Abstract

In recent years, the U.S. educational system has fallen short in training the technology innovators of the future. To do so, we must give students the experience of designing and creating technological artifacts, rather than relegating students to the role of technology consumers, and must provide educators with opportunities and professional development for identifying and supporting their students’ talents. This is especially important for the identification of student talents in computational thinking or engineering design where schools commonly lack educators well versed in those domains. Educational robotics systems are one possible method for providing educators and students with these opportunities.

Our creative robotics program, Arts & Bots, combines craft materials with robotic construction and programming tasks in a manner that encourages complexity such that a wide variety of student talents can surface while permitting integration with non-technical disciplines. This thesis describes our process in developing Arts & Bots as a tool for talent-based learning, which we define as leveraging understanding of a student’s talent areas to encourage and motivate learning. We look at this process and the outcomes of two multi-year Arts & Bots studies: the three year Arts & Bots Pioneers study, where we integrated Arts & Bots into non-technical classes; and the four year Arts & Bots Math-Science Partnership, where we further refined Arts & Bots as a tool for talent identification.

This thesis outlines our development of a teacher training model and case studies of two teacher-designed, Arts & Bots classroom projects. We present a taxonomy for novice-built robots along with other tools which support the identification of engineering design and computational thinking talent by non-technical teachers. Finally we describe our development of a suite of evaluation tools for assessing the outcomes of the Arts & Bots program along with our findings from that evaluation.