This study tested the theory that district use of STEMscopes science curriculum increases English/language arts (ELA) 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 their ELA and math as well. Specifically, we hypothesized that STEMscopes science curriculum increased science proficiency which, in turn, increased ELA and/or math proficiency (see figure below). STEMscopes science instruction includes and targets the specialized language used within science (e.g., vocabulary), as well as computation skills within scientific observational settings and investigations that are part of realistic problem-based and experiential learning. As student learning in science increases, we may expect increases in ELA and math learning.
To test this hypothesis, we used a mediation model with scores from the 2019 State of Mississippi Academic Assessment Program (MAAP). Mediation models are models that include multiple simultaneous regressions and test a process to determine how an outcome (such as ELA and math proficiency) is associated with a predictor (use of STEMscopes science curriculum by a district) through an additional variable such as science proficiency. Within a mediation model, we can also include other important predictors of science, ELA, and math proficiency to ensure that model outcomes are not caused by one of these other predictors instead of STEMscopes. Within this large mediation model, we evaluated whether the added “pathway” or process whereby STEMscopes science curriculum affects ELA and math proficiency through science proficiency is significant, and its potential effect on proficiency in ELA and math.

Districts were identified as STEMscopes districts if they had a subscription to STEMscopes Science for students in 5th grade and showed usage of STEMscopes based on the analytics data. The state of Mississippi creates benchmarks for proficiency and assesses students using five levels: minimal, basic, passing, proficient, and advanced. The district’s proficiency rate is defined as the percentage of students who were proficient or advanced in science. We also took into account the 2018 science proficiency rates as well as important district demographics, including the number of students, student demographic information, graduation rate, percentage of experienced principals and teachers, prevalence of chronic absenteeism, and incidents of violence.

Results

As noted in the previous Mississippi Proficiency Report, STEMscopes Science districts had significantly higher science proficiency rates compared to districts that did not use STEMscopes Science (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 whether science proficiency predicted ELA and math proficiency (tested separately) for the same year. Results indicated that science proficiency rates significantly predicted districts’ ELA and math proficiency rates.

As an overall test of the two-step process (STEMscopes → science → ELA or math), the final step of the mediation model was to consider both steps together. This overall test of the process can be expressed as “STEMscopes science curriculum’s effect on ELA and math proficiency through science proficiency.” For ELA, districts that used STEMscopes had a 2.34 percent increase in ELA proficiency (through STEMscopes, effect on science) compared to non-STEMscopes districts. This change was significant and equates to approximately 298 more children meeting the ELA benchmark within STEMscopes districts. For math, districts that used STEMscopes had a 2.70 percent increase in math proficiency (through STEMscopes, effect on science) compared to non-STEMscopes districts. This change was also significant and equates to approximately 344 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 science increases ELA and math learning through increasing science learning—this process explains the entire relationship between STEMscopes science curriculum and ELA or math. Put another way, we could say that STEMscopes, effect on science fully mediates the relationship between STEMscopes science curriculum and ELA or math proficiency. There is not a relationship between STEMscopes science and ELA or math proficiency unless we account for the process through science. This is to be expected because the STEMscopes science curriculum is not a direct-instruction, comprehensive ELA or math curriculum. Rather, it is a high quality science curriculum that includes ELA and math supports within the process of teaching science.
Conclusion

Districts that used STEMscopes science had higher science proficiency rates than districts that did not use STEMscopes science in 2019. This higher science proficiency rate, in turn, led to higher proficiency rates in ELA and mathematics for districts that used the STEMscopes curriculum versus districts that did not use STEMscopes. Specifically, even when controlling for other important predictors of science, ELA, and math, STEMscopes increased the ELA proficiency rate (through science) by 2.34 percent and math (through science) by 2.70 percent in elementary school.