This study tested the theory that district use of STEMscopes increases reading and mathematics proficiency through increases in science proficiency. Academic learning and achievement is often a synergistic process, with student learning in one subject potentially bolstering learning in other subjects. We proposed that exposure to the STEMscopes science curriculum not only increases students’ science proficiency, but possibly their reading and math as well. Specifically, we suggested a process such that: STEMscopes increased science proficiency which, in turn, increased reading and/or math proficiency (see figure). STEMscopes supports science instruction that (among other things) includes and targets the specialized language used within science (e.g., vocabulary), comprehension and leveled reading. It also targets computation skills within scientific observational settings and investigations that are part of realistic problem-based and experiential learning. As student learning in science increases, in turn, we may expect increases in reading and math learning.
To test this possibility, we used a mediation model with scores from the 2019 State of Texas Assessments of Academic Readiness (STAAR™). Mediation models are models that include multiple simultaneous regressions and test a process regarding how an outcome (such as reading and math proficiency) is associated with a predictor (use of STEMscopes by a district) through an additional variable such as science proficiency. Within a mediation model, we can also include other important predictors of science, reading and math proficiency to ensure that results of the model are not due to one of these other predictors instead of STEMscopes. Within this large mediation model, we evaluated whether the added "pathway" or process whereby STEMscopes affects reading and math proficiency through science proficiency is significant, and what potential effect it has on proficiency in reading and math. Districts were identified as STEMscopes districts if they had a subscription to STEMscopes for students in 5th grade and showed usage of STEMscopes based on the analytics data. The state of Texas creates proficiency benchmarks in science, reading, and math; identifying students as not proficient, approaching grade-level proficiency, meeting grade-level proficiency, and mastering grade-level proficiency. The percentage of students who approach grade-level performance is used by the state as the district passing rate for science, reading and math and was used here. We also accounted for other important predictors of science, reading and math including 2017-2018 passing rates as well as district demographics, including the size of the district, whether the district was a charter school district, average teacher experience, district attendance rate, and student race/ethnicity, socioeconomic status, and LEP status.

Results

As noted, in the previous Texas Proficiency Report, STEMscopes districts had significantly higher science proficiency rates compared to districts that did not use STEMscopes (even when controlling for other important variables that influence student proficiency). This is the first path (first step of the process) in the mediation model. The next part of the model tested was whether science proficiency predicted reading and math proficiency (tested separately) for the same year. Results indicated science proficiency rates predicted districts’ reading and math proficiency rates. As an overall test of the two step process (STEMscopes -> science -> reading or math), the final step of a mediation model is to consider both steps together. We can interpret the overall test of the process as “STEMscopes effect on reading and math proficiency through science proficiency.” For reading (controlling for previous year [4th grade] reading passing rates), districts that used STEMscopes had a 0.80 percent increase in reading proficiency (through STEMscopes effect on science) compared to non-STEMscopes districts. This change was significant and equates to approximately 2,800 more children meeting the reading benchmark within STEMscopes districts. For math (controlling for previous year math passing rates), districts that used STEMscopes had a 0.69 percent increase in math proficiency (through STEMscopes effect on science) compared to non-STEMscopes districts. This change was also significant and equates to approximately 2,417 more children meeting the math benchmark within STEMscopes districts.

Please note, when we include science as a mediator; that is, when we account for the expected process that STEMscopes increases reading and math learning through increasing science learning: this process explains the entire relationship between STEMscopes and reading or math. Put another way, we could say that STEMscopes effect on science fully mediates the relationship between STEMscopes and reading or math proficiency. There is not a relationship between STEMscopes and reading or math proficiency once the process through science is accounted for. This is to be expected because STEMscopes is not a direct instruction, comprehensive reading or math curriculum. Rather, it is a high quality science curriculum that includes reading and math supports within the process of supporting science.
Conclusion

Districts that used STEMscopes had higher science proficiency rates than districts that did not use STEMscopes in 2019. This higher science proficiency rate, in turn, led to higher proficiency rates in reading and mathematics for districts that used STEMscopes versus districts that did not use STEMscopes. Specifically, even when controlling for other important predictors of science, reading and math, STEMscopes increased the reading proficiency rate (through science) by 0.80 percent and math (through science) by 0.69 percent in elementary school.