



Waco ISD Prekindergarten STEMscopes Early Explorer Quantitative Impact Analysis: A Case for Starting STEM Early

2014-2015 IMPLEMENTATION STUDY

In the 2014-2015 school year, Accelerate Learning partnered with Waco ISD to implement STEMscopes Early Explorer in their entire preschool program. This district served approximately 1,100 preschoolers, predominantly minority and economically disadvantaged, during this school year. Data were collected through surveys, interviews, and observations to examine the integration of STEM instruction using Early Explorer in publicly-funded preschool classrooms facing similar challenges and limitations to preschool classrooms across the country. Teachers implemented the 12 modules of Early Explorer, with each module lasting between 2-3 weeks. The scope and sequence of the modules were chosen so they would be aligned with the district-adopted curriculum.

Using Early Explorer, teachers reported spending an average of 36 minutes per day on STEM instruction, compared to the national average of 1-3 minutes spent on math and science in preschool classrooms. Integration of STEM instruction increased over time as teachers became more comfortable with the curriculum components and methods for including them in the daily schedule. The Ramp Up and Round Up activities from the program were the first to be implemented, followed by Wrap Up and Keep It Up. In addition to these components, teachers reported regularly using the non-fiction and fiction big books as well as the vocabulary cards during literacy activities.

At the end of the implementation study, the ALI professional development team met with a small group of the Waco ISD preschool teachers selected to be science leaders and support the district in continuing this initiative into the 2015-2016 school year. This meeting also included kindergarten teacher representatives from every elementary campus, who were given training on STEMscopes and how to lead science professional learning communities (PLCs). It is the district's goal to continue this STEM initiative using STEMscopes in upcoming school years, starting in preschool and moving into early elementary school.

2015-2016 QUANTITATIVE FOLLOW-UP

In the 2015-2016 school year, the children who participated in the 2014-2015 implementation study were followed into kindergarten. All kindergarten students were assessed on their science and engineering skills throughout the school year. Specifically, students were assessed using the Children’s Learning Institute Engage, a comprehensive progress monitoring system that includes quantitative assessments across multiple domains of academic achievement. This system is used by PreK and kindergarten programs throughout Texas public schools and was created by researchers at University of Texas Health Science Center. For the purposes of this study, the science and engineering subscale of the CLI Engage was used. Teachers assessed students’ science and engineering knowledge three times throughout the year: in the fall, winter, and spring.

In the 2015-2016 school year, there were 1,271 students in kindergarten. Of these students, 905 of them were students in the Waco ISD PreK program in 2014-2015; 365 new students enrolled in kindergarten who did not participate in the Waco ISD PreK program. These two groups of students were compared on several important demographic differences (see table below).

	K Students who participated in Waco ISD PreK (N = 905)	K Students who did NOT participate in Waco ISD PreK (N = 365)
% African American	33%	37%
% Hispanic/Latino	60%	43%
% White	6%	18%
% Asian or Other	1%	2%
% Female	49%	42%
% Free/Reduced Lunch	96%	81%
% Special Education	2%	6%
% Gifted/Talented	1%	1%
% Bilingual	18%	7%
% ESL	11%	4%

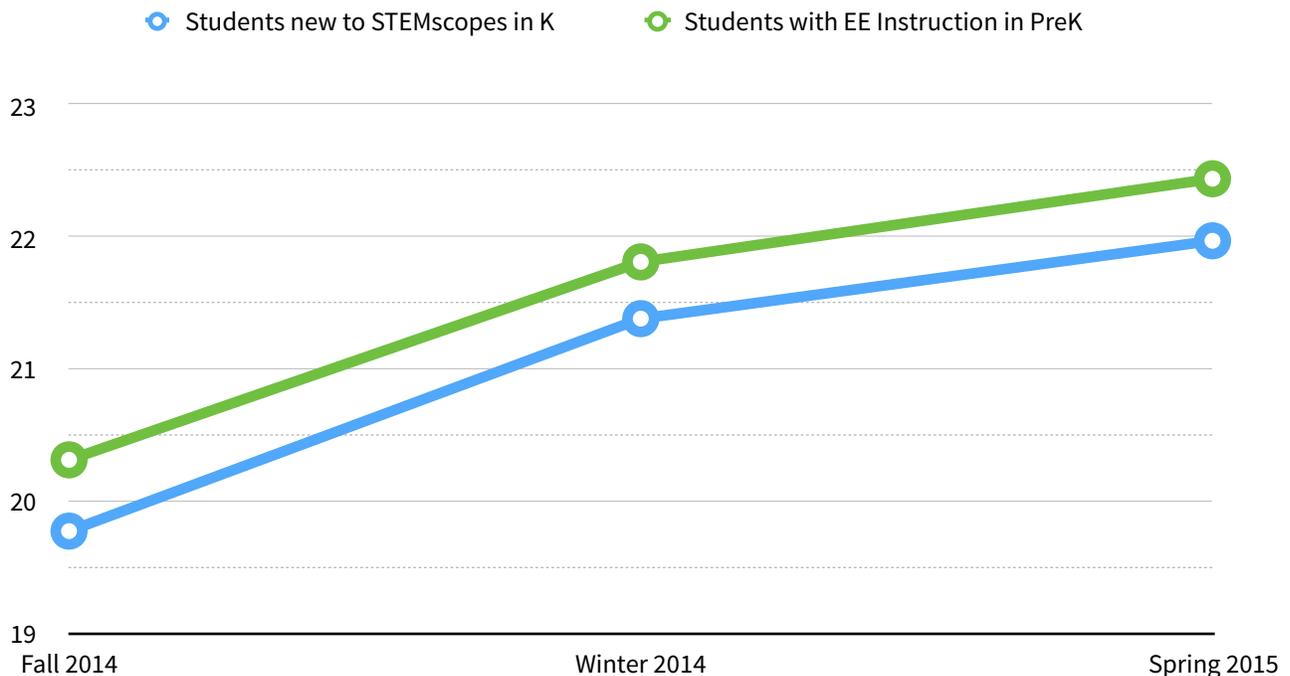
Independent sample t-tests were conducted to determine if these groups differed significantly on these demographic variables. Results showed that kindergarten students who participated in the Waco ISD PreK program in the previous school year were more likely to be Hispanic, female, bilingual and ESL, and qualify for free or reduced lunch. Students who did not participate in the PreK program the previous year were more likely to be White and qualify for special education. In other words, with the exception of special education status, the students who participated in the PreK program were students who historically have been found to have lower science achievement due to minority status, lower SES, and English as a second language.

SCIENCE ACHIEVEMENT

The CLI Engage science and engineering assessment is scored on a scale of 24 points. In the fall, students scored an average of 20.2 points; this increased to 21.7 points in the winter, and 22.3 points in the spring. On average, students gained 2.1 points across the school year, which is equivalent to one standard deviation. However, it is important to take into account important demographic variables known to be associated with academic achievement to determine if this growth was significant above and beyond these important variables. Therefore, student growth in science achievement was calculated using growth curve modeling to parse out the variance associated with demographic variables. Results showed that all students did significantly grow in their science and engineering achievement throughout the 2015-2016 school year. After controlling for the demographic variables listed in Table 1, students grew an average of 1.14 points. This is equivalent to more than a half of a standard deviation, indicating a medium effect size in growth.

Next, analyses were conducted to determine if participating in the 2014-2015 Waco ISD PreK program, and thus receiving increased STEM instruction in PreK with STEMscopes Early Explorer, was associated with higher science achievement in kindergarten, after controlling for important demographic variables. In other words, kindergarten students who participated in the 2014-2015 PreK program were compared to kindergarten students who did not participate in the Waco ISD PreK program. Results showed that participation in the Waco ISD PreK program was a significant predictor of science achievement. Students who participated in the PreK program had significantly higher science scores at the beginning of the school year and they maintained this advantage throughout the school year (see graph below). Specifically, controlling for demographic differences, these students had an advantage of 0.78 points, equivalent to 0.40 standard deviation, a medium effect size. Interestingly, all students achieved the same amount of growth throughout the school year, meaning that students who participated in the 2014-2015 PreK program maintained their advantage throughout the end of kindergarten.

STARTING STEM EARLY: GROWTH IN KINDERGARTEN SCIENCE ACHIEVEMENT FOR STUDENTS WHO DID VS. DID NOT RECEIVE EARLY EXPLORER INSTRUCTION IN PREK YEAR



CONCLUSION

To summarize, students at Waco ISD who received STEM instruction in PreK had higher science achievement in kindergarten, even after controlling for important demographic variables. While all kindergarten students grew in their science achievement during the 2015-2016 school year, students who received STEM instruction through STEMscopes Early Explorer in the previous school year had an added advantage that they maintained throughout the year. It is important to note that these analyses did not control for the type of preschool or childcare that the new kindergarten students received before they entered kindergarten at Waco ISD. However, given the rarity of STEM instruction in most PreK programs and the fact that the students who participated in the Waco ISD PreK program represented students who were more likely to be minority and economically disadvantaged, these results are noteworthy. Many studies have highlighted the significance of early intervention before kindergarten, particularly in science instruction. This study provides evidence for the use of STEMscopes Early Explorer in supporting early STEM instruction in preparing students for success in elementary school.

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