The role of engineering is expanding in K-12 education due to the need for graduating engineers that are better prepared to meet the challenges of the knowledge age; educating a technically literate public; and diversifying the engineering field to increase the percentage of women and underrepresented minorities in the workforce. Unfortunately, there are few resources grounded in the research on teaching and learning available to support K-12 engineering educators. To address this need, this project explored the potential of digital storytelling for increasing children's interest in and understanding of engineering. This goal was achieved by working closely with informal educators to develop, implement, assess and disseminate an innovative curriculum called Through My Window.

Through My Window is a multimedia curriculum designed to engage all children in engineering. Consistent with the research on teaching and learning, it is both idea-centered and narrative-based. By focusing on ideas, Through My Window honors the intelligence of children and initiates open-ended discussions that support a broad range of experiences and opinions. The use of Imaginative Education-- a theory of learning that emphasizes the use of developmentally-appropriate narratives and other cognitive tools--allows learners to identify with characters facing challenges similar to their own. This connection helps them transfer-in their own experiences to the learning process and supports a deeper engagement with the engineering concepts in each story.

The Through My Window Curriculum consists of two full-length children's STEM novels, *Talk to Me* and *TimeTilter*, and extensive associated curricula. Free access to all elements of Through My Window is available at www.teamthroughmywindow.org. Written by former engineer Sonia Ellis, the novels introduce students to diverse, relatable characters who use engineering to solve problems. In *Talk to Me*, a group of 14-year-olds re-engineer a robot cat with artificial intelligence to solve a crime and help an anxious child. It is available in print, e-reader (English/Spanish) and audiobook formats. In *TimeTilter*, teens use engineering to fight a corrupt corporation that's holding them hostage in a dystopian gaming world. It is also available in print/e-reader/audiobook formats.

Three story-based online learning adventures (modules) accompany *Talk to Me*. They feature the *Talk to Me* novel characters and go in-depth on specific engineering concepts: Rio's Brain, about Artificial Intelligence (AI), Catalina's Revenge, about engineering ethics, and Trapped in Time, about engineering design. Seven enrichment activities--five about AI and two about design--also accompany *Talk to Me*. Day-by-day lesson plans integrate the novel, learning adventures, and enrichment activities with supplemental materials.

A website, collusia.com, accompanies *TimeTilter*. Collusia.com is a fake company website for the Collusia corporation, the novel's antagonist. Students "hack in" using passwords and URLs from the book to discover Collusia's secrets. Day-by-day lesson plans integrate the *TimeTilter* novel, the collusia.com website, and supplementary resources that introduce concepts including biomimicry and human survival. The final task students complete is designing a "supersuit" to keep the wearer safe in an extreme environment, like a jungle or abandoned industrial site.

 Key outcomes showed that Through My Window

- positively impacted children's interest in and understanding of engineering and development of STEM identity;
- encouraged children to engage in complex ideas about engineering;
- engaged students and motivated learning, even in settings considered unconducive to meaningful learning;
- was effective in special education or mixed-ability student groups;
- encouraged children to read;

- broadened educators' understanding of engineering and increased confidence in their ability to teach engineering;
- filled a need for innovative STEM curriculum for middle school-aged children in informal education.

Through My Window increased understanding of engineering concepts. For example, for over 800 students in AY15-16 afterschool programs in the underperforming Bridgeport, CT school district:

- 75% said their ideas about AI had changed some or a lot (81% among those who read *Talk to Me*)
- 75% said their ideas about engineering design had changed some or a lot (78% among those who read *Talk to Me*)
- 59% said their ideas about engineering ethics changed some or a lot (61% among those who *Talk to Me*)

Through My Window also broadened perceptions of engineers and impacted STEM identity for this cohort:

- 33% showed increased agreement that engineers do many different kinds of things
- 31% showed increased agreement that engineers design things to help people
- 31% showed increased agreement that "if I wanted to, I could be an engineer"
- 31% showed increased agreement that "I enjoy learning about engineering"
- 21% showed increased agreement that both girls and boys can be good at engineering

In summer 2016, 500 Bridgeport students used Through My Window as a STEM/literacy program. After using Through My Window:

- 85% agreed that engineers do many different kinds of things (vs. 72% before)
- 75% agreed that engineers design things to help people (vs. 68% before)
- 46% agreed that "If I wanted to, I could be an engineer" (vs. 38% before)
- 41% agreed that "I enjoy learning about engineering" (vs. 31% agreed)
- 83% agreed that both boys and girls can be good at engineering (vs. 76% before)

Nationally, over 11,000 students in 16 states used Through My Window. 410 educators attended professional development workshops.