



Principal Investigator: Dr. Ann Robinson,
aerobinson@ualr.edu

Project Director: Kristy Kidd,
kakidd@ualr.edu

External Evaluator: Jill Adelson,
jill.adelson@louisville.edu

Executive Research Summary

Developing Talents in Young Children through Engineering 2016

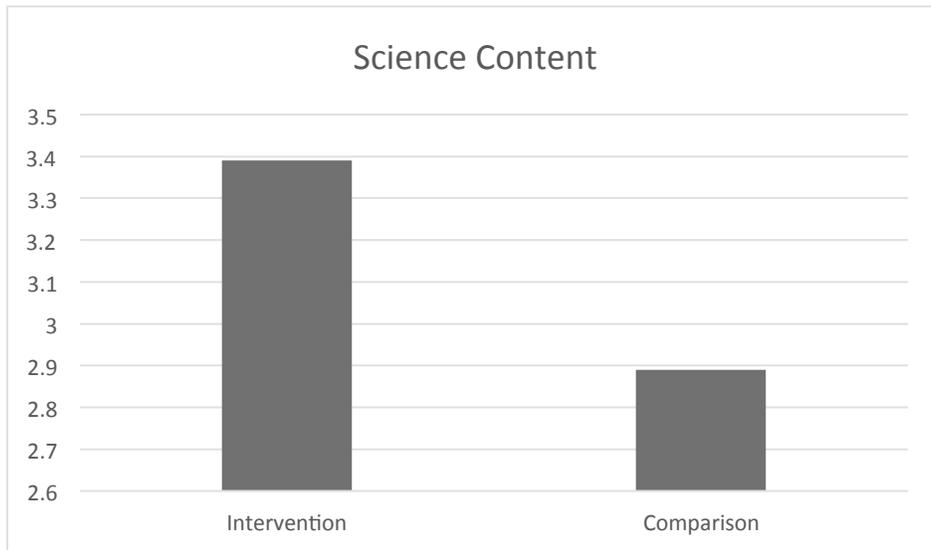
During the 2015-2016 school year, STEM Starters+, a research and demonstration project funded through the Jacob K. Javits Gifted Students Program (U.S. Department of Education) and designed by researchers at the University of Arkansas at Little Rock, provided engineering curricula in four Arkansas school districts in schools serving high proportions of culturally diverse and low-income children. The four districts are: Cabot, El Dorado, Little Rock, and Pulaski County Special School District. All first grade students participated in an acoustical engineering unit, *Sounds Like Fun: Seeing Animal Sounds*, developed by the Museum of Science, Boston, and a *Blueprint for Biography* based on *The Watcher: Jane Goodall's Life with the Chimps*, developed by the Mahony Center at the University of Arkansas for the STEM Starters+ project. Teachers implementing the intervention were trained in a one-week summer institute and coached in the classroom by a science and engineering specialist with preparation in gifted education.

We analyzed data for 1,387 students in 62 first grade classrooms in 18 schools, 9 in the comparison group and 9 in the intervention group. Approximately 46% of students identified as White and approximately 41% identified as Black. More than half of the students received a meal subsidy. Students in both intervention and comparison groups

completed two measures as a pretest and posttest: a science content assessment (constructed of released items from National Assessment of Educational Progress [NAEP] and Trends in International Mathematics and Science Study [TIMSS]) and *What is an Engineer?* (a 20-item measure of young student knowledge of engineering practices developed by the Museum of Science, Boston and scored as percent correct). Students in the intervention group also completed the Emotional Engagement and Behavioral Engagement scales of the *STEM Engagement Scale (SES): Engineering* at the end of the intervention. Prior to the implementation of STEM Starters+, schools did not provide first graders with engineering lessons, and the comparison schools did not engage students in engineering curricula during the 2015-2016 academic year. Therefore, intervention students could not complete the *SES Engineering* as a pretest and comparison students were not able complete it in this data cycle because they did not have the opportunity to be exposed to engineering. Given the increased importance of engineering in STEM programs for young children, the STEM Starters+ program provides new opportunities to learn for students in low-income schools.

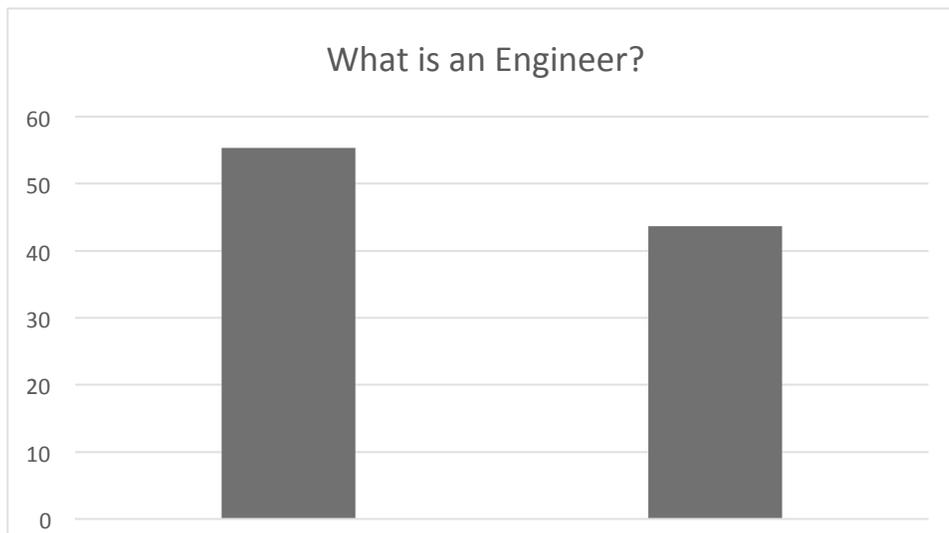
We asked three questions (1) How does the STEM Starters+ program affect first graders' science content achievement? (2) How does the STEM Starters+ program affect first graders' knowledge of engineers? (3) Given students started without the opportunity for engagement in engineering, how engaged were they at the end of the project? Next, we present the results for each of the measures.

Science Content. Intervention students scored higher than comparison students, after controlling for student characteristics and their pretest scores. They scored about 0.28



standard deviations higher. Whether students were in the intervention or not explained about 41% of the variability in school average scores.

What is an Engineer? Intervention students scored higher than comparison students on knowledge of engineering, after controlling for student characteristics and their



pretest scores. They scored about 0.66 standard deviations higher. Whether students were in the intervention or not explained about 74% of the variability in school average scores.

Engagement in Engineering. On a scale of 1-5 students reported being quite engaged, with an average emotional engagement score of 3.89 and an average behavioral engagement score of 4.09.

Conclusions. Young students who participate in an engineering intervention in Grade 1 learn more science, have a greater understanding of engineering, and are engaged by the experience. The achievement outcomes are substantial when compared with the achievement of similar students who did not participate in STEM Starters+. Given the economically modest investment in curricular materials and teacher professional development that produced these educationally significant gains, schools should consider adopting this evidence-based program.

Additional Implications. Like much past research, we found initial student differences in traditional achievement measures. Specifically, males, students receiving a meal subsidy, and underrepresented minorities scored lower on science content. However, we also used *What is an Engineer?*, a non-traditional measure, and there were no differences by gender, meal subsidy status, or underrepresented minority status. Similarly, students were generally equally engaged in the engineering classes, with no differences by gender, meal subsidy status, or underrepresented minority status in emotional engagement and no differences by gender or underrepresented minority status in behavioral engagement. Students receiving a meal subsidy did report less behavioral engagement. The importance of the engagement findings are that young students in low-income schools are

engaged when given the opportunity to experience engineering, a content area often reserved for older students and adult learners.

