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Correlational Study on Use of the Beyond Textbooks Framework to Raise Student Achievement Scores

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Executive Summary

Beyond Textbooks, a comprehensive framework of curriculum development, instructional improvement, student assessment, and multi-level interventions designed to improve student achievement, reaches over 9,000 teachers and 137,000 students at all grade levels, mostly in the state of Arizona. This study examines the correlational relationship between schools' use of the framework and changes in students' reading and math achievement using two types of statistical modeling. The first type of analysis uses regression modeling to identify the change in schoolwide student proficiency between 2015–2018 that is correlated with using the Beyond Textbooks framework. The second type of analysis utilizes school characteristics to first create a simulated, matched comparison between identified Beyond Textbooks adopters and non-adopting comparison schools across the state of Arizona before running identical models including only these matched sites.

Taking results from both sets of models into account, there is a consistent, positive correlational relationship between schools' usage of the Beyond Textbooks framework and increased school-level proficiency at every grade in both of the subjects tested.

This means that schools that used the Beyond Textbooks framework saw estimated growth in reading and math proficiency levels at every grade level tested. The increase in percent of proficient students associated with use of the program ranges from 0.3% to 12.1% across all assessments and both models. Additionally, this positive correlational relationship is statistically significant for at least one subject-specific assessment at almost every grade level across our two types of analyses. The correlation is statistically significant in more than half the estimations and these positive relationships range from 4.7% to 12.1% increases in proficient students. In these cases, we can determine with statistical modeling that this growth is very likely to be related to use of the framework and not any other factors we could account for. In total, between the two types of models, we identify a positive and statistically significant advantage for schools using the Beyond Textbooks framework versus those who do not on ten of the seventeen assessments tested: fifth- through seventh-grade Mathematics, Algebra II, third- through fourth-grade English Language Arts, sixth- through seventh-grade English Language Arts, and ninth- through tenth-grade English Language Arts.

This correlational study was designed to align with guidelines for showcasing "Promising Evidence" as detailed within the Every Student Succeeds Act (ESSA) of 2015 and other similar guidelines for establishing evidence base (e.g. recommendations from Arizona's Move on When Reading guidance document). Following the available resources regarding these standards, we feel these findings meet the requirements for establishing promising evidence of the effectiveness of the Beyond Textbooks framework in positively impacting student achievement scores.

Program and Study Background

Developed over the past decade by educators in Arizona's Vail Unified School District, the Beyond Textbooks framework is a comprehensive program of curriculum development, instructional improvement, student assessment, and multi-level interventions designed to improve student achievement. The model is primarily used in Arizona schools and districts, however, sites outside the state have also begun implementing the program. Schools implementing the Beyond Textbooks model undergo a rigorous, guided adoption process that includes professional development and planning sessions to incorporate Beyond Textbooks' programmatic methods and curricular materials. Ultimately, educators receive training in using these methods and can access a web-based tool with digital curriculum materials and other resources. The program also offers continuous, annual professional development to participating sites. Beyond Textbooks reaches over 9,000 teachers and 137,000 students at all grade levels, mostly in the state of Arizona.

With such widespread usage, it is crucial to understand the effectiveness of the program in impacting student achievement on annual standardized testing outcomes. In 2014–2015, Arizona adopted a new system for conducting statewide achievement assessments called Arizona's Measurement of Educational Readiness to Inform Teaching (AzMERIT). The AzMERIT assessments align with the new standards for Mathematics and English Language Arts adopted by the Arizona State Board of Education in 2010. Now, Arizona public school students in Grades 3 through high school take AzMERIT assessments in Mathematics and English Language Arts annually. Students in Grades 3 through 8 are assessed in both subjects at their grade level. Students taking high school level English (Grade 9 English and Grade 10 English) and Mathematics (Algebra, Algebra II, Geometry) courses take an end-of-course assessment in these subjects. For each assessment, student performance is rated with an overall scaled score and cutoffs within these scaled scores are used to determine proficiency levels. As the assessments were new in 2014–2015, the window between this first year of usage and 2017–2018 provides a four-year view of recent student performance that is aligned with current curricula and standards.

WestEd was hired in 2018 to conduct a research study on the effectiveness of schools' use of the Beyond Textbooks framework. Specifically, the organization was tasked with testing the correlational relationship between use of the framework and changes in students' reading and math achievement. WestEd designed this correlational study to align with guidelines for showcasing "Promising Evidence" as detailed within the Every Student Succeeds Act (ESSA) of 2015. According to this current policy, an educational program or intervention can be determined as being "supported by promising evidence" when positive results are found within "at least one well-designed and well-implemented correlational study with statistical controls for selection bias." Studies demonstrating promising evidence must "show a statistically significant and positive (i.e., favorable) effect of the intervention on a student outcome or other relevant outcome" and "must not be overridden by statistically significant and negative (i.e., unfavorable) evidence on that intervention from findings in studies that meet What Works

Clearinghouse Evidence Standards with or without reservations or are the equivalent quality for making causal inferences."[1]

Along with meeting the guidelines explicitly laid out by ESSA, studies meeting these guidelines should also meet the guidelines put forth by state-level Departments of Education that use the same ESSA-tiered evidence standards as their benchmarks for establishing an evidence base. In one such example, the Arizona Department of Education's Move on When Reading (MOWR) program recommends "using 'evidence-based' activities, strategies, and interventions with students" and defines "evidence-based" as meeting ESSA guidelines as defined by the U.S. Department of Education.[2]

Analysis Methods

The purpose of this study is to investigate a single research question: *Is adoption of the Beyond Textbooks framework associated with increased, school-level student achievement gains in AzMERIT English Language Arts and Mathematics assessments between 2014–2015 and 2017–2018?* This study analyzes whether there is a correlational relationship between program adoption by schools and increased student performance on AzMERIT English Language Arts and Mathematics assessments. Across two types of correlational models, statistical controls and analytic methods are used to reduce bias within the analysis. Within the second type of correlational modeling, matching techniques are also used to create a simulated experiment comparing schools that have fully implemented the Beyond Textbooks framework with matched, non-implementing sites across the state of Arizona. Details on the data and methods used for this analysis are described below.

Data

Data for this analysis is compiled from three sources. Two sources were used to compile data on schoolwide student achievement and school characteristics. The Arizona Department of Education (ADE) maintains annual student assessment data that contains school-level student performance and student demographic characteristics. Files from 2014–2015 and 2017–2018 were used to construct school-level profiles containing student achievement for math and reading across this timespan, as well as school demographic characteristics from 2017–2018. However, due to privacy concerns, this publicly-available data is suppressed for counts of student subgroups below ten and some necessary data values are missing.

To ensure that as much data as possible could be utilized within the analysis, missing data for individual schools was replaced by counts from the publicly-available Common Core of Data available from the National Center for Education Statistics (NCES). The most recent school- and district-level demographic characteristics currently available are from the 2015–2016 school year. Missing data values were replaced with either NCES school-level values or NCES district-level values, in that order. Some missing

[1] ESSA Tiered Evidence Guidelines: https://ed.gov/policy/elsec/leg/essa/guidanceuseseinvestment.pdf

[2] Move on When Reading: https://cms.azed.gov/home/GetDocumentFile?id=597117673217e10740daa748

values could not be replaced due to data availability constraints; these values were filled using missing data techniques within the correlational analyses. A summary of demographic characteristics for all schools included in the study is displayed in Table 1 (Page 4). A summary of data values filled in from the three possible sources is displayed in Table 2 (Page 5). The vast majority of data is pulled from either 2017–2018 Arizona or 2015–2016 NCES school-level data; only one variable, percentage of Limited English Proficient students, has a sizable pull from district-level data, as that data is not available from NCES at the school-level. Every possible school characteristic within publicly-available data is included.

The final data source for this analysis was a list of Beyond Textbooks framework adopters identified by the program's coordinators. Schools were included as program adopters if they were identified as fully implementing the model between 2014–2015 and 2017–2018. Schools were categorized as comparison sites if they had no exposure to the Beyond Textbooks framework at any point during that timeframe. Finally, sites were excluded for the analyses if they had incomplete implementation or stopped using the framework during the years of studied data. In total, 81 school sites were categorized as program adopters, 1,380 sites were available as comparison sites, and 227 sites were excluded because of incomplete participation in the program during the four-year span.

TABLE 1

Data for Included Schools

School % of:	Number of schools with data	Mean	Minimum	Maximum
Female students	1,683	.49	.21	1.00
African American students	1,679	.05	.00	.56
American Indian / Alaskan Native students	1,687	.06	.00	1.00
Asian students	1,682	.02	.00	.78
Hawaiian Native / Pacific Islander students	1,686	.00	.00	.13
Hispanic/Latino students	1,687	.46	.00	1.00
White students	1,688	.37	.00	1.00
Multi-racial students	1,684	.03	.00	.13
Students with Disability	1,528	.13	.00	1.00
Economically Disadvantaged students	1,669	.48	.00	1.00

School % of:	Number of schools with data	Mean	Minimum	Maximum
Students eligible for free- or reduced-price lunch	1,589	.59	.00	1.00
Homeless students	908	.02	.00	.81
Limited English Proficient students	1,626	.08	.00	.63
Migrant students	1,627	.00	.00	.57
Total Student Enrollment	1,445	690.4	54	5,046
Charter School Affiliation	1,688	24%	-	-

TABLE 2

Available Data by Source

	2017–2018 School-Level Testing Data		2015–2016 School-Level Common Core of Data		2015–2016 District-Level Common Core of Data	
Variables	Count after added	Missing after added	Count after added	Missing after added	Count after added	Missing after added
Female students	1,683	0%	1,683	0%	1,683	0%
African American students	1,062	37%	1,676	1%	1,679	1%
American Indian / Alaskan Native students	699	59%	1,683	0%	1,687	0%
Asian students	823	51%	1,679	1%	1,682	0%
Hawaiian Native / Pacific Islander students	817	52%	1,684	0%	1,686	0%
Hispanic/Latino students	1,620	4%	1,686	0%	1,687	0%
White students	1,488	12%	1,686	0%	1,688	0%

	2017–2018 School-Level Testing Data		2015–2016 School-Level Common Core of Data		2015–2016 District-Level Common Core of Data	
Variables	Count after added	Missing after added	Count after added	Missing after added	Count after added	Missing after added
Multi-racial students	909	46%	1,680	0%	1,684	0%
Students with Disability	1,528	9%	1,528	9%	1,528	9%
Economically Disadvantaged students	1,669	1%	1,669	1%	1,669	1%
Students eligible for free- or reduced-price lunch	1,445	14%	1,589	6%	1,589	6%
Homeless students	908	46%	908	46%	908	46%
Limited English Proficient students	1,053	38%	1,053	38%	1,626	4%
Migrant students	1,627	4%	1,627	4%	1,627	4%
Total Student Enrollment	1,445	14%	1,687	0%	1,687	0%
Charter School Affiliation	1,688	0%	1,688	0%	1,688	0%

Methods

Two types of analyses that align with study guidelines for establishing ESSA "Promising Evidence" were conducted. Both types use regression models, a statistical technique used to identify the relationship or "the correlation" between two variables when accounting for many other variables. In this case, we are interested in understanding the relationship between schools' usage of the Beyond Textbooks framework and any changes in student test scores, and we also want to account for the fact that schools have different characteristics that might also drive changes in student variables. We will model our relationship, while also accounting for or "holding constant" the impact of these possibly influential school characteristics. This type of model estimates the average increase or decrease in student achievement for schools that use the framework, independent of the unique characteristics of each school that might also impact achievement scores.

The first type of analysis uses regression modeling to identify the change in schoolwide student proficiency between 2015–2018 that is correlated with program usage when school-level demographic characteristics (race, economic disadvantage, limited English proficiency, students with disability, homeless or migrant student populations), total student enrollment, and charter school affiliation are all held constant. Seventeen models were run in total, with separate estimations for Grades 3–10 English

Language Arts assessments, Grades 3–8 Mathematics assessments, and end-of-course Mathematics assessments in Algebra, Algebra II, and Geometry.

The second type of analysis utilizes school characteristics to create a simulated, matched comparison between identified Beyond Textbooks adopters and non-adopting comparison schools across the state of Arizona. This type of comparison is a more rigorous approach than our first type of analysis. We start by pairing schools that are similar to each other in every way except use of the program and then eliminate all other schools from the analysis. This gives us two groups, one that used the framework and one that did not, that are otherwise evenly-matched on all other characteristics. Table 3 (Page 7) demonstrates this balance of characteristics obtained by the matching technique, in which the characteristics of adopting and non-adopting schools are now nearly identical.

Performing this matching technique is useful because there could be many reasons why schools adopt the Beyond Textbooks framework, and the schools that adopt or do not adopt the program can be wildly different in terms of characteristics and the populations they serve. As demonstrated in Table 3 (Page 7), without any matching beforehand, the schools using the program versus the schools not using the program are serving different average student populations. These differences can lead to bias within statistical estimates, which are impacts that we attribute to the program of interest but are really caused by underlying differences in characteristics between these schools. After reducing the number of schools included in the analysis to only a smaller number of otherwise similar schools, these differences in characteristics are balanced and potential bias is eliminated. After matching, we use regression modeling again to compare whether student achievement levels are different in schools using the program versus those who do not. Once matching is complete, regression modeling is conducted within only matched schools and statistical controls are included once again for as many factors as possible.

TABLE 3

Balance in School-level Demographics after Matching

	Unmatched			Matched		
School % of Subgroup / Variable	Non-Program Adopters' Mean	Program Adopters' Mean	Significantly Different?	Non-Program Adopters' Mean	Program Adopters' Mean	Significantly Different?
Female students	.49	.50	No	.50	.50	No
African American students	.06	.02	Yes	.03	.02	No
American Indian / Alaskan Native students	.04	.16	Yes	.12	.16	No
Asian students	.02	.01	Yes	.01	.01	No

	Unmatched			Matched		
School % of Subgroup / Variable	Non-Program Adopters' Mean	Program Adopters' Mean	Significantly Different?	Non-Program Adopters' Mean	Program Adopters' Mean	Significantly Different?
Hawaiian Native / Pacific Islander students	.00	.00	No	.00	.00	No
Hispanic/Latino students	.48	.31	Yes	.30	.31	No
White students	.37	.46	Yes	.50	.46	No
Multi-racial students	.03	.03	No	.03	.03	No
Students with Disability	.13	.13	No	.12	.13	No
Economically Disadvantaged students	.49	.37	No	.42	.37	No
Students eligible for free- or reduced-price lunch	.57	.51	No	.53	.51	No
Homeless students	.01	.01	No	.01	.01	No
Limited English Proficient students	.09	.04	Yes	.04	.04	No
Migrant students	.00	.00	No	.00	.00	No
Total Student Enrollment	578	542	No	521	542	No

Grade 3 Mathematics Assessment schools displayed for example.

Results Summary

Results for the two types of analyses are presented in Table 4 (Page 10) and Figures 1 and 2 (Pages 12 - 13). Within Table 4 (Page 10), the first two columns of results refer to the regression models without matching and the second set of columns display the results from the regression models with matched comparison. For both sets of results, the number listed represents the estimated change in schoolwide percentage of students reaching proficiency on that assessment when schools use the Beyond Textbooks framework. In all cases, this estimated change is independent of the impact on student achievement from other school characteristics.

Results that are highlighted in **bold** are those in which the estimate for schools implementing the framework is different than the estimate for schools not using the framework at a statistically significant

level. Statistical significance indicates that this actual difference is highly likely and not due to random chance; differences are determined to be statistically significant when there is probability of 95% or higher that the values could never be the same. For example, schools using the Beyond Textbooks framework are estimated to see a 6.24% higher increase in percent of proficient students on the Grade 5 Mathematics assessment when compared with all schools that do not use the framework and all other characteristics are held constant. When only compared with matched, nearly-identical sites, program adopters are estimated to see an 8.63% advantage. In both cases, the large improvement for schools adopting the program is very unlikely to be due to random chance.

Within the first set of regression models, use of the Beyond Textbooks framework has a positive correlational relationship with increased proficiency percentage on every assessment measured (nine unique assessments for Mathematics, eight for English Language Arts). These relationships are a statistically significant difference for schools using the framework versus those who do not on ten of the seventeen assessments: fifth- through seventh-grade Mathematics, Algebra II, third- through fourth-grade English Language Arts, sixth- through seventh-grade English Language Arts, and ninth- through tenth-grade English Language Arts. Additionally, this relationship is marginally statistically significant (very nearly reaching levels of a statistically significant difference) for the estimated advantage in third-grade mathematics proficiency.

Within these first models, the increases in percent of proficient students associated with use of the program range from 0.3% to 7.3% across all assessments. The correlation is statistically significant in more than half the estimations and these positive relationships range from 4.7% to 7.3% increases in proficient students. In all estimations, use of the framework is positively correlated with increased proficiency percentage even when controlling for prior percentage proficient, school-level demographics, and school characteristics.

Within the second set of regression models, in which schools using the Beyond Textbooks framework are compared with two, nearly-identical schools not using the program, using the framework is once again associated with increased performance on every assessment included and that positive relationship is statistically significant for six of these assessments. The increases in percent of proficient students associated with use of the program range from 1.2% to 12.1%. This estimation only compares schools that use the framework to nearly identical schools that do not and also controls for school-level characteristics after the matching. The positive correlational relationships are statistically significant for six of the seventeen assessments: fifth- through sixth-grade Mathematics, Algebra II, fourth-grade English Language Arts, sixth-grade English Language Arts, and tenth-grade English Language Arts. These positive relationships range from 7.5% to 12.1% increases in proficient students. Additionally, the relationship is marginally statistically significant for the estimated advantage in seventh-grade mathematics proficiency within this second analysis. Both columns of results are represented graphically in Figures 1 and 2 (Pages 12 -13).

Taking results from both sets of models into account, there is a consistent, positive correlational relationship between schools' usage of the Beyond Textbooks framework and increased school-level proficiency at every grade in both of the subjects tested. This means that schools that used the Beyond

Textbooks framework saw estimated growth in reading and math scores at every grade level tested. Additionally, this positive correlational relationship is statistically significant for at least one subject-specific assessment at almost every grade level across our two types of analyses. In these cases, we can determine with statistical modeling that this growth is very likely to be related to use of the framework and not any other factors that could be included.

Across both types of statistical models run, we see a nearly identical positive relationship between use of the Beyond Textbooks framework and increased student performance on all outcomes, even when using more rigorous methods. In total, between the two types of models, we identify a positive and statistically significant advantage for schools using the Beyond Textbooks framework versus those who do not on ten of the seventeen assessments tested: fifth- through seventh-grade Mathematics, Algebra II, third- through fourth-grade English Language Arts, sixth- through seventh-grade English Language Arts, and ninth- through tenth-grade English Language Arts.

This correlational study was designed to align with guidelines for showcasing "Promising Evidence" as detailed within the Every Student Succeeds Act (ESSA) of 2015 and other similar guidelines for establishing evidence base (e.g. recommendations from Arizona's Move on When Reading guidance document). Following the available resources regarding these standards, we feel these findings meet the requirements for establishing promising evidence of the effectiveness of the Beyond Textbooks framework in positively impacting student achievement scores. We also feel that these findings meet the requirements for establishing positive, promising evidence under policies defining "evidence-based" using similar or identical standards.

TABLE 4

Estimated change in percent of proficient students for schools using the Beyond Textbooks framework compared with schools not using the framework, by assessment

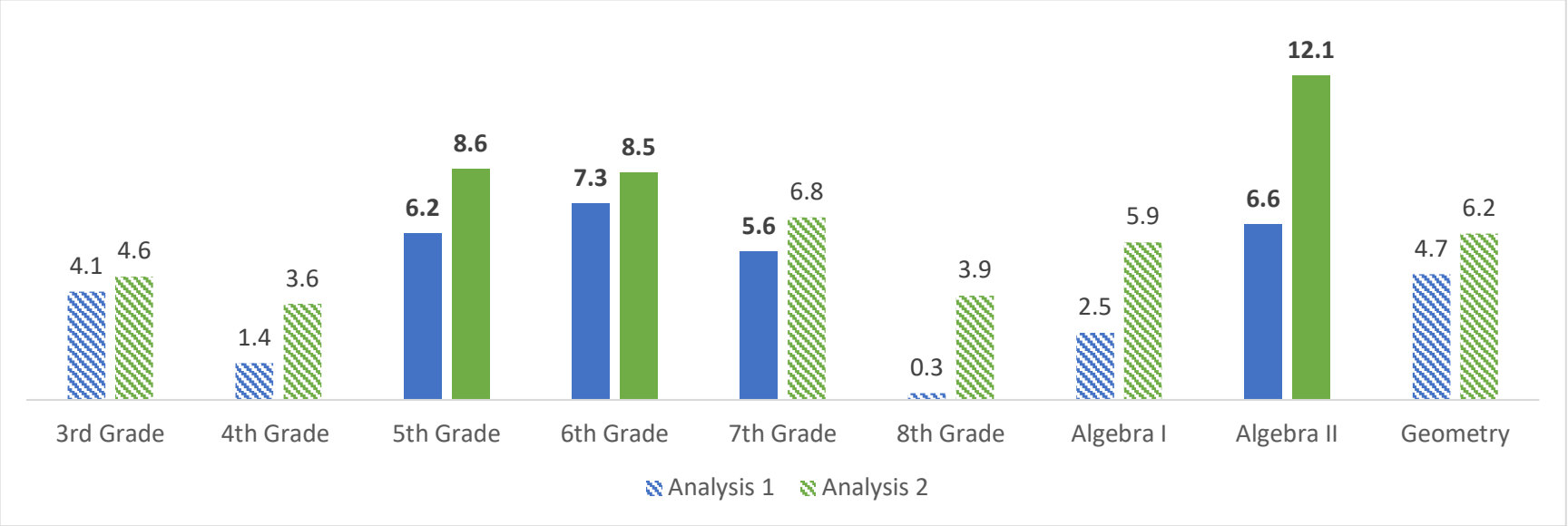
	Basic regression model		Regression model with matching	
	% change in proficient students for schools using the Beyond Textbooks framework	Number of schools	% change in proficient students for schools using the Beyond Textbooks framework	Number of schools
Mathematics assessments				
3rd Grade Mathematics	4.05	908	4.63	90
4th Grade Mathematics	1.38	904	3.59	92

	Basic regression model		Regression model with matching	
	% change in proficient students for schools using the Beyond Textbooks framework	Number of schools	% change in proficient students for schools using the Beyond Textbooks framework	Number of schools
5th Grade Mathematics	**6.24***	888	**8.63***	78
6th Grade Mathematics	**7.34***	762	**8.51***	68
7th Grade Mathematics	**5.56***	551	6.84	69
8th Grade Mathematics	0.26	513	3.90	73
Algebra I	2.51	461	5.90	81
Algebra II	**6.56***	277	**12.13***	65
Geometry	4.70	313	6.22	70
English Language Arts assessments				
3rd Grade English Language Arts	**5.07***	908	3.92	99
4th Grade English Language Arts	**3.41***	903	**7.49***	88
5th Grade English Language Arts	0.23	888	1.15	79
6th Grade English Language Arts	**4.70***	761	**8.75***	77
7th Grade English Language Arts	**4.66***	550	4.34	65
8th Grade English Language Arts	3.23	541	2.55	71
9th Grade English Language Arts	**4.83***	289	5.15	61
10th Grade English Language Arts	**6.16***	283	**8.62***	59

*Results in **bold** indicate that the difference between program-adopting schools and non-program-adopting schools is statistically significant.

FIGURE 1

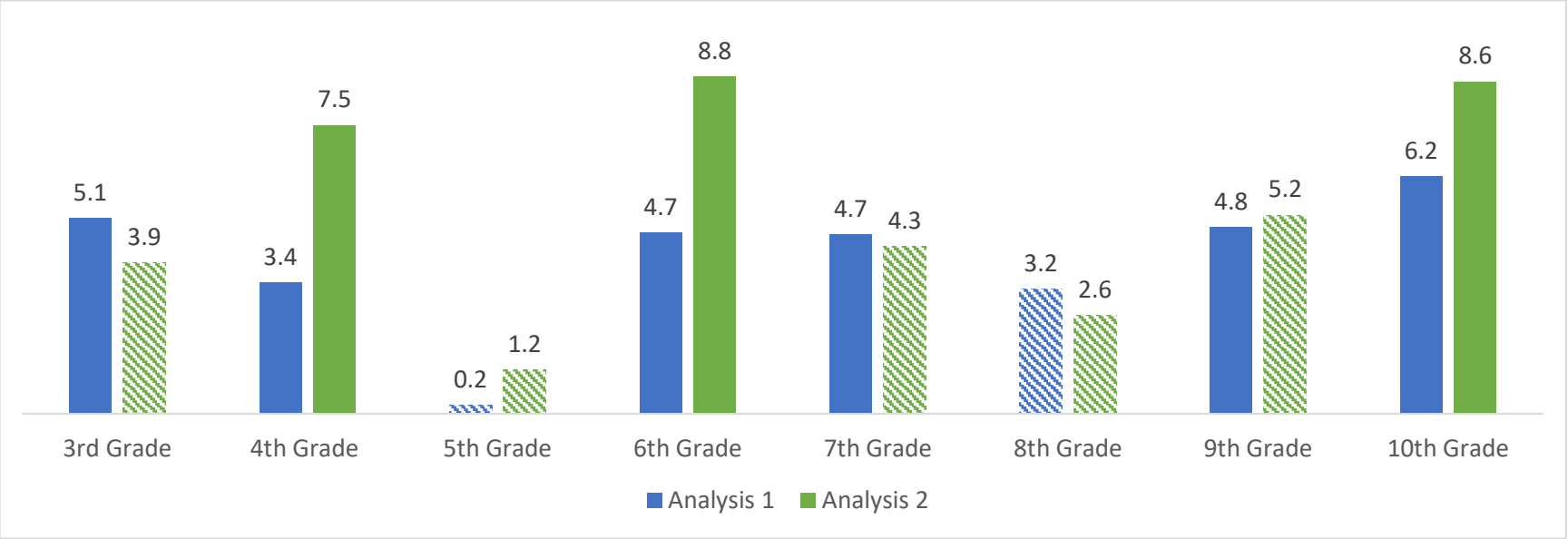
Estimated change in percent of proficient students for schools using the Beyond Textbooks framework compared with schools not using the framework, by mathematics assessment



Using the Beyond Textbooks framework was correlated with as increase in percent of proficient students on all math assessments and a statistically significant increase on four out of nine assessments. Solid bars indicate that the difference between adopting schools and non-adopting schools is statistically significant.

FIGURE 2

Estimated change in percent of proficient students for schools using the Beyond Textbooks framework compared with schools not using the framework, by English Language Arts (ELA) assessment



Using the Beyond Textbooks framework was correlated with as increase in percent of proficient students on all ELA assessments and a statistically significant increase on six out of eight assessments. Solid bars indicate that the difference between adopting schools and non-adopting schools is statistically significant.