

Reimagining Library Pursuits: CREATE-ing Spaces for Inquiry and Technology-Based Learning

In many traditional models of community engagement and education, universities have positioned themselves as knowledge holders—entering into schools and communities to carry out research and then exiting without consideration for sustainability or the needs of area stakeholders. In contrast to this problematic approach, many innovative universities and labs are now considering a more asset-based, responsive, and equitable approach to working with partners. Housed at Carnegie Mellon University's School of Computer Science, the CREATE Lab (Community Robotics, Education, and Technology Empowerment, <https://cmucreatelab.org>) believes in combining human-robot interaction with a desire to disruptively redefine how communities use robotic technologies to make sense of their context.

This article offers two perspectives on the goals, activities, and learning experiences of this model: first, that of the Coordinator of Community Education and Engagement at the CREATE Lab and then that of a school librarian who participates as an educator partner in the CREATE Lab Satellite Network.

The University Partner—Jordan Mroziak

We aim to create self-sustaining communities of learning, expression, and technology usage as fostered with hands-on approaches to learning. This learning uses technology as inspiration for wonder and discovery, leading to lifelong learning skills such as teamwork, problem solving, and self-identification with technology as a tool for exploration and personal expression.

The technologies that have emerged out of the work at CREATE lab have focused on hands-on, inquiry-based learning that transcends traditional disciplinary boundaries. One of our most widely used technologies has been our Hummingbird kits. These kits have been implemented in literature, science, and physical education, pushing the boundaries of where, when, why, and how robotics are used in K-12 settings.

We emphasize transparency in the dissemination of new technologies, curricula, and evaluation methodologies so that both research and the effective use of technology in formal and informal learning settings can grow intentionally and accessibly. As part of our technology development practices, we intentionally partner with educators in a variety of contexts. Importantly, our work is deeply underpinned by our collective belief in the expertise of educators' knowing not only their content areas, but the needs of their learners. In this way, we aim to support educators as designers of learning while also empowering them to develop technological fluency.

The CREATE Lab Satellite Network is a unique organization that brings together innovation hubs, colleges of education, school districts, and educational product companies to create pathways for integrating new technologies into educational programs for technological fluency while simultaneously providing authentic capacity-building through professional development for pre-service and in-service educators.

The CREATE Lab's sustained relationship approach, in contrast to the project-by-project approach of traditional professional development models, enables deeper growth and makes possible outcomes that could not be otherwise imagined. We foster an ecosystem where educators and organizations are partners in thought, innovation, development, and engagement across projects: co-designing with our engineers and adapting our work for their unique learning environments. The longer we practice this approach, the more we find our partners gain agency and ownership over CREATE Lab projects, even initiating new ones. We seek out partners who work primarily with underserved and underrepresented communities, engaging and empowering teachers and students in locally meaningful ways, while bringing their needs and voice to bear on the processes of innovation.

Through this ongoing engagement, educators cultivate an adaptive understanding of technology, as a multifaceted and personally meaningful tool in teaching and learning. Significantly, working with educators necessitates a parallel evolution of our CREATE Lab thinking and technologies. As educators grow through experiences with CREATE Lab, the lab also evolves to better serve the needs and expectations of the educators.

The School Librarian Partner—Kristen Rowe

School librarians often work with public libraries and museums to provide students with more resources, but partnerships should go beyond traditional organizations. I have collaborated with groups such as local news outlets and companies from time to time, but building lasting relationships with organizations in the community can be valuable for not only students and teachers but for librarians as educators. Some of my strongest connections during my time at Plum Senior High School (Pittsburgh, PA) were with ABC CREATE, a STEAM education collaborative located at Penn State New Kensington and a regional hub of the CREATE Lab at CMU (https://satellite.cmucreatelab.org/projects/ABC_CREATE).

One benefit ABC CREATE provides to its member school districts is access to a lending library. I've borrowed equipment that my district could not afford to purchase on its own, such as Hummingbird robot kits, Speck air quality monitors, and drones. In some cases, this let us "test-drive" the equipment before we determined we would use it often enough to ask the district to purchase it. In others, although the equipment was necessary for one or two units—so having it available to us a few times a year was sufficient.

Another benefit of ABC CREATE is the opportunity to connect with other educators. This organization routinely hosts trainings on emerging technology and forums for educators to share best practices. Many of these events sparked ideas that I could bring back to my own library or share with teachers in my school. The CREATE Lab hosted a conference called CONTEXT: Tech and Data Fluency for Teaching and Learning (<http://www.contextconference.org/>) that brought Pittsburgh-area stakeholders in technology and education together to discuss new developments and ideas. I met several people at that event that led to partnerships for learning within my school.

One of the strengths of the librarian is that she works with teachers in all subject areas, so she can spread ideas throughout the school. Ideally, this will lead to cross-curricular connections. In

my experience, libraries are still strongly linked to the English department in many schools, so attending STEM events allows the librarian to infuse STEM into literary lessons. Teachers trust their librarian as an educational partner, so the librarian can leverage these relationships to introduce new strategies and technology to enhance student learning.

One example of this is when I had the opportunity to introduce basic coding and robotic skills to students in English classes, thanks to Hummingbird kits from ABC CREATE. Students read *A Brave New World* and then worked in groups to imagine their own utopias. After they set the rules and norms of their societies, they were able to visualize them by making a diorama that was set in motion using Scratch coding. Scratch is perfect for students who have had no prior experience with coding. Once they get the hang of the building-block-style platform, they can quickly try more advanced coding techniques.

This project was so successful and gained so much attention from students that other teachers began asking me to introduce the technology into their classes. I worked with health teachers to use the same equipment so students could create a moving scenario that illustrated the refusal skills they had been practicing as part of a drug unit. And because this technology can easily be scaffolded, we've used it to illustrate and expand upon concepts in other classes, such as English and psychology. Eventually students in a STEAM sampler class were able to construct their own Rube Goldberg machines.

After the successes of the Hummingbird robot projects, teachers allowed me to introduce more STEAM learning into their classrooms. I've taught units that included stop-motion filmmaking, website design, and virtual reality. In all cases, the project included some type of research and/or literacy connection—traditional strengths of the library. Because teachers had felt comfortable relying on me to teach these skills, they trusted me to introduce the STEM component as well. Gaining this level of confidence from teachers takes years of reliability and innovation from a librarian, but it's crucial for designing meaningful learning for students.

Robotics Tools and Resources for Educators

Hummingbird robotics kits (Birdbrain Technologies): <https://www.birdbraintechnologies.com/>

Parrot drones (Parrot Education): <https://edu.parrot.com/>

Speck air quality sensors (Airviz): <https://www.specksensor.com/>

Jordan Mroziak and Kristen Rowe

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