

# **Using “Learn By Doing” to Overcome Disparities in Prior Computer Programming Experience of Incoming Freshman EE Students**

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Freshman Electrical Engineering students arrive with large disparities in their prior exposure to computer systems and computer programming. In particular, some students have extensive knowledge and experience with programming from participating in high school robotics competitions or design projects; while many others have little or no prior exposure to computers beyond running applications on their smartphones, laptops, and game consoles. This experience disparity in the past resulted in students without prior expertise struggling to pass their freshman computer programming course; and carrying forward deficiencies of confidence and motivation to engage programming challenges in future courses. To remove this disparity, the EE 151 Introduction to Electrical Engineering Laboratory course at California Polytechnic State University was redesigned to incorporate a more extensive introduction to computer programming that assumed no prior programming knowledge. By developing motor control, line following, obstacle avoidance, and remote control operation of an autonomous robot, students are introduced to all basic programming structures and concepts using the simplified Arduino programming language. Students learn variable data types, functions with parameters and return values, conditional branching, and various forms of looping. Students are also introduced to top-down design, functional decomposition, and software testing techniques. A survey of EE 151 students demonstrated that while 55% of 97 incoming freshman EE students had little or no prior programming experience, only 6% of students still felt that they had little understanding of programming concepts after ten weeks of both independent and team-based programming assignments developing robot functions in hands-on laboratory assignments.