-0.23	(0.130)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005 and 2006 SAT-10 test scores (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference in impact between early and late cohorts for grade 1 was -10.2 scaled score points. The difference in effect size was -0.21 standard deviations. The estimated difference was not statistically significant at the $p \leq .05$ level (p=.181).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.7: Estimated Impacts on Reading Comprehension by Award Group: Spring 2006; Percent At or Above Grade Level

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Statistical Significance of Impact (p-value)
Early Award Sites				
Percent At or Above Grade Level				
Grade 1	50.4	52.3	-1.9	(0.751)
Grade 2	41.8	48.6	-6.8	(0.303)
Grade 3	44.7	52.4	-7.7	(0.225)
Late Award Sites				
Percent At or Above Grade Level				
Grade 1	44.9	35.5	9.4*	(0.024)
Grade 2	38.5	32.8	5.7	(0.155)
Grade 3	36.2	32.0	4.2	(0.269)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed average percent of first-graders reading at or above grade level with Reading First in the early award sites was 50.4 percentage points. The estimated average percent without Reading First was 52.3 percentage points. The impact of Reading First on the percent of students reading at or above grade level was -1.9 percentage points, which was not statistically significant at the $p \leq .05$ level (p=.751).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.8: Award Group Differences in Estimated Impacts on Reading Comprehension: Spring 2006; Percent At or Above Grade Level

	Difference in Impact (Early – Late)	Statistical Significance of Difference (p-value)
All Sites		
Percent At or Above Grade Level		
Grade 1	-11.3	(0.123)
Grade 2	-12.4	(0.105)
Grade 3	-11.8	(0.107)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference in impact between early award and late award sites for the grade 1 is -11.3 percentage points. The estimated difference was not statistically significant at the $p \leq .05$ level (p=.123).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit G.9: Estimated Impacts on Instructional Outcomes by Award Group: Spring 2005

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Effect Size of Impact	Statistical Significance of Impact (p-value)
Early award sites					
Number of minutes of instruction in five dimensions combined					
Grade 1	62.69	57.20	5.49	0.26	(0.376)
Grade 2	62.82	51.89	10.93	0.51	(0.083)
Percentage of intervals in five dimensions with					
Highly Explicit Instruction					
Grade 1	30.88	21.82	9.06*	0.50*	(0.035)
Grade 2	32.06	26.40	5.66	0.29	(0.176)
High Quality Student Practice					
Grade 1	21.68	20.25	1.43	0.09	(0.717)
Grade 2	22.41	17.72	4.68	0.26	(0.199)
Late award sites					
Number of minutes of instruction in five dimensions combined					
Grade 1	56.51	45.00	11.51*	0.55*	(0.001)
Grade 2	55.10	40.25	14.84*	0.70*	(<0.001)
Percentage of intervals in five dimensions with					
Highly Explicit Instruction					
Grade 1	28.80	22.79	6.00*	0.33*	(0.040)
Grade 2	31.90	23.95	7.94*	0.41*	(0.016)
High Quality Student Practice					
Grade 1	21.02	23.27	-2.25	-0.13	(0.417)
Grade 2	23.30	19.69	3.61	0.20	(0.206)

Notes:

The complete RFIS study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean amount of time spent in instruction in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) in first grade classrooms with Reading First in early award sites was 62.69 minutes. The estimated mean amount of time without Reading First was 57.20 minutes. The impact of Reading First on the amount of time spent in instruction in the five dimensions was 5.49 minutes (or 0.26 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.376).

Source: RFIS Instructional Practice in Reading Inventory, spring 2005

Exhibit G.10: Award Group Differences in Estimated Impacts on Instructional Outcomes: Spring 2005

	Difference in Impact (Early - Late)	Effect Size of Difference	Statistical Significance of Difference (p-value)
Number of minutes spent in instruction in five dimensions combined			
Grade 1	-6.02	-0.29	(0.398)
Grade 2	-3.91	-0.18	(0.590)
Percentage of observation intervals in five dimensions with			
Highly Explicit Instruction			
Grade 1	3.05	0.17	(0.552)
Grade 2	-2.28	-0.12	(0.665)
High Quality Student Practice			
Grade 1	3.68	0.22	(0.445)
Grade 2	1.08	0.06	(0.815)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference between the early and late award sites in the impact of Reading First on instructional time spent in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) for grade 1 was –6.02 minutes. This translates into an effect size of -.29 standard deviations. The estimated difference was not statistically significant at the $p \leq .05$ level (p=.398).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005

Exhibit G.11: Estimated Impacts on Instructional Outcomes, by Award Group: Fall 2005 and Spring 2006

	Actual Mean with Reading First	Estimated Mean without Reading First	Impact	Effect Size of Impact	Statistical Significance of Impact (p-value)
Early award sites					
Number of minutes of instruction in five dimensions combined					
Grade 1	62.51	58.35	4.16	0.20	(0.457)
Grade 2	64.77	60.21	4.56	0.21	(0.410)
Percentage of intervals in five dimensions with Highly Explicit Instruction					
Grade 1	30.68	28.37	2.30	0.13	(0.455)
Grade 2	31.51	30.84	0.67	0.03	(0.845)
High Quality Student Practice					
Grade 1	17.86	19.92	-2.05	-0.12	(0.462)
Grade 2	16.33	10.63	5.70*	0.32*	(0.041)
Late award sites					
Number of minutes of instruction in five dimensions combined					
Grade 1	57.12	45.09	12.03*	0.58*	(0.004)
Grade 2	56.82	40.71	16.11*	0.76*	(<0.001)
Percentage of intervals in five dimensions with Highly Explicit Instruction					
Grade 1	29.04	27.42	1.62	0.09	(0.495)
Grade 2	31.19	19.00	12.19*	0.63*	(<0.001)
High Quality Student Practice					
Grade 1	18.10	13.28	4.82*	0.29*	(0.020)
Grade 2	16.52	14.65	1.87	0.10	(0.357)

Notes:

The complete RFIS study sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Values in the "Actual Mean with Reading First" column are actual, unadjusted values for Reading First schools; values in the "Estimated Mean without Reading First" column represent the best estimates of what would have happened in RF schools absent RF funding and are calculated by subtracting the impact estimates from the RF schools' actual mean values.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The observed mean amount of time spent in instruction in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) in first grade classrooms with Reading First in early award sites was 62.51 minutes. The estimated mean amount of time without Reading First was 58.35 minutes. The impact of Reading First on the amount of time spent in instruction in the five dimensions was 4.16 minutes (or 0.20 standard deviations), which was not statistically significant at the $p \leq .05$ level (p=.457).

Sources: RFIS Instructional Practice in Reading Inventory, fall 2005 and spring 2006

Exhibit G.12: Award Group Differences in Estimated Impacts on Instructional Outcomes: Fall 2005 and Spring 2006

	Difference in Impact (Early – Late)	Effect Size of Difference	Statistical Significance of Difference (p-value)
Number of minutes spent in instruction in five dimensions combined			
Grade 1	-7.87	-0.38	(0.254)
Grade 2	-11.55	-0.54	(0.088)
Percentage of observation intervals in five dimensions with			
Highly Explicit Instruction			
Grade 1	0.68	0.04	(0.860)
Grade 2	-11.52*	-0.60*	(0.007)
High Quality Student Practice			
Grade 1	-6.87*	-0.41*	(0.047)
Grade 2	3.83	0.21	(0.262)

Notes:

The complete RFIS sample includes 248 schools from 18 sites (17 districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the spring 2005, fall 2005, and spring 2006 IPRI data (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference between the early and late award sites in the impact of Reading First on instructional time spent in the five dimensions (phonemic awareness, phonics, vocabulary, fluency, and comprehension) for grade 1 was –7.87 minutes. This translates into an effect size of -.38 standard deviations. The estimated difference was not statistically significant at the $p \leq .05$ level (p=.254).

Sources: RFIS Instructional Practice in Reading Inventory, fall 2005 and spring 2006

Exhibit G.13: Award Group Differences in Estimated Impacts on Percentage of Students Engaged with Print: Fall 2005 and Spring 2006

	Difference in Impact (Early – Late)	Effect Size of Difference	Statistical Significance of Difference (p-value)
All Sites			
Percentage of students engaged with print			
Grade 1	-13.9	-0.47	(0.073)
Grade 2	-12.5	-0.44	(0.105)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

The effect size of the impact is the impact divided by the actual standard deviation of the outcome for the non-Reading First schools pooled across the fall 2005 and spring 2006 STEP data (by grade).

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The estimated difference in impact between early and late award sites for grade 1 was –13.9 percentage points. This translates into an effect size of -0.47 standard deviations. The estimated difference was not statistically significant at the $p \leq .05$ level (p=.073).

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Exhibit G.14: Differences Across Years for Reading Comprehension, Reading Instruction, and Student Engagement with Print: Early Award Sites

Outcome Domain	Outcome	Grade	p-value
Reading Comprehension	SAT 10 Scaled Score	Grade 1	(0.989)
		Grade 2	(0.945)
		Grade 3	(0.783)
	At or Above Grade Level	Grade 1	(0.963)
		Grade 2	(0.887)
		Grade 3	(0.786)
	Index	Grade 1	(0.973)
		Grade 2	(0.967)
		Grade 3	(0.776)
Instructional Outcomes	Minutes in Five dimensions	Grade 1	(0.873)
		Grade 2	(0.443)
	HEI	Grade 1	(0.198)
		Grade 2	(0.353)
	HQSP	Grade 1	(0.470)
		Grade 2	(0.823)
	Index	Grade 1	(0.389)
		Grade 2	(0.421)
Percentage of Students Engaged with Print	STEP	Grade 1	N/A
		Grade 2	N/A

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For Grade 2, two non-RF schools could not be included in the analysis because no data for grade two were available. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: Differences across years in impacts of Reading First on reading comprehension in grade 1, as measured by the SAT 10 scaled score, were not statistically significant at the $p \leq .05$ level (p=.989).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR); RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006; and RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Exhibit G.15: Differences Across Years for Reading Comprehension, Reading Instruction, and Student Engagement with Print: Late Award Sites

Outcome Domain	Outcome	Grade	p-value
Reading Comprehension	SAT 10 Scaled Score	Grade 1	(0.310)
		Grade 2	(0.800)
		Grade 3	(0.674)
	At or Above Grade Level	Grade 1	(0.531)
		Grade 2	(0.914)
		Grade 3	(0.626)
	Index	Grade 1	(0.395)
		Grade 2	(0.952)
		Grade 3	(0.637)
Instructional Outcomes	Minutes in Five dimensions	Grade 1	(0.922)
		Grade 2	(0.815)
	HEI	Grade 1	(0.242)
		Grade 2	(0.304)
	HQSP	Grade 1	(0.040)*
		Grade 2	(0.619)
	Index	Grade 1	(0.612)
		Grade 2	(0.666)
Percentage of Students Engaged with Print	STEP	Grade 1	N/A
		Grade 2	N/A

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites, with 137 schools, and 10 early award sites, with 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: Differences across years in impacts of Reading First on reading comprehension in grade 1, as measured by the SAT 10 scaled score, were not statistically significant at the $p \leq .05$ level (p=.310).

Sources: RFIS SAT 10 administration in the spring of 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR); RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006; and RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Appendix H: Alternative Moderators of Reading First Impacts

The discussion in Chapter 4 indicates that the study team had a priori hypotheses about potential differences in sample schools due to award date. There were, in fact, differences in the patterns of Reading First impacts on reading comprehension scores between early and late award sites in first and second grade (see top two panels of Exhibit H.1). In the late award sites in these grades, schools with Reading First had higher reading comprehension scores than they would have had in the absence of Reading First. In early award sites, there was no statistically significant impact of Reading First.

In this appendix, we explore the early and late award site differences further, as well as explore two other potential moderating factors, fall 2004 reading performance for non-Reading First schools and Reading First funding per student. The appendix describes the construction of these potential moderating factors and presents results of various tests that were conducted to test the relationship of these moderators to impacts.

Award Date

The award date information was obtained from Reading First district coordinators in November 2005. District coordinators were asked to provide the month and year that Reading First money was made available to schools in their respective districts. The continuous award variable was then calculated as the number of months between the month/year the funds became available to each site and January 2003. For example, if the funds became available to a site in April of 2003, the continuous award variable for that site would be 3.

Fall 2004 Reading Performance of the non-Reading First Schools

Fall 2004 reading performance for students in the non-RF schools represents the best approximation of existing student reading proficiency in each site. This variable draws on test score data from fall 2004, which is up to 16 months after the RF award date in early award sites, and prior to the RF award date in all late award sites. The percent of students in grades 1-3 at or above grade level variable was constructed using students' fall 2004 SAT 10 scaled scores,[52] as well as the test date at each school. Each student's scaled score was compared to corresponding grade equivalency norms to determine whether the student was at or above grade level. The percent of non-Reading First students at or above grade level was created by taking the mean of the student-level at or above grade level variable, across all grades within a school, and averaging across all schools within a site.

[52] In the fall of 2004, students' SAT 10 scores were unavailable. For those sites scores from the spring of 2005 were substituted and adjusted by the mean difference of all other students' spring and fall SAT 10 scores, by grade.

Reading First Funding Per Student

The amount of the Reading First funding per student was constructed using data from the SEDL database[53] (as of October 2004) about award amounts for each site, and the Common Core Data that provided the number of K-3 students within each school. The Reading First funding per pupil was calculated separately for the 2002-2003 and 2003-2004 school years. Since 20 percent of the Reading First grant award to each district was set aside for district Reading First activities, and therefore not used to directly fund Reading First schools, for each of these school years the Reading First award amount per site was multiplied by .80. The award amount was then divided by the number of students in grades K-3 in all Reading First schools per site. The Reading First funding per pupil for the two school years was then averaged by site to create the Reading First per pupil expenditure variable used in analysis.

Subgroup Analyses of the Effects of the Moderating Factors

For each of the three moderating factors, sites were ordered by the moderating factor and then separated into two subgroups of sites that are as balanced as possible, with respect to the number of Reading First schools.[54] Program impacts were then estimated for one key outcome measure from each of the three domains for the two subgroups. These outcomes included (a) the SAT 10 scaled score for reading comprehension, (b) total minutes in the five dimensions of reading instruction, and (c) percentage of students engaged with print. First, analyses tested the difference between impacts for the two subgroups. Then, to test whether the conclusions were sensitive to the specific cut-point chosen to define the subgroups, average impacts were re-estimated for each subgroup after dropping the two sites closest to the cut-point between the two subgroups. This was repeated again after dropping the next two sites closest to the cut-point between the two subgroups.

The exhibits show the detailed results of subgroup analyses based on award dates, fall 2004 student reading performance, and RF funds per student. Each exhibit presents results for one outcome measure, by subgroup and by grade. Exhibits H.1–H.3 show the results for award date. Exhibits H.4–H.6 and Exhibits H.7–H.9 report the subgroup analyses results for fall 2004 performance of non-Reading First school students and RF funds per student, respectively. The results suggest that some differences exist between early and late sites' impacts both in reading comprehension and instruction; only differences in impacts for reading comprehension in grades two and three are statistically significant. There were no systematic differences in impacts for the two subgroups of sites whose non-RF schools were lower-performing versus higher-performing or for the two subgroups of sites who had lower versus higher amounts of RF funding per student. Findings across all three moderators were not generally sensitive to the omission of borderline sites from the analyses.

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[53] Southwest Educational Development Laboratory (SEDL) is contracted to maintain the Reading First Awards database available online at http://www.sedl.org/readingfirst/welcome.html. SEDL lists the amount awarded to each Reading First district in the first year. State Reading First Coordinators are responsible for providing this information to SEDL.

[54] For each moderating factor, the order of sites was slightly different. Therefore, the composition of the two subgroups for each moderating factor differed both in the actual sites included and in the total number of schools included.

Interaction Analyses of the Effects of the Moderating Factors

In addition to the subgroup analysis approach, a linear interaction model was used to gauge possible interactions between the impact of Reading First and the three proposed moderating factors—timing of local Reading First awards, fall 2004 student reading performance, and Reading First funds per K-3 student.

The following equation describes the statistical model used in this analysis:

$$Y_{ijkm} = \sum_{mt} \beta_{0m} S_{mk} YR_t + \beta_1 T_k + \beta_2 T_k F_{ijkm} + \sum_{mt} \beta_{3m} S_{mk} R_k YR_t + \sum_{mt} \beta_{4m} S_{mk} \overline{Y_{-1km}} YR_t$$
$$+ \sum_{t} \gamma_t Z_{jk} YR_t + \sum_{nt} \theta_n X_{nijk} YR_t + \mu_k + \upsilon_{jk} + \varepsilon_{ijk}$$

where:

Y_{ijkm} = the post-test for student i from classroom j in school k in site m,
S_{mk} = one if school k is in site m and zero otherwise, m = 1 to 18,
T_k = one if school K is a treatment school and zero otherwise,
R_k = the rating for school k in site m (standardized and centered by site),
F_m = a moderating factor for site m (its timing of local Reading First awards, fall 2004 student proficiency in reading, or Reading First funds per K-3 student).
$\overline{Y_{-1km}}$ = the mean baseline pretest for school k (standardized and centered by site),
YR_t = an indicator for follow-up years, 2005 or 2006,
Z_{jk} = a variable indicating when the post-test was given for classroom j in school k (site-centered),
X_{nijk} = demographic characteristic n of student i from classroom j in school k,
μ_k, υ_{jk} and ε_{ijk} = school-level, classroom-level, and student-level random error terms, respectively, assumed to be independently and identically distributed.

In this model, β_1 is the estimated impact of Reading First weighted by precision.[55] β_2 is the coefficient for the interaction term between the treatment status indicator and one of the moderating factors. This coefficient indicates how the impact of Reading First changes per unit of change in the moderating factor. Exhibit H.10 presents the estimated values of β_2 for each of the three moderating factors and for each of the three outcome domains. Results suggest that for only one moderating factor, Reading First dollars per K-3 student, there was a statistically significant linear relationship with impacts on reading comprehension. For the other two moderating factors, timing of the Reading First award and fall 2004 student reading proficiency, the linear relationship with program impacts was not statistically significant.

[55] Because the moderating factor was not interacted with the site dummy, it is not possible to weight by the number of RF schools in each site. In this model one treatment indicator is specified for all sites.

Summary

Across the alternative moderating factors explored in this appendix, only one (Reading First funding per student) factor was statistically significantly related to student reading achievement. However, when the RFIS sample is divided into two subgroups (on the factors described above), differences between subgroups are not generally significant, with the exception of early and late award subgroups.

Exhibit H.1: Estimated Impacts on Reading Comprehension, by Award Status

SAT 10 Scaled Scores		Full	Drop 1 Pair	Drop 2 Pairs
Early Award Sites				
Grade 1	Impact	-0.22	-0.56	3.42
	SE	5.14	5.33	5.69
	p-value	(0.966)	(0.916)	(0.547)
Grade 2	Impact	-4.78	-5.87	-4.02
	SE	4.45	4.67	4.65
	p-value	(0.283)	(0.209)	(0.387)
Grade 3	Impact	-6.98	-8.74*	-6.12
	SE	4.18	4.38	4.28
	p-value	(0.095)	(0.046)	(0.153)
Late Award Sites				
Grade 1	Impact	6.58*	5.53	1.99
	SE	3.14	3.38	3.82
	p-value	(0.036)	(0.102)	(0.602)
Grade 2	Impact	6.09*	5.62*	6.97*
	SE	2.59	2.86	3.48
	p-value	(0.019)	(0.050)	(0.045)
Grade 3	Impact	2.43	1.38	1.13
	SE	2.25	2.43	2.69
	p-value	(0.280)	(0.569)	(0.675)
Difference				
Grade 1	Impact	-6.80	-6.09	1.43
	SE	6.02	6.31	6.86
	p-value	(0.260)	(0.335)	(0.835)
Grade 2	Impact	-10.87*	-11.48*	-10.99
	SE	5.15	5.48	5.81
	p-value	(0.036)	(0.037)	(0.059)
Grade 3	Impact	-9.41*	-10.12*	-7.24
	SE	4.75	5.00	5.05
	p-value	(0.049)	(0.044)	(0.153)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 8 late award sites totaling 137 schools and 10 early award sites totaling 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in early award sites for grade 1 on reading comprehension was -0.22 scaled score points, on average, for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.966). The impact of the Reading First program in early award sites for grade 1 on reading comprehension was -0.56 scaled score points, on average, for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.916). The impact of the Reading First program in early award sites for grade 1 on reading comprehension scaled score was 3.42 scaled score points, on average, for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.547).

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit H.2: Estimated Impacts on Reading Instruction, by Award Status

Minutes in Five Dimensions		Full	Drop 1 Pair	Drop 2 Pairs
Early Award Sites				
Grade 1	Impact	4.73	3.46	2.46
	SE	4.89	5.14	5.50
	p-value	(0.336)	(0.503)	(0.655)
Grade 2	Impact	7.49	7.49	8.90
	SE	5.16	5.44	5.83
	p-value	(0.149)	(0.171)	(0.130)
Late Award Sites				
Grade 1	Impact	11.57*	11.36*	8.83*
	SE	3.32	3.66	3.91
	p-value	(0.001)	(0.002)	(0.027)
Grade 2	Impact	15.63*	13.94*	12.72*
	SE	3.25	3.42	3.91
	p-value	(<0.001)	(<0.001)	(0.002)
Difference				
Grade 1	Impact	-6.83	-7.89	-6.37
	SE	5.91	6.31	6.75
	p-value	(0.249)	(0.212)	(0.346)
Grade 2	Impact	-8.14	-6.44	-3.82
	SE	6.09	6.42	7.01
	p-value	(0.183)	(0.317)	(0.587)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites totaling 137 schools and 10 early award sites totaling 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in early award sites for grade 1 on the number of minutes of instruction in the five dimensions was 4.73 minutes on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.336). The impact of the Reading First program in early award sites for grade 1 on the number of minutes of instruction in the five dimensions was 3.46 minutes on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.503). The impact of the Reading First program in early award sites for grade 1 on the number of minutes of instruction in the five dimensions was 2.46 minutes on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.655).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006.

Exhibit H.3: Estimated Impacts on Percentage of Student Engagement with Print, by Award Status

Percentage of Students Engaged with Print		Full	Drop 1 Pair	Drop 2 Pairs
Early Award Sites				
Grade 1	Impact	-3.10	-2.05	-0.51
	SE	6.26	6.46	6.73
	p-value	(0.622)	(0.752)	(0.940)
Grade 2	Impact	-15.77*	-15.51*	-17.91*
	SE	5.81	5.87	6.23
	p-value	(0.008)	(0.010)	(0.005)
Late Award Sites				
Grade 1	Impact	10.78*	2.48	6.27
	SE	4.52	4.78	5.47
	p-value	(0.019)	(0.605)	(0.255)
Grade 2	Impact	-3.24	-8.78	-7.10
	SE	5.06	5.08	6.52
	p-value	(0.522)	(0.087)	(0.280)
Difference				
Grade 1	Impact	-13.88	-4.53	-6.78
	SE	7.72	8.04	8.67
	p-value	(0.073)	(0.574)	(0.435)
Grade 2	Impact	-12.53	-6.72	-10.80
	SE	7.70	7.76	9.02
	p-value	(0.105)	(0.387)	(0.232)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 8 late award sites totaling 137 schools and 10 early award sites totaling 111 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program on early award sites for grade 1 on the percentage of student engagement with print was –3.10 percentage points on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.622). The impact of the Reading First program in early award sites for grade 1 on the percentage of student engagement with print was –2.05 percentage points on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.752). The impact of the Reading First program in early award sites for grade 1 on the percentage of student engagement with print was –0.51 percentage points on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.940).

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Exhibit H.4: Estimated Impacts on Reading Comprehension, by Fall 2004 Reading Performance of the non-Reading First Schools

SAT 10 Scaled Scores		Full	Drop 1 Pair	Drop 2 Pairs
High Non-RF School Performance				
Grade 1	Impact	5.87	4.52	8.14*
	SE	5.02	4.09	4.11
	p-value	(0.243)	(0.269)	(0.048)
Grade 2	Impact	-2.59	0.24	2.70
	SE	3.90	3.20	2.97
	p-value	(0.506)	(0.939)	(0.364)
Grade 3	Impact	-3.15	-1.20	2.04
	SE	3.79	3.05	2.88
	p-value	(0.406)	(0.693)	(0.480)
Low Non-RF School Performance				
Grade 1	Impact	1.02	2.85	3.28
	SE	3.22	3.51	3.53
	p-value	(0.751)	(0.418)	(0.355)
Grade 2	Impact	5.32	6.07	6.21
	SE	2.89	3.13	3.14
	p-value	(0.066)	(0.056)	(0.051)
Grade 3	Impact	-0.53	-0.88	2.00
	SE	2.45	2.83	2.84
	p-value	(0.829)	(0.756)	(0.484)
Difference				
Grade 1	Impact	-4.85	-1.66	-4.86
	SE	5.97	5.39	5.42
	p-value	(0.417)	(0.758)	(0.370)
Grade 2	Impact	7.91	5.82	3.51
	SE	4.85	4.48	4.32
	p-value	(0.105)	(0.195)	(0.418)
Grade 3	Impact	2.62	0.32	-0.04
	SE	4.51	4.16	4.05
	p-value	(0.562)	(0.938)	(0.992)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 10 high non-RF comparison school sites totaling 120 schools and 8 low performance non-RF school sites totaling 128 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in high performance non-RF school sites for grade 1 on reading comprehension was 5.87 scaled score points on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.243). The impact of the Reading First program in high performance non-RF school sites for grade 1 on reading comprehension was 4.52 scaled score points on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.269). The impact of the Reading First program in high performance non-RF school sites for grade 1 on average reading comprehension scaled score was 8.14 scaled score points on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was statistically significant at the $p \leq .05$ level (p=.048).

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit H.5: Estimated Impacts on Reading Instruction, by Fall 2004 Reading Performance of the Non-Reading First Schools

Minutes in Five Dimensions		Full	Drop 1 Pair	Drop 2 Pairs
High Non-RF School Performance				
Grade 1	Impact	12.21*	13.85*	14.18*
	SE	4.53	4.13	4.23
	p-value	(0.008)	(0.001)	(0.001)
Grade 2	Impact	13.37*	15.39*	17.60*
	SE	4.47	4.03	4.13
	p-value	(0.003)	(0.002)	(<0.001)
Low Non-RF School Performance				
Grade 1	Impact	5.07	4.60	4.77
	SE	3.48	3.82	3.92
	p-value	(0.148)	(0.232)	(0.226)
Grade 2	Impact	10.86*	8.65*	10.15*
	SE	3.64	3.99	4.10
	p-value	(0.003)	(0.033)	(0.015)
Difference				
Grade 1	Impact	-7.14	-9.25	-9.41
	SE	5.71	5.27	5.77
	p-value	(0.213)	(0.101)	(0.104)
Grade 2	Impact	-2.51	-6.74	-7.45
	SE	5.76	5.67	5.82
	p-value	(0.663)	(0.236)	(0.202)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 10 high performance non-RF school sites totaling 120 schools, and 8 low performance non-RF school sites totaling 128 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in high performance non-RF school sites for grade 1 on the number of minutes of instruction in the five dimensions was 12.21 minutes on average for the full sample of 18 sites. The impact was statistically significant at the $p \leq .05$ level (p=.008). The impact of the Reading First program in high performance non-RF school sites for grade 1 on the number of minutes of instruction in the five dimensions was 13.85 minutes on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was statistically significant at the $p \leq .05$ level (p=.001). The impact of the Reading First program in high performance non-RF school sites for grade 1 on the number of minutes of instruction in the five dimensions was 14.18 minutes on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was statistically significant at the $p \leq .05$ level (p=.001).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006.

Exhibit H.6: Estimated Impacts on Student Engagement with Print, by Fall 2004 Reading Performance of the Non-Reading First Schools

Percentage of Students Engaged with Print		Full	Drop 1 Pair	Drop 2 Pairs
High Non-RF School Performance				
Grade 1	Impact	-1.33	-4.60	-3.51
	SE	5.82	5.51	5.54
	p-value	(0.819)	(0.406)	(0.528)
Grade 2	Impact	-10.08	-4.52	-5.23
	SE	5.07	4.53	4.64
	p-value	(0.050)	(0.321)	(0.263)
Low Non-RF School Performance				
Grade 1	Impact	10.48*	15.53*	17.32*
	SE	4.78	5.25	5.33
	p-value	(0.031)	(0.004)	(0.002)
Grade 2	Impact	-7.64	-7.84	-3.93
	SE	5.67	6.10	6.36
	p-value	(0.181)	(0.203)	(0.538)
Difference				
Grade 1	Impact	11.81	20.14*	20.83*
	SE	7.53	7.614	7.685
	p-value	(0.118)	(0.009)	(0.007)
Grade 2	Impact	2.44	-3.32	1.30
	SE	7.61	7.60	7.88
	p-value	(0.748)	(0.663)	(0.869)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 10 high performance non-RF school sites totaling 120 schools and 8 low performance non-RF school sites totaling 128 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in high performance non-RF **school sites for grade 1 on the percentage of student engagement with print was –1.33 percentage points on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.819). The impact of the Reading First program in high performance** non-RF **school sites for grade 1 on the percentage of student engagement with print was –4.60 percentage points on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.406). The impact of the Reading First program in high performance** non-RF **school sites for grade 1 on the percentage of student engagement with print was –3.51 percentage points on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.528).**

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Exhibit H.7: Estimated Impacts on Reading Comprehension, by Reading First Funds Per Student

SAT 10 Scaled Score		Full	Drop 1 Pair	Drop 2 Pairs
Low RF Funding				
Grade 1	Impact	1.11	-3.33	-7.24
	SE	4.82	4.71	5.49
	p-value	(0.817)	(0.480)	(0.187)
Grade 2	Impact	0.55	-4.69	-7.40
	SE	4.08	3.84	4.58
	p-value	(0.892)	(0.222)	(0.106)
Grade 3	Impact	2.25	-2.40	-4.99
	SE	3.61	3.43	4.01
	p-value	(0.533)	(0.483)	(0.213)
High RF Funding				
Grade 1	Impact	7.89	6.19	5.72
	SE	4.50	5.09	5.36
	p-value	(0.079)	(0.223)	(0.286)
Grade 2	Impact	5.55	6.83	6.42
	SE	3.60	4.49	4.76
	p-value	(0.123)	(0.128)	(0.178)
Grade 3	Impact	0.62	-1.42	-1.67
	SE	3.34	3.58	3.86
	p-value	(0.852)	(0.693)	(0.666)
Difference				
Grade 1	Impact	-6.78	-9.52	-12.96
	SE	6.59	6.93	7.67
	p-value	(0.305)	(0.171)	(0.093)
Grade 2	Impact	-4.99	-11.52	-13.82*
	SE	5.44	5.91	6.61
	p-value	(0.359)	(0.052)	(0.038)
Grade 3	Impact	1.63	-0.99	-3.33
	SE	4.92	4.96	5.57
	p-value	(0.741)	(0.842)	(0.550)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 9 low RF funding sites totaling 124 schools and 9 high RF funding sites totaling 124 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in low Reading First funding sites for grade 1 on reading comprehension was 1.11 scaled score points on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.817). The impact of the Reading First program in low Reading First funding sites for grade 1 reading comprehension scaled score was –3.33 scaled score points on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.480). The impact of the Reading First program in low Reading First funding sites for grade 1 on average reading comprehension scaled score was –7.24 scaled score points on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.187).

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR).

Exhibit H.8: Estimated Impacts on Reading Instruction, by Reading First Funds Per Student

Minutes in Five Dimensions		Full	Drop 1 Pair	Drop 2 Pairs
Low RF Funding				
Grade 1	Impact	4.00	4.74	2.92
	SE	4.17	4.28	4.98
	p-value	(0.340)	(0.270)	(0.559)
Grade 2	Impact	8.63	7.81	3.74
	SE	4.43	4.56	5.16
	p-value	(0.054)	(0.089)	(0.470)
High RF Funding				
Grade 1	Impact	13.05*	11.33*	10.88*
	SE	3.76	4.15	4.49
	p-value	(0.001)	(0.008)	(0.0187)
Grade 2	Impact	15.40*	14.84*	17.76*
	SE	3.64	4.28	4.67
	p-value	(<0.001)	(0.001)	(<0.001)
Difference				
Grade 1	Impact	-9.05	-6.59	-7.96
	SE	5.61	5.96	6.70
	p-value	(0.108)	(0.271)	(0.236)
Grade 2	Impact	-6.77	-7.03	-14.01*
	SE	5.73	6.25	6.96
	p-value	(0.239)	(0.262)	(0.045)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 9 low RF funding sites totaling 124 schools and 9 high RF funding sites totaling 124 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in low Reading First funding sites for grade 1 on the number of minutes of instruction in the five dimensions was 4.00 minutes on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.340). The impact of the Reading First program in low Reading First funding sites for grade 1 on the number of minutes of instruction in the five dimensions was 4.74 minutes on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.270). The impact of the Reading First program in low Reading First funding sites for grade 1 on the number of minutes of instruction in the five dimensions was 2.92 minutes on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.559).

Sources: RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006.

Exhibit H.9: Estimated Impacts on Percentage of Student Engagement with Print, by Reading First Funds Per Student

Percentage of Student Engagement with Print		Full	Drop 1 Pair	Drop 2 Pairs
Low RF Funding				
Grade 1	Impact	8.42	9.01	-1.49
	SE	5.42	5.65	6.26
	p-value	(0.123)	(0.114)	(0.813)
Grade 2	Impact	-8.07	-8.73	-17.32*
	SE	6.50	6.78	7.21
	p-value	(0.218)	(0.201)	(0.019)
High RF Funding				
Grade 1	Impact	0.78	3.46	3.60
	SE	5.11	6.03	6.40
	p-value	(0.879)	(0.568)	(0.575)
Grade 2	Impact	-8.63	-6.96	-6.69
	SE	4.46	5.51	5.81
	p-value	(0.056)	(0.211)	(0.254)
Difference				
Grade 1	Impact	7.64	5.55	-5.09
	SE	7.45	8.26	8.95
	p-value	(0.306)	(0.502)	(0.570)
Grade 2	Impact	0.56	-1.77	-10.63
	SE	7.88	8.73	9.26
	p-value	(0.944)	(0.839)	(0.252)

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. There are 9 low RF funding sites totaling 124 schools and 9 high RF funding sites totaling 124 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating and site-specific funding cut-point into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: The impact of the Reading First program in low Reading First funding sites for grade 1 on the percentage of student engagement with print was 8.42 percentage points on average for the full sample of 18 sites. The impact was not statistically significant at the $p \leq .05$ level (p=.123). The impact of the Reading First program in low Reading First funding sites for grade 1 on the percentage of student engagement with print was 9.01 percentage points on average for the sample of 16 sites remaining after one pair of sites closest to the cut-point was dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.114). The impact of the Reading First program in low Reading First funding sites for grade 1 on the percentage of student engagement with print was –1.49 percentage points on average for the sample of 14 sites remaining after two pairs of sites closest to the cut-point were dropped. The impact was not statistically significant at the $p \leq .05$ level (p=.813).

Sources: RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

Exhibit H.10: Change in Impact Associated with One Unit of Change In Continuous Dimensions

		Reading Comprehension (SAT 10 scaled score)	Reading Instruction (min. in 5 Dimensions	Student Engagement with Print (% of students)
Award Date				
Grade 1	Impact	0.49	0.57	0.69
	SE	0.49	0.50	0.68
	p-value	(0.318)	(0.250)	(0.311)
Grade 2	Impact	0.56	0.02	0.00
	SE	0.40	0.52	0.70
	p-value	(0.165)	(0.964)	(0.998)
Grade 3	Impact	0.50	N/A	N/A
	SE	0.37	N/A	N/A
	p-value	(0.175)	N/A	N/A
Fall 2004 Reading Performance of non-RF Schools				
Grade 1	Impact	0.11	0.20	-0.50
	SE	0.25	0.26	0.36
	p-value	(0.670)	(0.434)	(0.159)
Grade 2	Impact	-0.29	0.36	0.09
	SE	0.21	0.28	0.37
	p-value	(0.166)	(0.188)	(0.804)
Grade 3	Impact	-0.07	N/A	N/A
	SE	0.20	N/A	N/A
	p-value	(0.733)	N/A	N/A
Reading First Funding Per Student				
Grade 1	Impact	0.03*	0.01	0.02
	SE	0.01	0.01	0.01
	p-value	(0.007)	(0.378)	(0.207)
Grade 2	Impact	0.03*	0.02	0.01
	SE	0.01	0.01	0.02
	p-value	(0.001)	(0.078)	(0.590)
Grade 3	Impact	0.01	N/A	N/A
	SE	0.01	N/A	N/A
	p-value	(0.456)	N/A	N/A

Notes:

The complete RF study sample includes 248 schools from 18 sites (17 school districts and 1 state) located in 13 states. 125 schools are Reading First schools and 123 are non-Reading First schools. For grade 2, one non-RF school could not be included in the analysis because test score data were not available. There are 8 late award sites totaling 137 schools and 10 early award sites totaling 111 schools. There are 10 high performance non-RF school sites totaling 120 schools, and 8 low performance non-RF sites totaling 128 schools. There are 9 low RF funding sites totaling 124 schools and 9 high RF funding sites totaling 124 schools.

Impact estimates are statistically adjusted (e.g., take each school's rating, site-specific funding cut-point, and other covariates into account) to reflect the regression discontinuity design of the study.

A two-tailed test of significance was used, and where applicable, statistically significant findings at the $p \leq .05$ level are indicated by *.

EXHIBIT READS: An increase of one month in Reading First award date in grade 1 is associated with an increase of 0.49 scaled score points in reading comprehension, 0.57 minutes of instruction in the five dimensions, and 0.69 percentage points in the percentage of students engaged with print. None of these impacts was statistically significant.

Sources: RFIS SAT 10 administration in the spring of 2005 and 2006, as well as from state/district education agencies in those sites that already use the SAT 10 for their standardized testing (i.e., FL, KS, MD, OR); RFIS Instructional Practice in Reading Inventory, spring 2005, fall 2005, and spring 2006; and RFIS Student Time-on-Task and Engagement with Print, fall 2005 and spring 2006.

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