

Robotics as an Entrée to K-12 Computer Science for Underrepresented Students

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EXTENDED ABSTRACT

Large educational disparities exist in STEM education with women, minorities, and persons with disabilities all greatly underrepresented in STEM education and careers. Among the more difficult challenges in Computer Science (CS) education is engaging underserved high school students who have little previous experience with technology. This presentation will describe the results of three separate NSF projects that used robotics to promote understanding and awareness of CS concepts among students from underrepresented minorities.

The NSF-supported Multi-Tiered-Mentoring project (M3) focused on a Birmingham inner city high school with 98% African-American students. For one hour per week over a 10-week period, robotics instruction was provided to a mathematics class. The students learned how to program a robot while also understanding the real-world application of mathematics to problem solving. The training was replicated at 12 schools in Tuscaloosa and repeated over three years. The robot teams competed at the annual Alabama robotics contest, with one team finishing in first place in 2012, third place in 2013, and second and third place in 2014. Each year of the competition had over 300 students participating and included over 60 teams, with the M3 students often scoring higher than other teams from some of Alabama's top magnet schools. Pre- and post-surveys also documented both increased mastery of CS topics, but also heightened self-efficacy and interest in STEM careers.

Auburn's Robo Camp and Robotics and Game Development inclusive K-12 projects recruited and retained, since 2005, over 1,500 middle and high schools students, with a focus on girls and special needs students, in computing careers. The project was designed to foster interest in CS by providing an engaging and active programming development experience using several robotics platforms. In these programs, students are assigned individual tasks and work together in teams to complete assignments using Lego Mindstorms NXT, Lego Mindstorm EV3, and Lego Tetrix robots with Carnegie Mellon University's RobotC, C++, and Python languages.

On the NSF Robot Algebra Project at the University of Pittsburgh, Sam King (now at Auburn University) contributed to the design of surveys to measure teacher preparedness for implementing robotics in their classes that had a high percentage of students from under-represented groups at magnet public schools in Pittsburgh. It was easy to adapt the math curriculum to integrate robotics for a few weeks at those schools because they had (relative) autonomy. The quantitative evaluation results indicated that the Robotics intervention had resulted in increase in positive attitudes towards robotics/STEM.