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# Milling Circuit Pathways: Enhancing Students' Competencies and Experiences with Microelectronics (Resource Exchange)

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# Milling Circuit Pathways: Enhancing Students' Competencies and Experiences with Microelectronics

**Target Grade Level:**
10-12

**Content Areas:**
Electronics & Manufacturing

**Standards:**
EK-ETA-11 Advanced Electrical Diagrams /Schematics
EP-MP-1 Advanced Subtractive Manufacturing

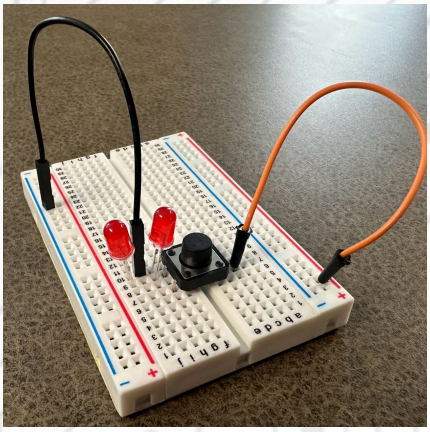
tinyurl.com/MillingPCB

In response to the growing need to foster microchip literacy among K-12 students and the CHIPS and Science Act, educational institutions and educators are exploring innovative ways to introduce young learners to the world of microelectronics. This creates an opportunity to develop design projects that not only nurture students' interest but also equip them with practical skills for the digital age. In this context, the "Milling Circuit Pathways" project aims to empower students by enhancing their competencies in microelectronics through hands-on experiences. To comprehend the intricacies of circuitry, students will embark on the journey of designing and crafting their own circuit boards. The pivotal aspect of this project lies in the use of milling techniques, which enables students to create intricate circuit pathways. Milling offers an efficient and precise method for etching circuit boards, providing students with a tangible and immersive learning experience. This goes beyond traditional electronic prototyping projects, such as breadboarding, where students can struggle with conceptual understandings by simply following schematics in the reproduction of specific projects. Also, breadboarding limits the permeance of any circuit designs that students do create. With this project, students can gain a deeper understanding of microelectronics but also acquire desirable 21st-century skills tied to circuit design and digital fabrication. Students will learn to use CAD software to create integrated electrical and mechanical designs and can carry those designs into physical products using printed circuit board manufacturing techniques that have historically been unavailable at the K-12 level. As an outcome, students will have a strong understanding of microelectronics regarding both how they work and how they are manufactured and be better prepared to enter the growing semiconductor/microelectronics industry.

SCALE K-12

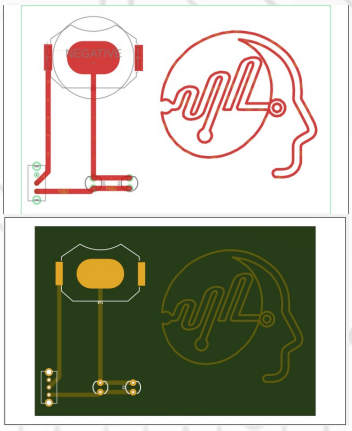
**Sean Wiseman, Victoria Constantine, Deana Lucas, Greg J. Strimel PhD., Tamara J. Moore PhD.**

## Circuit Design and Breadboarding



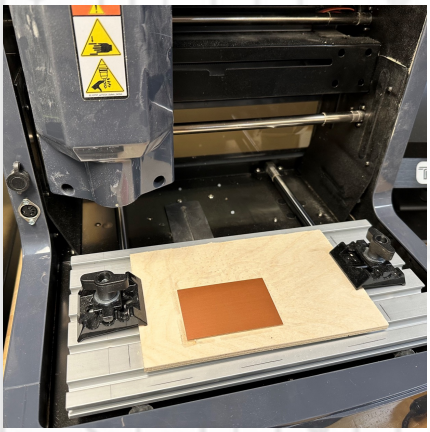
Students kickstart their circuit design journey by utilizing breadboards. Unlike traditional methods, breadboarding allows students to experiment and prototype circuits swiftly without the need for soldering.

## Electronic CAD Design



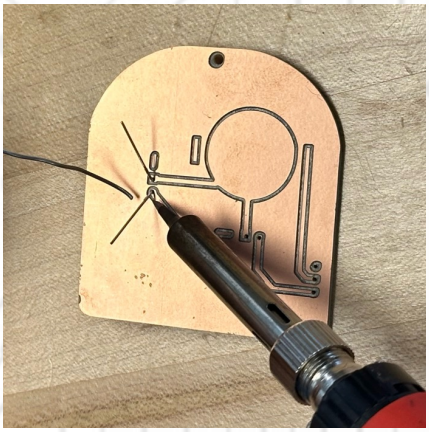
Students utilize Electronic Computer-Aided Design (CAD) to digitally refine and simulate their circuit designs before the milling process. This step enhances precision, troubleshooting skills, and overall mastery in microelectronics.

## CNC Milling and Manufacturing



Using Computer Numerical Control (CNC), students manufacture printed circuit boards, bringing their digital designs to life with efficiency and precision. This step refines students' skills in translating digital designs into tangible, functional circuitry.

## Soldering



In the final step, students solder components onto their printed circuit boards (PCBs), bringing their digital designs to life and showcasing a wholistic understand of the electronics design process.

SCALE K-12

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