A Comparison of District Science 5th Grade Passing Rates for STEMscopes™ and non-STEMscopes™ Districts on the Texas State Assessment of Academic Readiness (STAAR™)

The Study

The purpose of this study was to examine the effect of using STEMscopes™ on district level passing rates for the 5th grade Texas state science assessment, STAAR™. STEMscopes™ is a comprehensive, online K-12 science curriculum that is fully aligned to the Texas science standards (the Texas Essential Knowledge and Skills) and combines online content, activities, and teacher materials with hands-on experiments and explorations. STEMscopes™ uses an inquiry-based approach to science, in which the teacher guides students towards the discovery of concepts and skills instead of using explicit direct instruction. The online component of STEMscopes™ serves as both a support and a guide to teachers, as well as a platform through which students can interact with the material and get feedback on their progress.

Average Student Demographics*

Student Group	Districts with STEMscopes	Districts with Other Curricula
Qualified for F/RL	56%	59%
African American	10	9
Latino	40	38
White	46	49
LEP	11	9
Asian	2	1

*none of these differences was statistically significant at a $p < 0.05$ level.

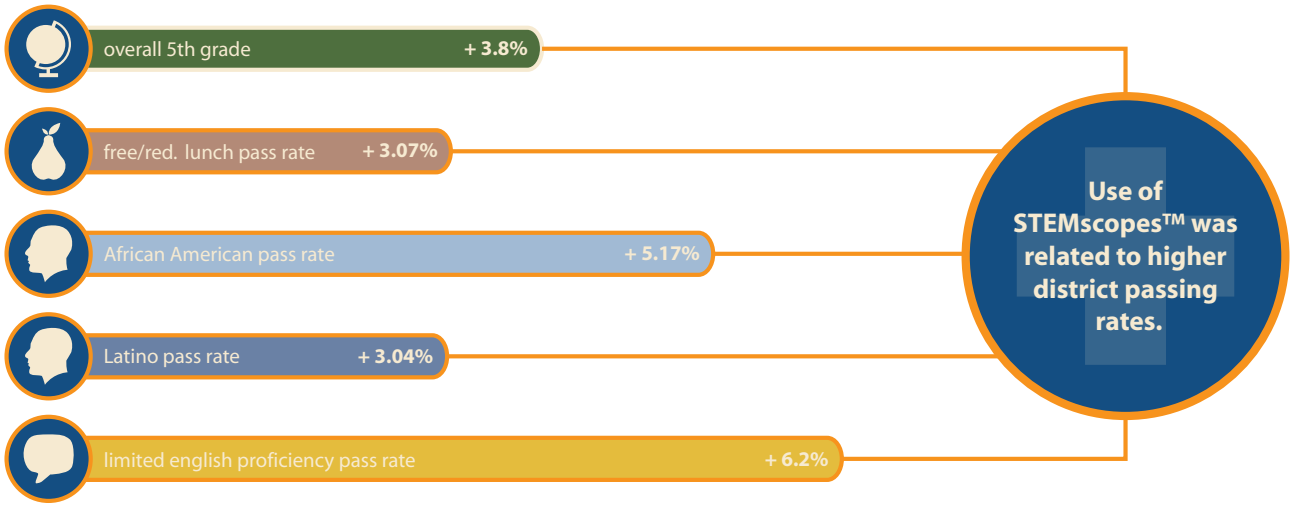
District Supplemental Science Curriculum Adoption, 5th Grade

Total Districts	Districts using STEMscopes	Districts with Other Science Curricula	Districts with > 1 Science Curriculum	Districts with STEMscopes and Another Science Curriculum
634	178	456	120	54

The STEMscopes™ research team collected and analyzed data from 634 independent school districts in Texas for 2010-2011 (student demographic data) and 2011-2012 (STAAR™ passing rates for 5th grade). The table above shows the differences in science curriculum adoptions across the districts. We compared the district passing rates for districts that adopted STEMscopes™ to those districts that did not adopt STEMscopes™ as its supplementary science curriculum.

Analyses

The research team asked whether using STEMscopes™ was related to higher passing rates for 5th grade students in science. We took into account which supplementary science curriculum the district adopted, the demographic make-up of each district to control for variation across districts, and the fact that 120 districts adopted more than one supplemental science curriculum. We also asked whether STEMscopes™ influenced the passing rates of different groups of students in each district. These subgroups included students who qualified for free lunch or for reduced lunch, African American students, Latino students, White students, and students with limited English proficiency (LEP).



Conclusions

The team found that, on average, passing rates on the 5th grade STAAR™ science test were higher in districts that chose to adopt STEMscopes™ as its supplementary science curriculum. This was true for the overall population of 5th grade students in these districts, as well as for various student subgroups that tend to be at-risk academically. These findings were present even when we controlled for district demographic make-up and for multiple science curricular adoptions. The effect of having STEMscopes™ as a supplemental science curriculum ranged from an additional 3.04 points to an additional 6.2 points for the districts' passing rates.

RICE STEMscopes™

A Comparison of District Science 5th Grade Passing Rates for STEMscopes™ and non-STEMscopes™ Districts on the Texas State Assessment of Academic Readiness (STAAR™)

Description of the Study

The purpose of this study was to examine the effect of using STEMscopes™ on district level passing rates for the 5th grade Texas state science assessment, STAAR™. STEMscopes™ is a comprehensive, online K-12 science curriculum that is fully aligned to the Texas science standards (the Texas Essential Knowledge and Skills) and that combines online content, activities, and teacher materials with hands-on experiments and explorations. STEMscopes™ uses an inquiry-based approach to science, in which the teacher guides students towards the discovery of concepts and skills instead of using explicit direct instruction (Crawford, 2007). The online component of STEMscopes™ serves as both a support and a guide to teachers, as well as a platform through which students can interact with the material and get feedback on their progress.

The specific way that STEMscopes™ delivers inquiry-based instruction is by building on the Biological Science Curriculum Study's 5E inquiry model (Bybee et al., 2006). 5E refers to five steps: engagement, exploration, explanation, elaboration, and evaluation. Engagement refers to how teachers activate students' prior knowledge about and interest in a new topic, building connections between what they know and what they are learning. Exploration is the step where students take part in activities and experiments that allow them to experience and learn new concepts and skills. Explanation requires students to explain those new concepts and skills learned during the explore phase. Elaboration challenges them to deepen their conceptual understanding through new, but related, experiences. Finally, in the evaluation phase, students' knowledge is assessed to inform teachers of their progress towards mastery.

The STEMscopes™ pedagogical model adds two key steps: intervention and acceleration. Intervention means that STEMscopes™ provides teachers with the tools both to identify where students are struggling and to provide them with additional opportunities to learn and practice those learning objectives. Acceleration refers to the activities that STEMscopes™ provides for those students that have demonstrated mastery of a particular learning objective. For example, students can undertake a problem-based learning challenge, or connect science to art through a creative project. These two tools help teachers differentiate their instruction and address students' individual learning needs (Zuiker & Whitaker, 2014).

Design

The STEMscopes™ research team collected and analyzed data from 634 independent school districts[1] in Texas from the years 2010-2011 (student demographic data) and 2011-2012

[1] Though there are over 1,000 public school districts in Texas, we were only able to obtain data for the 634 included our analysis.

(STAAR™ passing rates for 5th grade)[2]. Of these districts, 178 had adopted STEMscopes™ and 456 districts adopted a different supplemental science curriculum (See table 1 below). A total of 120 districts adopted more than one science curriculum; of the 178 STEMscopes™ districts, 54 of them adopted more than one science curriculum. We compared the district passing rates for districts that adopted STEMscopes™ to those districts that did not adopt STEMscopes™ as its supplementary science curriculum.

Table 1: District supplemental science curriculum adoption, 5th grade

Total districts	Districts using STEMscopes	Districts that adopted a different supplemental science curriculum	Districts that adopted more than one science curriculum	Districts that adopted STEMscopes and another curriculum
634	178	456	120	54

Sample

The two groups of school districts were very similar. Table 2 presents student demographic data for the entire sample of districts, and table 3 compares the two groups of districts. In general, the sample resembles the statewide average student body.[3] Furthermore, there were no significant differences across the two groups of school districts. Demographic data were from 2010-2011 and were obtained through the Texas Academic Excellence Indicator System (AEIS), and the STAAR™ data were from the 2011-2012 school year and were obtained through Pearson's webpage.

Table 2: District demographics: Average size of student subgroups

Eligible free or reduced lunch benefits	African American students	White students	Latino students	LEP students
57.80%	9.60%	38.60%	48%	9.90%

Table 3: Average student demographics

	Average student demographics*	
Student group	Districts with STEMscopes	Districts with other curricula
Qualified for FRL	56	59
African American	10	9
Latino	40	38
White	46	49
LEP	11	9
Asian	2	1

*None of these differences was statistically significant at a $p < 0.05$ level.

[2] We only analyzed 5th grade passing rates because, for elementary school, the state science exam is only given at the end of 5th grade.
[3] See www.tea.state.tx.us/acctres/Enroll_2010-11.pdf for more information on state student enrollment.

RICE

Analyses

The research team utilized multiple regression to parse out the effect of having adopted STEMscopes™ on district level science passing rates. In addition to taking into account which supplementary science curriculum the district adopted, we also considered the demographic make-up of each district to control for variation across districts, as well as the effect demographic characteristics had on science passing rates. Specifically, we controlled for the effects of the percent of students eligible for free or reduced lunch, the percent of African American students, Latino students, White students, Asian students, and limited English proficient (LEP) students. We also controlled for the fact that 120 districts adopted more than one supplemental science curriculum. The two curriculum variables were dichotomous—either a district did or did not adopt STEMscopes™, and either a district adopted only one or more than one curriculum.

We also examined whether STEMscopes™ influenced the passing rates of different groups of students. Specifically, we asked whether adoption of STEMscopes™ mattered for the overall 5th grade pass rate, the pass rate for students who qualified for free lunch or for reduced lunch, the pass rate for African American students, Latino students, White students, and LEP students. Separate models were estimated for each outcome and regression coefficients with a p-value < .05 were considered statistically significant.

Results of the Study

The adoption of STEMscopes™ was related to higher passing rates for several of the outcomes (see table 4 for a summary of the estimated impact of STEMscopes™). Specifically, for all student groups, districts with STEMscopes™ on average had 5th grade science STAAR™ test passing rates that were 3.8 percentage points higher than districts that did not adopted STEMscopes™, all else equal. For students that qualified for free lunch, passing rates in STEMscopes™ districts were 3.07 points higher. The passing rate for African American students was 5.17 points higher in STEMscopes™ districts, while the passing rate for Latino students was 3.04 points higher in STEMscopes™ districts. Finally, the average district passing rate on the 5th grade science exam for LEP students was 6.2 points higher in STEMscopes™ districts, all else equal.

Table 4: Summary of coefficients and significance levels

Outcome	Unstandardized regression coefficient for use of STEMscopes variable	t value	Significance
Overall 5th grade pass rate	3.8	2.11	0.04*
Free lunch pass rate	3.07	2.19	0.03*
Reduced lunch pass rate	2.49	1.38	0.17
African American pass rate	5.17	2.34	0.02*
Latino pass rate	3.04	2.03	0.04*
White pass rate	6.54	1.79	0.07
LEP pass rate	6.2	2.84	0.01*

*Indicates statistical significance at the $p < 0.05$ level.

STEMscopes™ PREK-12

Conclusions

The team found that, on average, passing rates on the 5th grade STAAR™ science test were higher in districts that chose to adopt STEMscopes™ as its supplementary science curriculum. This was true for the overall population of 5th grade students in these districts, as well as for various student subgroups that tend to be at-risk academically. These findings were present even when we controlled for district demographic make-up and for multiple curricular adoptions. The effect of having STEMscopes™ as a supplemental science curriculum ranged from an additional 3.04 points to an additional 6.2 points for the districts' passing rates. These findings provide evidence that, as a resource, STEMscopes™ has a positive impact on student learning in 5th grade science.

References

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Crawford, B. A. (2007). Learning to teach science inquiry in the rough and tumble of practice. *Journal of Research in Science Teaching, 44*(4), 613-642.

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