Cummins and Iridescent partnership leads to lasting STEM education impact in local community

"These young learners have been empowered to develop their curiosity to understand how things work, their creativity to try new ideas and their persistence to find a solution despite failures. Schmitt Elementary appreciates the time and energy Cummins employees have given to better prepare our students for the future."

–Carrie Green, teacher at Schmitt Elementary

Cummins engineer Mukul Aggarwal talks with students about cantilever beams at Schmitt Elementary during the 2015-2016 school year

1. Background

Iridescent partnered with L.C. Schmitt Elementary (referred to as Schmitt) and Cummins to bring STEM support (curriculum and mentors) to students in grades 3-6 in Columbus, Indiana. Local Cummins engineers served as mentors to help engage students in the engineering design process to inspire as role models, learn the basics of engineering and science concepts through hands-on building, and improve their problem solving skills. The lead educator used Iridescent's Curiosity Machine (CM) platform and curriculum to guide students through Design Challenges (DCs), which are open-ended, hands-on projects that are inspired by real engineers' work. CM supports students, parents, educators, and mentors to build, learn, and teach using the engineering design process (EDP) to learn curiosity, creativity and perseverance. Funding for the program came from Cummins Inc., which is also based in Columbus. Cummins is a global power leader that designs, manufactures, sells, and services diesel and alternative fuel engines, as well as related components and technology, in over 190 countries and territories.

2. Pilot Program

Iridescent and Cummins partnership began through a pilot program at three local Columbus parks in the summer of 2015. The primary audience was underserved children who participated in the free summer camp held at the public parks. The secondary audiences were educators (camp counselors) who were trained to implement the courses and engineers who were trained to support. The main objective of this pilot program was to bring hands-on STEM learning to the Columbus, IN community, which was successfully accomplished. From this pilot, we were able to implement a long term and sustainable strategy to support Curiosity Machine, through our partnership with L.C. Schmitt Elementary. The initial pilot program was championed by the Director of Technology at Cummins. The school partnership was then turned over to an engineer at Cummins who helped recruit more mentors and bring the program to Schmitt Elementary.

3. Goals of Project

The broad goals of this project were to evaluate the reception of this novel STEM programming from the various stakeholders: educators, students, and volunteer engineers. In order to implement this project, each partner had various roles:

Iridescent:

- Provide training to educators to use and implement the Curiosity Machine (CM) platform in their classrooms
- Adapt CM online programming to a classroom (STEM lab) experience for building Design Challenges using the engineering design process to solve a real-world problem
- Provide access to a specific collection of videos and design challenges (DCs) with comprehensive instructions that were hosted online on the CM platform
- Support program implementation through online and in-person meetings for educators

Cummins:

- Provide skill-based volunteer opportunities for their engineers to feel more connected to their community and develop communication skills for their professional development
- Train engineers to use their expertise to support children's learning in-person and online
- Provide in-person and online mentors from Cummins to support each student with feedback, when student progress is posted on the CM platform

Schmitt:

- Incorporate hands-on engineering project based learning opportunities into their STEM lab curriculum
- Oversee program implementation, organize logistics, and recruit program participants

4. Program Scope

During the 2015-2016 school year, 380 students used the Curiosity Machine platform to create 9 design challenges over Fall and Spring quarters, which amounted to over 2,600 online submissions. This effort was led by a teacher at Schmitt Elementary. There were a total of 40 online mentors and 31 in-person mentors who invested over 220 hours working with students as volunteers.

Each DC was taught in 3 parts:

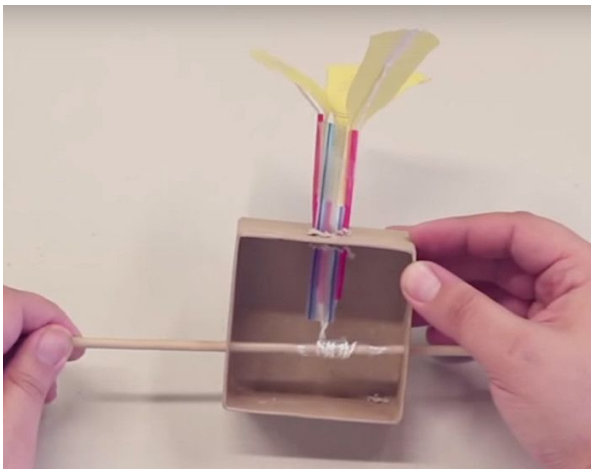
Session 1: A teacher showed the video, explained the DC, and then students planned the building of their DC. This plan was submitted to the online platform for feedback from mentors.

Session 2: Students built their DC and uploaded pictures, video, and/or written explanations of it to CM.

Session 3: Students continued to redesign and responded to in-person or online feedback on their DC. Mentors received training to effectively provide in-person mentoring as well as online mentoring to the students.

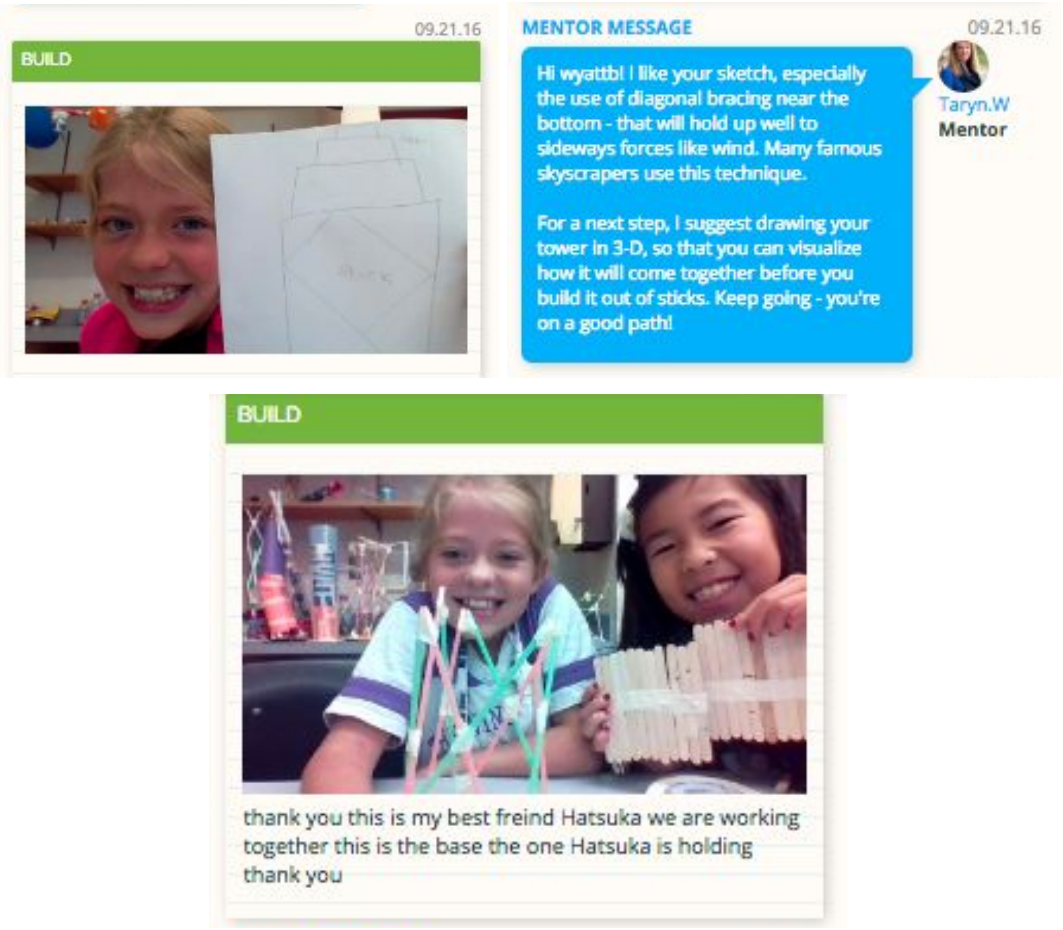
Example Design Challenges (DCs):

Build a Blooming Flower
Build a flower that can open to communicate with pollinating insects and birds.



Engineer an Air-Powered Spinning Machine
Build an air-powered spinning machine inspired by Boeing CST-100 Starliner.

Example of online mentor and student interaction on the Curiosity Machine platform:



Participant anecdotal feedback

Cummins:

"Growing up around many engineers, including my own father, provided me with valuable exposure to engineering as a career option,"

–Jennifer Rumsey, Vice President Chief Technology Officer at Cummins and the corporate sponsor of the initiative.

"It was a rewarding experience working with the 5th graders this semester. Looking forward to the next one."

"That was way fun! Thanks for letting me be a part of this and thank you for leading this for Cummins!"

Students:

"Thank you for helping with Curiosity Machine. I like that we can build and create stuff."

"Thank you for enlarging the circumference of my knowledge"

"Thank you for helping me with my projects I would never build stuff that works if you never helped"

"Thank you have been helpful in telling us what we need to change and what (you) think would work."

"Thank you for taking time from your day to help us build our contraptions."

5. Lessons Learned from Students

- Some students improved in their ability to complete and upload DCs after 2-3 weeks of practice on the CM Platform.
- Students have different, sometimes undocumented ways of planning their design challenges.
- Students engaged in hands-on design challenges more when mentors were present
- Design challenges can be adapted to a classroom setting and support educational goals

6. Challenges

- Although students viewed the instructional video in class and were instructed to complete a project plan, not all students uploaded their project plan to the CM website.
- Not all redesign or feedback was documented on CM-- mentors would give feedback in person, so some documentation is likely lost.
- Students were limited on time for each stage of the EDP which may have impeded the learning process for some of them.

7. Things to Improve

Iridescent

- Improve Educator training so that they can better support students to submit high quality projects and incorporate mentor feedback into the learning process
- Allow students to mentor other students after they prove mastery on a particular design challenge (& after training)
- Improve Educator Dashboard with a detailed assessment rubric and to monitor students' progresses

Cummins

- Continued support from senior leadership to improve mentor recruitment and training
- Continued support with more volunteers for mentors
- Transition a portion of fundraising to schools for more buy-in

Schmitt *with Iridescent's help*

- Build further capacity by engaging parents in 5 week Curiosity Machine evening Family Science program
- Provide student science test scores (by grade) to Iridescent to correlate with Curiosity Machine data
- Encourage students to do different designs beyond what they see in videos
- Budget time for students to upload submissions

8. Outcomes

"To me, this program is so successful because it creates a meaningful connection between Cummins employees, students and parents. "The teaching methods are designed so that students exercise scientific inquiry, critical thinking and their problem solving skills."

–Rafael DeVasconcellos, a Corporate Responsibility Project Leader at Cummins

Cummins Engineer Mentors
Cummins engineers (volunteers) learned the rewarding aspect of mentoring young people by transferring their knowledge and experience to help young people become inspired by engineering and science. They were able to help students apply the engineering design process and became role models of problem solving to students. They also learned to enhance their communication skills by providing feedback to children in simple language. Cummins was also able to mobilize their employee workforce to give back to the community and simultaneously help those employees to develop other helpful skills through this skill-based volunteer opportunity.

Students
Children learned to use the engineering design process to build various design challenges using their hands. By viewing the inspirational videos, students learned how real engineers and scientists try to solve problems in real-world challenges and some aspect of what they do on their jobs. With the instructional videos, they learned how to apply the process in a practical hands-on, open-ended way with many possible solutions. Through each step of planning, building, testing, redesigning and reflecting, they were able to learn how to apply the EDP to solve problems. They were also introduced to engineers through in-person and online mentoring provided by Cummins engineers. They were able to learn from role models on how to use the engineering design process to solve real challenges.

Schmitt
The school was able to host mentoring engineers to inspire and mentor students and open up their potential aspirations for careers in engineering and science. The dedicated teacher was able to introduce practical applications of engineering to students and facilitate the engineers' interactions with students. The school was able to bring several hands-on STEM project based learning opportunities to their students through the Curiosity Machine and their STEM Lab. There is a high likelihood of this program being sustainable beyond this school year as there is a large investment from the teacher and school leadership as well as buy-in from the students and parents.

Iridescent
Through partnership with dedicated educators and STEM professionals, Iridescent inspired and educated children toward STEM careers and taught ways to solve problems in a novel way that supplements standard education processes. Educators were trained to successfully implement Curiosity Machine's technology-based, hands-on engineering curriculum, and enthusiastic mentors were trained to communicate technical work and concepts to young students, and also give specific feedback on student work to inspire further exploration.

With these initial observations, learnings and outcomes, Cummins is deepening and broadening its relationship with Iridescent to successfully build a sustainable model in this community by providing the content and trainings to support all the stakeholders—including students, educators, mentors, and sponsors.