

## **WIP: Introducing Integrative Project Based-Learning in Electric Circuits Laboratory**

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Electric circuits laboratories aim to provide fundamental knowledge and essential experimentation skills to students. Yet, these laboratories generally consist of disjointed exercises where students often carry out experiments without truly understanding the concepts. On this poster we report our recent effort to alleviate the missed learning opportunity by introducing an exploratory project in electric circuits laboratory. The project integrates students' knowledge and skills from the experiments they perform in the laboratory. This effort aims to bring an inquiry-based active learning experience that has made its way into many other electrical engineering classes to our most fundamental course. The project was introduced in the Fall 2018 semester. Prior to this laboratory, students take an introductory engineering laboratory in their freshman year. The (freshman) engineering laboratory introduces students to basic principles, tools and instruments, circuit building and testing skills, and examples of microcontroller applications. In the presented work, students were provided with a guideline to design an electronic project that uses concepts and tools they have learned in the course, but may not use microcontrollers. Students worked in a pair. Three lab sessions, 9<sup>th</sup>, 11<sup>th</sup> and 14<sup>th</sup>, were dedicated for project discussion, troubleshooting, and presentation. Students were expected to spend additional time outside of the designated project sessions needed to complete to project. On the third project session, students presented their project, conducted demonstrations, and submitted a report that included design details, circuit diagrams, troubleshooting steps, results, and a reflection on team effectiveness. Assessments were conducted through (i) no-credit quizzes on fundamental circuit concepts, and experimentation and troubleshooting skills given on the first and the last project sessions, (ii) self-assessment and feedback surveys, and (iii) the overall instructors' assessments of their performance in the current and the following laboratory courses. On quizzes, percentage of students scoring above 80% increased from 12% (pre-activity) to 25% in (post-activity). The percentage of students expressing very high confidence in various concepts and abilities to apply those concepts increased from 33% in pre-activity survey to 53% in post-activity survey. The outcomes of this effort including detailed assessment results, our experience, different example projects, and our plan to assess the impact be will be presented.