Arkansas Department of Education Data Analysis of K-2 Literacy Initiative: Final Report

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Executive Summary

As part of the state-wide Reading Initiative for Student Excellence (RISE), the Arkansas Department of Education (DOE) provided professional development in literacy to kindergarten through second grade (K-2) educators. The initiative strived to increase educator knowledge of reading and reading instruction. The intended goal was to improve reading instruction to increase student reading outcomes across the state.

The current document reports (a) educators' knowledge of reading before they participated in the professional development opportunity of RISE training, (b) evidence for a positive association between classroom teacher's knowledge of reading and their student's reading performance at the end of the school year, and (c) growth in educators' knowledge of reading following RISE training. Overall, there were three major findings.

1) Educator academic knowledge of the English language was assessed before RISE training. Educators with different roles in the schools exhibited differences in their knowledge performance. Reading interventionists had the highest levels of knowledge before the RISE training.

2) Classroom teachers' knowledge measured in the summer immediately before starting RISE training was positively associated with their students' reading outcomes at the end of the school year. Classroom teachers who knew more about the English language had students who performed better on foundational literacy skills at the end of the school year.

3) Participation in RISE training was associated with growth in educator's scores on the test of their academic knowledge of the English language. Educators correctly answered more of the questions on the knowledge test after completing the RISE training than they did before starting the training.

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The current document reports (a) educators' knowledge of reading before they participated in the professional development opportunity of RISE training, (b) evidence for a positive association between classroom teacher's knowledge of reading and their student's reading performance at the end of the school year, and (c) growth in educators' knowledge of reading following RISE training.

Summary of the Data Sources

This whitepaper reports on data obtained from educators who participated in RISE and the reading outcomes of their students. All data were deidentified by personnel in the Arkansas DOE before sharing it with the authors of this report as per a data-sharing agreement and institutional review board protocol. Data was structured so that teacher information could be linked to individual students, and both teacher and student information could be linked to individual schools.

Educators

Data from educators in the state of Arkansas was acquired through an online learning management system. Before starting in the RISE training, each educator completed Form A of the 50-item knowledge test (described below) and background items about their educational history and current role in schools. Most of the educators completed this baseline measure before or shortly following the beginning of the 2018-2019 academic year. Upon completion of RISE training, some educators completed Form B of the 50-item knowledge test as a post-test using the same online learning management system. The data in this report come from cohorts of educators who began RISE training in 2018. A total of 2,335 educators started this knowledge test before they participated in RISE training. Analyses in this report use samples of educators for whom complete data were available to address each point (i.e., full baseline data, full baseline data and labeled as a classroom teacher who linked to students, or full baseline and post-RISE training data).

Educator Knowledge

Educator knowledge was assessed using a test developed by McMahan and her colleagues (2019) based on prior surveys of teacher knowledge (e.g., Binks-Cantrell, Joshi, et al., 2012; Bos et al., 2001; Moats, 1994). The knowledge test from McMahan et al. (2019) contains 50-items to measure five domains of basic knowledge of the English language: phonological sensitivity, phonemic awareness, decoding, encoding, and morphology. *Phonological sensitivity* is the awareness of parts of words larger than a phoneme, such as rhyme and syllable. *Phonemic awareness* is the knowledge of and ability to manipulate the smallest unit of sounds in speech. *Decoding* is the ability to match letters with sounds. *Encoding* is the ability to link sounds to letters in writing or spelling. *Morphology* refers to the study of the smallest units of meaning in language. Within each domain of knowledge, there were 10

multiple-choice questions that all focused on explicit academic content knowledge. Some questions required the educators to define terms, such as phonological awareness, or identify instructional activities, such as phoneme deletion and phoneme manipulation. Other test items required the educators to demonstrate their ability to perform a task, such as to count the number of phonemes in a word or identify where a word would be divided into syllables. There are two equivalent versions of this test, Form A and Form B. The initial validation study revealed no significant effects related to whether a participant received Form A or Form B (McMahan et al., 2019). The reported Cronbach's alpha for the 50-item test was .86 for Form A and .87 for Form B, respectively (McMahan et al., 2019). Total scores are reported as the proportion of items answered correctly. In some instances, the proportion of items correctly answered within each of the five domains are also reported.

Student Reading Outcomes

Student data was acquired as part of universal screening procedures within the state to assess student's reading and literacy skills. The specific instrument used varied across schools. The data in this report come from students during the 2018-2019 school year. Student data were included in analyses when a given student could be linked to a teacher who completed the baseline knowledge test before that teacher started RISE training.

Educator Knowledge before RISE training

Major finding: *Educators varied in their academic knowledge of the English language. However, reading interventionists had greater knowledge than classroom teachers and special educators before they began the RISE training*.

Knowledge of the English Language at Baseline Before RISE training

Table 1 reports performance on the knowledge test as a whole and across each domain. Scores are provided for the analytic sample for whom complete pre-RISE training (i.e., baseline) data are available. The Cronbach's alpha was .75 for this analytic sample. Overall, these educators have some explicit academic knowledge of the English language before they started RISE training. However, there is also evidence that there is room for them to grow in their knowledge of the included domains. In Table 1, these educators are also grouped based on their reported role in their schools. The grouping of educators by role allows for an exploration of whether individuals who held different roles came into the RISE training with different amounts of knowledge of these reading-related constructs. The educators who identified themselves as reading interventionists tend to exhibit higher performance on the knowledge test than the other groups of educators. Appendix A provides the demographic characteristics of these educators and further exploration of potential differences across these groups of educators in their explicit knowledge of the English language before RISE training.

Table 1. *Scores on the Knowledge Test at Baseline Before RISE Training*

Proportion Correct	Educator Groups			
	Analytic Sample (*N* = 1574)	Classroom Teachers (*n* = 1369)	Reading Interventionists (*n* = 74)	Special Educators (*n* = 131)
	M (*SE*)	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Total	.57 (0.00)	.57 (0.00)	.68 (0.02)	.54 (0.01)
Phonological Sensitivity	.72 (0.00)	.73 (0.00)	.79 (0.02)	.68 (0.01)
Phonemic Awareness	.66 (0.00)	.66 (0.01)	.77 (0.02)	.65 (0.02
Decoding	.64 (0.00)	.64 (0.01)	.74 (0.02)	.59 (0.01)
Encoding	.48 (0.00)	.48 (0.00)	.60 (0.02)	.47 (0.01)
Morphology	.35 (0.01)	.34 (0.01)	.49 (0.03)	.33 (0.02)

Educator Knowledge Before RISE Training Predicts Student Outcomes

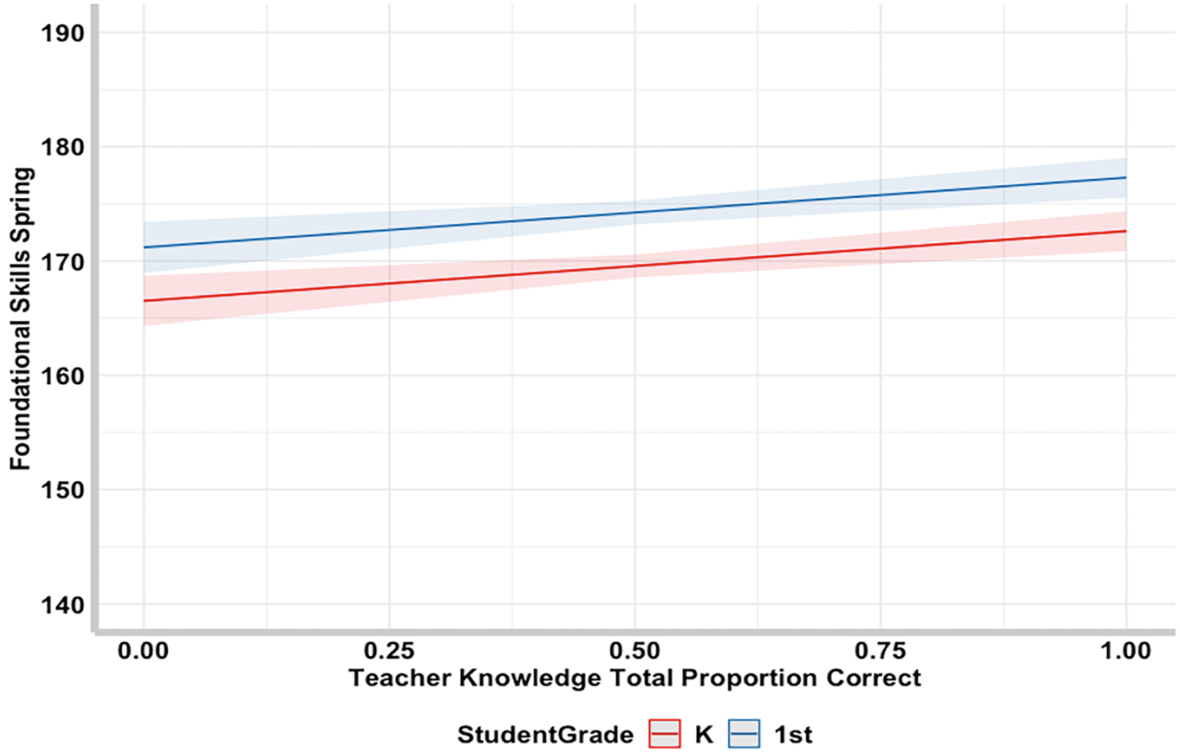
Major Finding: *Educator's knowledge before RISE training was associated with their student's reading scores at the end of the school year. Students of teachers with higher knowledge scores were likely to have relatively higher spring reading scores than their peers whose teachers exhibited lower performance on the knowledge test.*

Educator Knowledge Links to Student Outcomes

To examine the association between educator's knowledge before RISE training and student outcomes, individual educator's data was linked to student scores obtained through the state's universal screening procedures. This section of this document restricts the focus to classroom teachers, and those teachers for whom both fall and spring (i.e., beginning and end of the school year) reading scores were available for their students. Schools across the state varied in which of three instruments they chose to use for universal screening. The largest proportion of the present cohort of teachers came from schools that used the Northwest Evaluation Association Measures of Academic Progress for Primary Grades (NWEA MPG; Thum & Hauser, 2015). This instrument provides scores for different subtests and the domains of reading and literacy covered by the subtests vary based on the student's grade level. Kindergarten and first grade students have a score for a foundational skills subtest that covers many of the same domains that are covered by the knowledge test their teachers completed. As described in more detail in Appendix B, a multilevel regression model was used to predict student's spring foundational skill scores based on their teacher's academic knowledge of the English language before the teachers started RISE training. The statistical model incorporated sociodemographic characteristics of the individual students, their fall foundational skill scores, and background education characteristics of the teachers. The model also accounted for the nesting of students in teachers and schools. These additional factors were included in the model to control for their influence on the student's outcome. Data were available for 512 classroom teachers who came from 112 schools. These teachers were linked to 8,743 students who comprised the analytic sample.

As illustrated in Figure 1, teacher's knowledge before RISE training was positively associated with their student's foundational skills scores in spring, at the end of the school year. This effect was significant even with the factors representing characteristics of the students and teachers in the model. The spring foundational skills scores are shown on the y-axis in Figure 1. According to the national norms for this test, the cut-off for the 25th percentile is 149 for kindergarten and 168 for first grade, whereas a score at the 50th percentile would need to be 158 for kindergarten and 178 for first grade (Thum & Hauser, 2015). Appendix B provides a table illustrating that regardless of a student's sociodemographic characteristics, students whose teachers had higher performance on the knowledge test are predicted to have higher foundational skills scores in the spring at the end of the school year.

Figure 1. *Student Spring Scores Based on Educator Knowledge Before RISE Training*



Note. K = kindergarten; 1st = first grade. The predicted values in this graph control for the teacher's degree, and years of teaching experience as well as the student's ethnicity, free or reduced lunch status, gender, and fall scores. This figure presents scores for students who are Caucasian females, not receiving free or reduced lunch whose fall scores are at the mean for this sample, and whose teacher has a bachelor's degree. In other words, a child who is in the reference category or at the sample mean for all predictors in the statistical model. Across both grade levels, students whose teachers exhibited greater knowledge are expected to have higher performance on the universal screening measure.

Change in Educator Knowledge Following RISE Training

Major Finding: *Educators exhibited growth in their academic knowledge of the English language following RISE training.*

Table 2 provides the pre- and post-RISE training knowledge scores for all educators who completed all knowledge test items at both timepoints (N = 881). For this analytic sample, the Cronbach's alpha for the pre- and post-RISE training knowledge tests were .76 and .78, respectively. The post-RISE training knowledge scores were significantly greater than the pre-RISE training score, $t(880) = 27.07$, $p < .001$. A growth score was calculated by subtracting the pre-RISE score from the post-RISE score.

On average, these educators had a growth score of .11 (SD = 0.12, range = -.24 - .50), which is significantly different from 0 or no growth, $t(880) = 27.07$, $p < .001$. For 84% (n = 740) of this sample, their knowledge score either stayed the same or increased with two people exhibiting a score increase of .50. In contrast, only 3.3% (n = 29) of this sample had a score that decreased by .10 or more. Table 2 also shows that on average for each of the five domains on the knowledge test, scores were higher post-RISE training than they were before the educators began RISE training.

Appendix C provides the demographic characteristics of these educators and a further reporting of potential differences in knowledge growth observed for educators who held different roles in their respective schools.

Table 2.

Proportion Correct on the Knowledge Test before (pre-test) and after (post-test) RISE training

Proportion Correct	Pre-test			Post-test		
	M	*SD*	Range	*M*	*SD*	Range
Total	.58	0.12	.18 - .94	.69	0.12	.3 - .94
Phonological Sensitivity	.73	0.16	0 - 1	.83	0.13	.3 - 1
Phonemic Awareness	.67	0.18	0 - 1	.82	0.15	.3 - 1
Decoding	.64	0.17	0 - 1	.69	0.17	0 - 1
Encoding	.49	0.15	0 - .9	.60	0.15	0 - 1
Morphology	.35	0.18	0 - .9	.50	0.22	0 - 1

Appendix A

Additional Information About Educator Knowledge Before RISE Training

Analytic Sample Participants

Complete baseline data (i.e., responses to all knowledge test items and background demographic questions) acquired before RISE training was available for 1,574 licensed educators who comprised the analytic sample for this initial portion of the report. Each educator indicated their role in their school. Table A1 provides the demographic and educational background characteristics for this full analytic sample (N = 1,574), as well as three groups of educators based on their roles in schools. The educators reported when they received their initial teaching certification, and the years since that date were calculated and used as a proxy for years of teaching experience. The educators on average had 14.16 years of teaching experience (SE = 0.27, range = 0 - 56). The reading interventionists had been teaching longer (M = 21.19, SE = 0.29) than the other educators, $F(2, 1573) = 18.21$, $p < .001$, $\eta_p^2 = .02$. However, the classroom teachers (M = 13.68, SE = 0.29) and special educators (M = 15.19, SE = 0.92) did not differ in how long they reported teaching, with a Bonferroni corrected comparison of $p = .36$.

Table A1.

Participant Demographic Characteristics

Variables	Educator Groups			
	Analytic Sample (N = 1574)	Classroom Teachers (n = 1369)	Reading Interventionists (n = 74)	Special Educators (n = 131)
	%	%	%	%
Gender (Female)	95.20[a]	94.70[b]	100	96.90[c]
Race and Ethnicity				
African American	5.21	5.00	5.40	6.90
American Indian /Alaska Native	0.57	0.50	0.00	1.50
Asian	0.13	0.10	0.00	0.00
Caucasian	87.74	87.70	90.50	86.30
Hispanic	0.95	1.00	0.00	0.80
Multiple races/ethnicities	1.27	1.10	2.70	2.29
Not reported	4.13	4.50	1.40	2.30
Master's Degree	42.90	39.60	63.50	66.40
Reading Endorsement	9.80	8.80	36.50	6.10
Special Education Endorsement	12.10	4.20	2.70	100

Note. [a]n = 63 not reported, [b]n = 62 not reported, [c]n = 1 not reported.

Additional Analyses Predicting Performance

The main text above provides descriptive data about these educators' performance on the knowledge test before RISE training. Another way to look at their knowledge performance is to ask if characteristics of the educator can be used to predict their scores.

Data Analysis Plan

A multiple regression analysis was conducted to address whether educators with different roles exhibited differences in their performance on the knowledge test after controlling for other demographic characteristics. This analysis used the lm command in R (R Core Team, 2020) with effect sizes for the contrast estimates calculated from the emmeans package (Lenth, 2020). The outcome variable is the total proportion of correct responses on the knowledge test. The predictors were a categorical variable for the educator's role (i.e., a classroom teacher, a reading interventionist, or a special educator), and separate dichotomous variables for whether the educator had a master's degree, or reading endorsement, or not. For these predictors, the reference category was the largest group of people (i.e., classroom teacher, bachelor's only, no reading endorsement). The final predictor in the model was the continuous variable of the number of years since the educator obtained their initial teaching certification, which serves as a proxy for years of teaching experience. Effect size estimates for contrasts between groups of educators accounted for other predictors by averaging results across continuous scores (years since certification) or levels for categorical predictors (master's degree and reading endorsement).

Results

The regression model was significant (see Table A2). Although the predictors used to characterize the educator's background (i.e., possession of a master's degree and/or reading endorsement, and years since certification) were not significant, the impact of the educator's role did significantly predict their knowledge test score. The estimates from the unstandardized coefficients in Table A2 indicate that when other variables are held constant, a reading interventionist's score on the knowledge test would be higher than that of a classroom teacher by 0.11 units. Further, Cohen's *d* values were calculated for pairwise contrasts of the predicted values from the model for the groups of educators. After accounting for other predictors in the model, there were large effects indicating interventionists had higher scores than both teachers (*d* = 0.95, *SE* = 0.12) and special educators (*d* = 1.19, *SE* = 0.15). In contrast, there was a small effect such that classroom teachers' scores were higher than special educators' scores (*d* = 0.23, *SE* = 0.09).

Table A2.

Summary of Regression Analyses Predicting Performance on the Knowledge Test Before RISE Training

Variable	*B*	*SE*	*t*	*p*	95% CI
(Intercept)	0.56	0.01	108.09	< .001	[0.55, 0.57]
Reading Interventionist	0.11	0.01	7.75	< .001	[0.08, 0.13]
Special Educator	-0.03	0.01	-2.53	.012	[-0.05, -0.01]
Master's	0.01	0.01	1.53	.127	[-0.00, 0.02]
Reading Endorsement	0.01	0.01	0.52	.600	[-0.01, 0.03]
Years since certification	0.00	0.00	0.74	.460	[-0.00, 0.00]
R^2	.05				
Adjusted R^2	.05				
F (5, 1568)	16.40			< .001	

Appendix B

Additional Information About Predicting Student Reading Outcomes from Educator's Knowledge Performance Before RISE Training

Analytic Sample Participants

As described in the main text above, within this state, at the time this data was collected, schools could choose from one of three instruments to assess students' reading skills for universal screening purposes. Each instrument varies in the structure of subtests and score ranges for these measures of reading skill. This report contains data from a cohort of teachers who went through RISE training and came from schools throughout the state. Once the teacher data was linked to individual students, the size of the student-teacher linked sample varied based on which test the students completed. The largest number of teachers and students came from schools that used the Northwest Evaluation Association Measures of Academic Progress for Primary Grades (NWEA MPG; Thum & Hauser, 2015), a computer adaptive testing system for universal screening and continuous progress monitoring of reading in students from K to Grade 2.

The pool of potential items on the NWEA MPG Reading K-2 that may be seen by any given student was designed such that the majority of items (approximately 90%) aligned to Common Core State Standards (CCSS) and the rest aligned to specific state content standards (Thum & Hauser, 2015). All items are accompanied by an audio presentation and primarily use a multiple-choice format. Each student responds to 6-10 items within an instructional area (NWEA, 2011). Scores were reported for different instructional areas as equal interval Rasch Unit (RIT) scores ranging from about 130 to 210 based on the norming study conducted by the test developers (Thum & Hauser, 2015). A student's RIT score indicates the student is likely to get about half of the questions correct at that difficulty level. The foundational skills score refers to the student's ability to understand the organization and basic features of print, exhibit phonological and phonemic awareness skills to isolate, blend, and manipulate individual sounds, and apply grade-level phonics and word analysis skills in decoding words. This subtest score was available for students in kindergarten and first grade. It was further examined in our models because it measures a student's ability to engage in the same types of skills that are explored within the items on the knowledge test that their teachers completed before their RISE training.

Table B1 provides the demographic and educational background characteristics for all educators who completed the pre-RISE training knowledge test and could be linked to a student in kindergarten or first grade who had reading benchmark scores from the NWEA MPG universal screener for both fall and spring of the school year after their teacher took the knowledge test. Five hundred and twelve teachers met these criteria to be in the analytic sample of this section of the report. These teachers had been certified educators for an average of 13.53 years (*SD* = 10.50, range = 0 – 56). On average, they had a proportion correct on the pre-RISE training knowledge test of .58 (*SD* = 0.11, range = .18 - .86). These teachers came from 112 schools and each teacher could be linked to at least 9 students.

Table B2 presents the demographic characteristics for the students who had both fall and spring scores available and were in one of the four largest groups based on their ethnicity and English learning status. The majority of English language learners (ELL) in this state are Hispanic, thus ethnicity and ELL status were crossed to form groups of children within each ethnicity who were and were not ELL. There were small numbers of children who represented

either multi-ethnicities or ethnicities other than African American, Hispanic, and Caucasian, and very small numbers of African American or Caucasian students who were identified as ELL. Thus, the analytic sample of students includes African American not-ELL, Caucasian not-ELL, and Hispanic not-ELL students as well as Hispanic + ELL students (N = 8,743). These students' fall foundational skills scores ranged from 100 – 194 for the kindergarten students (M = 138.60, SD = 12.28) and from 108 – 237 for the first grade students (M = 163.23, SD = 16.35), which would put the sample mean at the 42nd and 58th percentiles, respectively for each grade based on the national norms (Thum & Hauser, 2015). In contrast, their spring scores ranged from 101 – 226 (M = 158.40, SD = 14.68) for kindergarten students, and from 110 – 227 for first grade students (M = 180.13, SD = 18.89), which puts the sample mean at the 50th and 58th percentiles, respectively.

Table B1.

Demographic Characteristics of Teachers in Analytic Sample Linked to Students

Variables	*n*	%
Gender (Female)	480[a]	93.8[a]
Race and Ethnicity		
African American	30	5.9
Caucasian	439	85.7
Hispanic	5	1.0
Other groups	38	7.4
Advanced Degree	234	45.7
Reading Endorsement	55	10.7
Special Education Endorsement	20	3.9

Note. N = 512 teachers (first grade teachers *n* = 261; kindergarten teachers *n* = 251).
[a]*n* = 27 did not complete this item.

Table B2.

Student Demographic Characteristics in the Analytic Sample Linking Students and Teachers

	First grade (*n* = 4,828)		Kindergarten (*n* = 3,915)	
Student Characteristics	*n*	%	*n*	%
Free Reduced Lunch Yes	2,803	58.1	2,145	54.8
Caucasian	2,986	61.8	2,552	65.2
African American	947	19.6	844	21.6
Hispanic	208	4.3	144	3.7
Hispanic + ELL	687	14.2	375	9.6
Male	2,442	50.6	2,000	51.1

Note. N = 8,743 students. Free Reduced Lunch Yes is used as a proxy indicating a relatively lower socioeconomic status for a given student.

Analyses Investigating the Relationship Between Educator Knowledge and Student Reading Outcomes

The main text summarizes findings from an investigation of the relationship between educator's knowledge and their student's reading outcomes at the end of the school year. These analyses are described further here. They address the extent to which educator's knowledge before RISE training was associated with their student's spring reading scores from the universal screening measure.

Data Analysis Plan

A multilevel linear regression analysis was conducted through the lme4 and ggeffects packages in R (Bates et al., 2015; Ludecke, 2018) with the student's spring foundational skills score from the NWEA MPG as the outcome variable. The intraclass correlation coefficient (ICC) revealed that the between-school differences accounted for 15% of the variance in student's scores, and between-teacher differences accounted for 26% of the variance. Next, a model was developed to examine the student-level and teacher-level predictors that impact the student's spring reading scores. There were random intercepts for the nesting of students in schools and with teachers. The student's sociodemographic characteristics were entered as separate dichotomous or categorical fixed effects. The model syntax allowed categorical variables to be represented as a single item, although the model calculations, degrees of freedom, and output present them as the number of categories present minus 1, reflecting each category's comparison to the reference group, coded as 0. Free reduced lunch was coded 1 for yes, and 0 for no. Sex was coded 1 for male and 0 for female. The Caucasian not-ELL group was used as the reference category because it was the largest. This group was directly compared to the African American not-ELL, Hispanic not-ELL, and Hispanic + ELL groups. Additionally, the grade level was coded as 1 for first grade and 0 for kindergarten students. Finally, the student's fall score was also included as a continuous fixed effect. Next, there were three teacher-level fixed effects. There was a dichotomous variable for teacher's degree that was coded 0 for bachelor's degrees and 1 for advanced degrees (i.e., master's degrees). The number of years since the teacher was certified in this state was also entered as a continuous fixed effect. Finally, the primary fixed effect of interest was the teacher's performance on the knowledge test before RISE training, which was represented as a continuous variable of the total proportion of correct responses provided by each teacher.

Results

Table B3 reports the parameter estimates and model R^2 values. The predictors representing student characteristics were significant. This finding indicates that differences are observed in the spring reading scores of students who have different sociodemographic characteristics (e.g., African American as compared to Caucasian students, students who are as compared to students who are not economically disadvantaged, and males relative to females, as well as compounding effects when the multiple characteristics (i.e., ethnicity, socioeconomic status, and sex) a given student has are combined), and students in kindergarten as compared to first grade. Further, as anticipated, the score that the student obtained in the fall of the school year predicted the score that the student earned in the spring. Students whose fall scores were relatively higher were predicted to have higher spring scores as well. In contrast, knowing whether the teacher had a graduate-level degree or how long the teacher had been teaching did not add to the ability to predict the students' spring scores. Importantly, the student's teacher's academic knowledge of the English language also predicted the student's spring score. In the main text, Figure 1 illustrates the relationship between

teacher's knowledge scores obtained before RISE training and their student's spring foundational skills scores. Further, Table B4 illustrates that this relationship is present across students who have different sociodemographic characteristics and that there is some variability in the predicted values that may be observed for students who possess these different qualities.

Table B3.

Model Parameters Predicting Student Spring Reading Scores

Effect	Parameter	*Estimate*	*SE*	95% CI
	Fixed effects			
Intercept	γ_{000}	63.64*	1.76	60.19 – 67.09
Student Characteristics				
Free Reduced Lunch Yes	γ_{100}	-3.26*	0.32	-3.90 – -2.63
African American	γ_{200}	-3.13*	0.43	-3.97 – -2.28
Hispanic	γ_{300}	-0.97	0.67	-2.29 – 0.35
Hispanic + ELL	γ_{400}	-2.86*	0.47	-3.78 – -1.94
Male	γ_{500}	-0.89*	0.26	-1.40 – -0.39
Fall Score	γ_{600}	0.68*	0.01	0.66 – 0.70
1st Grade	γ_{700}	4.68*	0.44	3.81 – 5.55
Teacher Characteristics				
Years Certified	γ_{010}	0.03	0.02	-0.00 – 0.06
Advanced Degree	γ_{020}	0.26	0.37	-0.45 – 0.98
Knowledge	γ_{030}	6.11*	1.74	2.70 – 9.52
	Random effects			
Variance Components		Estimate	ICC	
Level 1 (student)	σ^2	140.77	91%	
Level 2 (teacher)	$\tau_{\pi 000}$	5.59	4%	
Level 3 (school)	$\tau_{\beta 000}$	8.44	5%	
	Goodness of fit			
Deviance	68462.54			
$\Delta\chi^2$	5428.14			
Δdf	10			
	Model effect sizes			
Marginal R^2	.60			
Conditional R^2	.64			

Note. Free Reduced Lunch Yes = lower socioeconomic status; ICC = intraclass correlation coefficient. The intercept parameter estimate (γ_{000}) represents the average spring foundational skills RIT score across the full analytic sample (N = 8,743 students, N = 512 teachers, N = 112 schools). Parameters for student characteristics represent the difference in spring foundational skills RIT scores based on the following qualities: students who receive free reduced lunch relative to students who do not (γ_{100}), students who are African American relative to Caucasian (γ_{200}), students who are Hispanic relative to Caucasian (γ_{300}), Hispanic + ELL students relative to Caucasian students (γ_{400}), male relative to female students (γ_{500}), the impact of the student's fall foundational skills RIT score (γ_{600}), and first grade relative to kindergarten students (γ_{700}). Parameters for teacher characteristics represent the difference in a student's spring foundational skills RIT scores based on the number of years their teacher has been certified (γ_{010}), whether their teacher has a master's degree as opposed to a bachelor's degree (γ_{020}), and their teacher's knowledge score before RISE training (γ_{030}).
* $p < .001$

Table B4.

Mean Predicted Spring Foundational Skills Scores for Students by Grade level, Sociodemographic Groups, and Educator Knowledge Before RISE Training

Student Characteristics	Teacher Knowledge Total Proportion Correct		
	0	.50	1
Kindergarten No Free Reduced Lunch			
Caucasian Female	166.51	169.56	172.62
Caucasian Male	165.61	168.67	171.72
African American Female	163.38	166.44	169.49
African American Male	162.49	165.54	168.60
Hispanic Female	165.54	168.59	171.65
Hispanic Male	164.64	167.70	170.75
Hispanic + ELL Female	163.65	166.70	169.76
Hispanic + ELL Male	162.75	165.81	168.86
Kindergarten Yes Free Reduced Lunch			
Caucasian Female	163.24	166.30	169.35
Caucasian Male	162.35	165.40	168.46
African American Female	160.12	163.17	166.23
African American Male	159.22	162.28	165.33
Hispanic Female	162.27	165.33	168.38
Hispanic Male	161.38	164.43	167.49
Hispanic + ELL Female	160.38	163.44	166.49
Hispanic + ELL Male	159.49	162.54	165.60
First Grade No Free Reduced Lunch			
Caucasian Female	171.19	174.24	177.30
Caucasian Male	170.30	173.35	176.41
African American Female	168.06	171.12	174.17
African American Male	167.17	170.22	173.28
Hispanic Female	170.22	173.27	176.33
Hispanic Male	169.32	172.38	175.44
Hispanic + ELL Female	168.33	171.38	174.44
Hispanic + ELL Male	167.43	170.49	173.54
First Grade Yes Free Reduced Lunch			
Caucasian Female	167.92	170.98	174.04
Caucasian Male	167.03	170.09	173.14
African American Female	164.8	167.85	170.91
African American Male	163.90	166.96	170.02
Hispanic Female	166.95	170.01	173.06
Hispanic Male	166.06	169.12	172.17
Hispanic + ELL Female	165.06	168.12	171.17
Hispanic + ELL Male	164.17	167.22	170.28

Note. No Free Reduced Lunch = the student does not receive free or reduced lunch which represents relatively higher socioeconomic status; Yes Free Reduced Lunch = students with a relatively lower socioeconomic status; ELL = English language learner. Values are presented based on teacher's exhibiting a total proportion correct on the pre-RISE training knowledge test of 0, .50, and 1. The mean total proportion correct on the pre-RISE training knowledge test for this analytic sample of teachers was .58 (*SD* = 0.11, range = .18 - .86).

Appendix C

Additional Information About Changes in Educator Knowledge Following RISE Training

Analytic Sample Participants

Table C1 provides the demographic and educational background characteristics for all educators who completed both the pre- and post-RISE training knowledge tests, the full analytic sample for this section of the report (*N* = 881). The overwhelming majority of these individuals identified themselves as classroom teachers (*n* = 695). Other educators in this group identified themselves as reading interventionists (*n* = 38), special educators (*n* = 49), instructional coaches (*n* = 27), or administrators (*n* = 41), or provided an additional role that comprised a mixed group of other educators (*n* = 31). Table C1 provides demographic characteristics for the three largest groups of educators based on their reported role in their school. Table C2 illustrates their knowledge performance across the pre- and post-RISE training tests.

Table C1.

Participant Demographic Characteristics for Individuals with Pre- and Post-RISE Training Data

Variables	Educator Groups			
	Analytic Sample (*N* = 881)	Classroom Teachers (*n* = 695)	Reading Interventionists (*n* = 38)	Special Educators (*n* = 49)
	%	%	%	%
Gender (Female)	94.1[a]	94.7[b]	100.0	98.0
Race and Ethnicity				
African American	3.9	3.7	2.6	2.0
Caucasian	89.1	89.1	94.7	98.0
Hispanic	9.0	1.0	0.0	0.0
Other groups	6.0	6.2	2.6	0.0
Advanced Degree	44.3	37.1	57.9	59.2
Reading Endorsement	10.4	7.6	39.5	8.2
Special Education Endorsement	8.9	3.3	7.9	89.8

Note. Advanced degree refers to possession of a master's, education specialist, or doctoral degree. [a]*n* = 29 not reported, [b]*n* = 28 not reported.

Table C2.

Proportion Correct on the Knowledge Test Before (pre-test) and After (post-test) RISE Training, and Growth Scores by Educator Role

	Pre-test			Post-test			Growth		
	M	*SD*	Range	*M*	*SD*	Range	*M*	*SD*	Range
Analytic Sample									
Total	.58	0.12	.18 - .94	.69	0.12	.30 - .94	.11	0.12	-.24 - .50
Phonological Sensitivity	.73	0.16	0 - 1	.83	0.13	.30 - 1	.10	0.16	-.50 - .80
Phonemic Awareness	.67	0.18	0 - 1	.82	0.15	.30 - 1	.15	0.18	-.40 - 1
Decoding	.64	0.17	0 - 1	.69	0.17	0 - 1	.04	0.21	-.60 - .70
Encoding	.49	0.15	0 - .90	.60	0.15	0 - 1	.11	0.19	-.50 - .70
Morphology	.35	0.18	0 - .90	.50	0.22	0 - 1	.14	0.26	-.50 - .90
Classroom Teachers									
Total	.57	0.11	.18 - .90	.69	0.11	.32 - .94	.11	0.12	-.24 - .50
Phonological Sensitivity	.73	0.16	0 - 1	.83	0.13	.30 - 1	.10	0.17	-.50 - .80
Phonemic Awareness	.66	0.17	0 - 1	.82	0.15	.30 - 1	.15	0.18	-.40 - 1
Decoding	.64	0.17	0 - 1	.69	0.17	.1 - 1	.05	0.21	-.60 - .70
Encoding	.48	0.15	0 - .90	.60	0.16	0 - 1	.12	0.19	-.50 - .70
Morphology	.34	0.18	0 - .90	.50	0.22	0 - 1	.15	0.26	-.50 - .80
Reading Interventionists									
Total	.68	0.12	.38 - .94	.74	0.11	.46 - .94	.06	0.10	-.20 - .30
Phonological Sensitivity	.81	0.15	.30 - 1	.88	0.10	.60 - 1	.08	0.14	-.30 - .40
Phonemic Awareness	.77	0.16	.30 - 1	.87	0.13	.50 - 1	.09	0.15	-.10 - .50
Decoding	.74	0.17	.40 - 1	.76	0.15	.30 - 1	.02	0.17	-.40 - .30
Encoding	.63	0.15	.20 - .90	.67	0.15	.40 - 1	.04	0.15	-.20 - .40
Morphology	.46	0.21	.10 - .90	.54	0.21	.10 - .90	.08	0.22	-.30 - .50
Special Educators									
Total	.55	0.11	.36 - .80	.64	0.11	.44 - .94	.09	0.11	-.16 - .38
Phonological Sensitivity	.68	0.15	.30 – 1	.79	0.15	.50 - 1	.11	0.15	-.30 - .40
Phonemic Awareness	.68	0.18	.20 – 1	.78	0.16	.40 - 1	.11	0.18	-.20 - .70
Decoding	.59	0.17	.30 - .90	.63	0.16	.30 - .90	.04	0.21	-.40 - .50
Encoding	.46	0.18	.10 - .80	.61	0.14	.20 - 1	.14	0.19	-.40 - .60
Morphology	.33	0.16	.10 - .80	.38	0.22	0 - .90	.05	0.23	-.50 - .60

Note. Growth scores were calculated as post-test proportion correct minus pre-test proportion correct.

Additional Analyses Predicting Knowledge After RISE Training

The main text describes the growth observed in the educator's knowledge following participation in RISE training. The following section examines what characteristics of the educator can be used to predict their post-RISE training knowledge score.

Data Analysis Plan

A multiple regression analysis was conducted to examine factors that impact the educator's post-RISE training knowledge test performance. This analysis used the lm and emmeans commands in R (Lenth, 2020; R Core Team, 2020). The outcome variable is the total proportion of correct responses on the post-RISE training knowledge test. The predictors were a categorical variable for the educator's role, and separate dichotomous variables for whether the educator had a master's degree, or reading endorsement, or not. For these predictors, the reference category was the largest group of people (i.e., classroom teacher, bachelor's only, no reading endorsement). There were two other continuous variables entered as predictors, the number of years since the educator obtained their initial teaching certification, and their total proportion of correct responses on the pre-RISE training knowledge test. Effect size estimates for contrasts between groups of educators accounted for other predictors by averaging results across continuous scores or levels for categorical predictors.

Results

The regression model was significant (see Table C3). Although the predictors used to characterize the educator's background (i.e., possession of an advanced degree and years since certification) were not significant, their pre-RISE training knowledge score, having a reading endorsement, and their role significantly predicted their post-RISE training knowledge test score. In general, individuals who had relatively higher scores on the pre-RISE training knowledge test also had relatively higher scores on the post-RISE training knowledge test. Further, Cohen's *d* values using predictions from this model for the post-RISE training scores after controlling for the other variables in the model suggest there was a small effect such that classroom teachers and interventionists had higher post-RISE training scores than special educators (*d* = .34, *SE* = .15; *d* = .38, *SE* = .23), but do not differ from each other (*d* = .03, *SE* = .18). This pattern corresponds to some of the differences seen across educators in those same roles in terms of their academic knowledge of the English language before RISE training (see Appendix A). In general, all educators, regardless of role, exhibited growth in the knowledge of the domains of the English language examined following RISE training.

Table C3.

Summary of Regression Analyses Predicting Post-RISE Training Performance on the Knowledge Test

Variable	*B*	*SE*	*t*	*p*	95% CI
(Intercept)	0.44	0.02	22.39	< .001	0.40 – 0.48
Reading Interventionist	0.00	0.02	0.20	.85	-0.03 – 0.04
Special Educator	-0.03	0.02	-2.24	.03	-0.06 – -0.00
Advanced Degree	0.00	0.01	0.24	.81	-0.01 – 0.02
Reading Endorsement	0.03	0.01	2.12	.03	0.00 – 0.06
Years since certification	0.00	0.00	-0.81	.42	-0.00 – 0.00
Pre-RISE knowledge proportion correct	0.43	0.03	12.95	<.001	0.36 – 0.49
R^2	.21				
Adjusted R^2	.21				
F (6, 727)	32.9				

References

Bates, D., Machler, M., Bolker, B. M., & Walker, S. C. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1), 1–48. https://doi.org/10.18637/jss.v067.i01

Binks-Cantrell, E., Joshi, R. M., & Washburn, E. K. (2012). Validation of an instrument for assessing teacher knowledge of basic language constructs of literacy. *Annals of Dyslexia*, *62*, 153–171. https://doi.org/doi.org/10.1007/s11881-012-0070-8

Bos, C., Mather, N., Dickson, S., Podhajski, B., & Chard, D. (2001). Perceptions and knowledge of preservice and inservice educators about early reading instruction. *Annals of Dyslexia*, *51*, 97–120. https://doi.org/10.1007/s11881-001-0007-0

Lenth, R. (2020). *emmeans: Estimated Marginal Means, aka Least-Squares Means* (1.5.1) [R package]. https://CRAN.R-project.org/package=emmeans

Ludecke, D. (2018). ggeffects: Tidy data frames of marginal effects from regression models. *The Journal of Open Source Software*, *3*(26), 772. https://doi.org/10.21105/joss.00772

McMahan, K. M., Oslund, E. L., & Odegard, T. N. (2019). Characterizing the knowledge of educators receiving training in systematic literacy instruction. *Annals of Dyslexia*, *69*(1), 21–33. https://doi.org/10.1007/s11881-018-00174-2

Moats, L. (1994). The missing foundation in teacher education: Knowledge of the structure of spoken and written language. *Annals of Dyslexia*, *44*, 81–102. https://doi.org/10.1007/BF02648156

NWEA. (2011). *Technical manual for measures of academic progress & measures of academic progress for primary grades*. Northwest Evaluation Association.

R Core Team. (2020). *R: A language and environment for statistical computing* (4.0.3) [Computer software]. R Foundation for Statistical Computing. https://www.R-project.org/

Thum, Y. M., & Hauser, C. H. (2015). *NWEA 2015 MAP Norms for student and school achievement status and growth* (NWEA Research Report). NWEA.