

Using Virtual Delivery to Build Interest in Technology Careers

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The goal of the Building Career Interest in Computer Science through Advanced Real-World Technology Projects (CICSTART) Program is to provide additional professional and technical skills to cohorts of high school students through a Saturday Program and inspire participants to pursue pathways that lead them to careers in the technician workforce. CICSTART is funded through the National Science Foundation (NSF) Advanced Technological Education (ATE) program, Grant #2113261. Program curriculum is continuously reviewed and modified to address current skills needed by the technician workforce including coding.

Program structure

CICSTART utilizes industry-driven, project-based learning (PBL); lessons in career and college readiness; and a summer teacher workshop. Each student session consists of five consecutive Saturdays and is taught by a team of high school teachers, community college faculty, and instructors with expertise in professional skills, teambuilding, leadership, technical writing, coding, and STEM disciplines. Mentors from college programs and industry are also brought in to provide examples of career pathways and illustrate the diverse backgrounds of successful technicians. Student participants are recruited from inner-city high schools as the target population is underrepresented populations in STEM disciplines.

While CICSTART was originally planned as in-person, the leadership team decided to shift to a virtual environment as the pandemic caused the closure of community college campuses where the program was to be held. Each cohort of the program is held for five consecutive Saturdays. Program modalities and curriculum were modified to shift to an online experience. Students also received a BBC Micro:bit, which will be discussed later, as a way to maintain a hands-on component during the virtual Saturday workshops.

Zoom is utilized for teleconferencing and Google Classroom for the learning management system. An important part of this program is teaching students how to work in teams. During the typical in-person workshops, students would work in teams to assemble and program mini-drones. Using virtual breakout rooms, students were still able to work as teams to complete specific teambuilding exercises as well as to work on their technology projects together.

For the professional skills modules, students learn the DISC (Dominance, Influence, Steadiness and Conscientiousness) Behavioral Model and how to work in a team environment. The DISC model is covered in great detail, so students learn not only about their behavioral style, but also how to recognize and interact with other behavioral styles. Student evaluations report that DISC learning is an important component of the program and is immediately useful to understand and communicate both in school and in their personal lives. Students also learn about the basic professional skills needed in a work environment and the educational pathways available to guide them to a technician career.

For the virtual technical skills modules, TinkerCAD is used for the study of electronics and CAD design for circuit theory and the creation of virtual circuits. Participants simulate simple electrical circuits. Students are first exposed to the theory behind electrical circuits and then

proceed with computer-aided drawing of virtual circuits using the software's drag and drop components, adjusting resistance and voltage, and measuring the corresponding currents and voltages using online meters. Both series and parallel resistor configurations are examined. Participants explore the CAD functionality of TinkerCAD with the construction of their own 3D designs using drag and drop geometries as well as geometry manipulation similar to parametric CAD drafting.

The BBC Micro:bit and the MakeCode online Integrated Development Environment (IDE) was adopted to allow a physical and online experience for programming. Students are provided with their own BBC Micro:bit device and challenged with writing programs for industry and real-world scenarios given to each team. For example, students code programs that allow them to measure the sound in their homes, play a rock-paper-scissors game, and measure the temperature with the integrated sensors of the BBC Micro:bit.

Sample Assignment for Circuit Work

Use TinkerCAD Circuits to create a series circuit with a 9V battery, 1 KOhm Resistor, and a LED. You will do, as a team, two simulations. For the first simulation, you will use two multimeters to show the voltage drop across the resistor and LED will add to be equivalent to the 9V battery. For the second simulation, you will use two multimeters to measure the current through each component is the same. Remember that when measuring current, the multimeters need to be placed in the path of the circuit or flow of electricity. For your submission, you will need to create a separate document and submit just one document for your team.

Outline for your submission:

Heading: Team Letter, Names of Students, Date, and Title for Assignment

Circuit 1 image

Circuit 1 summary and conclusion

Circuit 2 image

Circuit 2 summary and conclusion

You and your teammates will need to prepare to present your work. One teammate will be chosen at random to present.

You and your teammates are also responsible to make sure that your teammates have submitted past work as well.

Program Impacts

CICSTART has provided 57 inner-city students from four high schools with out-of-school, hands-on educational programs focusing on professional skills, technical writing and engineering technology competencies. The average participant demographics include 88% minority and 57% female students.

CICSTART's leadership team disseminates best practices through presentations, social media, publications and workshops at national conferences. A four-day Summer Teachers' Workshop brings high school and community college educators from throughout the United States to experience the same program that is used for the high school students. The participants are

presented with the same professional skills and technical skills modules that the student participants are given. Summer Teachers' Workshop participants are provided with stipends for their participation and have the opportunity to receive an additional stipend by submitting professional skills or technical skills curriculum based on what they learned during the workshop.

CICSTART's outreach efforts and the national dissemination of best practices for engaging underrepresented populations in technology careers has a national impact that will potentially increase the diversity of the technician workforce. The program has inspired participants to have confidence in their own abilities. Principals from participating high schools have commented that students who attended the CICSTART have demonstrated an improvement in their academics and behavior due to the knowledge of professional and technical skills that they have gleaned from the program. Students implement the concepts they learn from the DISC behavioral model into their social networks.