Executive Summary: An Evaluation of the Implementation of Engineering is Elementary in Fourteen Minneapolis Public Schools

During the 2009-2010 school year, with funding from the Cargill Foundation, 22 schools in the Minneapolis Public Schools district participated in the first year of a district-wide roll-out of EiE units in grades 3, 4, and 5. During the 2009-2010 school year, two Engineering is Elementary (EiE) curricular units, *Designing Model Membranes* and *Seeing Animal Sounds*, were implemented in all third grade classrooms in 14 Minneapolis public schools. The units were taught by science specialists from the Science Museum of Minnesota. Students in participating classrooms engaged in one of the two units in conjunction with the related science unit. A control sample was chosen from non-implementing schools; students from control classrooms did not do any Engineering is Elementary units but did participate in a related science unit.

Students in both groups completed identical pre- and post-assessments and surveys. Control classrooms implementing the science unit FOSS: *Physics of Sound* completed the same unit assessments as test classrooms that completed the *Physics of Sound* unit together with EiE: *Seeing Animal Sounds*. Test classrooms implementing EiE: *Designing Model Membranes* together with the science unit FOSS: *Structures of Life* completed a different unit assessment; there was no control group. In all cases, students completed pre-assessments before instruction in any of the target science and (for the test group) engineering units, and post-assessments after all instruction was complete. Most students completed the "Engineering Attitudes" student survey measuring students' interest in and attitudes toward the work of scientists and engineers. A subset of students also completed the "What is Technology?" assessment, measuring their ideas about what technology is.

Compared to control students, EiE students learned significantly more about engineering and technology, as well significantly more about the related science topic. Their attitudes about science and engineering careers were also more likely to become more positive as compared to a control group. EiE students were significantly more likely than control students to have improved attitudes towards science and engineering as careers and the relevance of math and science in the real world. Additionally, students participating in EiE were more likely to report having an increased understanding of what scientists and engineers do for their jobs. Black students who participated in EiE showed significantly more interest in work having to do with helping people or society.

Students participating in EiE showed a significantly improved understanding of what technology is. Results from the unit assessment for *Seeing Animal Sounds* show that EiE students showed more understanding about properties of sound, ways to change sounds, and ways to represent sounds. On two of the three subscores, however, low-income students scored lower than other students participating in EiE, and it is unclear whether their performance is any better or worse than that of similar students in the control group. Overall, scores of students participating in EiE: *Designing Model Membranes* increased on scales measuring knowledge about bioengineering, survival needs and adaptations, the use of nature to inspire design, and natural and artificial membranes; however we cannot say whether this difference would be greater than that of a control group as none was available for this unit.

We found that students with special needs, low-income students, students with limited English proficiency, and students from underrepresented minority groups (Black, Hispanic, and Native American), often had lower scores than mainstream students; however, these effects were usually the same for students in both the test and control groups, indicating that although the "achievement gap" between such students and more mainstream students was not closed, such students still learned from EiE.