SFS Microelectronics Supplement: Igniting High School Students' Interest in Semiconductors Through a Chip Camp

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Abstract

This paper introduces a work-in- progress of our recent project in offering a chip camp to local high school students, which was partially funded by NSF SFS through a supplemental grant. The camp was held during the fall break of the local student district, making it convenient for high school students to attend. The camp introduces the full lifecycle of semiconductor chip design and microfabrication with short lectures, hands-on exercises, demos and videos. We also offer a tour to a class 100/1000 cleanroom facility at the Micro/Nano Technology Center. Student survey results show that the camp has increased students' interest in studying and pursuing career in semiconductor or related field.

1. Introduction

The semiconductor industry is a key driver of innovation and economic growth worldwide. Given their central role in modern technology, semiconductors have far-reaching implications for industries and fields that touch nearly every aspect of our lives. However, there is a significant semiconductor talent shortage in United States [1]. Thus, it is important to provide semiconductor education broadly to prepare future workforce.

The paper introduces a chip camp we created at the University of Louisville (UofL) for high school students, which expose them to the full lifecycle of semiconductor chip design and microfabrication with short lectures, hands-on exercises, demos, videos, and tours to a class 100/1000 cleanroom facility at the Micro/Nano Technology Center. The goal of the camp is to ignite students' interest in studying and pursuing career in semiconductor or related field. As the demand for semiconductor knowledge grows, we believe the next generation of innovators will need to be well-versed in this essential technology to help shape the future of our world.

The microfabrication techniques are introduced to camp students in both lecture and practical components. The lecture component teaches the basic principles of microfabrication including photolithography, bulk micromachining from wet and dry etching, physical and chemical deposition, and electron microscopy for characterization. The practical component for the camp begins with a detailed tour of the cleanroom facility, studying previous projects and learning the functions of the major tools we have available.

A series of wafers are brought to the classroom for learners to have direct observations of a potential device at multiple stages of a fabrication process. These wafers were fabricated beforehand by experienced staff members at the MNTC. In addition, the camp has exposed participants to key microfabrication processes through wafer cleaving, photoresist development, and metal deposition lift-off.

2. Project Progress and Preliminary Results

Our target audience includes students in grades 8-12 from public schools, private schools, and homeschools in Louisville, Kentucky. The fall camp was held during Jefferson County Public Schools' (JCPS) fall break (October 1-4, 2024), ensuring students could participate fully. We set up a project website and reached out to local high school principals and science teachers to distribute information about the chip camp to their students. We successfully recruited 30 high school students for the fall camp, comprising 40% female and 60% male students.

We conducted a pre-survey and post-survey to assess students' interest in microelectronics and potential careers in semiconductors. The results are shown in Tables 1 and 2, respectively. Our findings indicate that the camp significantly increased students' interest in semiconductors. Notably, the percentage of students who were extremely interested in a semiconductor career rose from 7% to 36.8% after the camp, highlighting the camp's effectiveness in fostering high school students' interest in this field.

	Somewhat Interested	Interested	Very Interested	Extremely Interested
Pre-Camp	0.00%	14.30%	78.60%	7%
Post-Camp	0%	15.80%	47.40%	36.80%

Table 1. Camp participants' interests in microelectronics.

Table 2 shows the percentage of camp participants interested in pursuing a future career in semiconductors. Many of the students come from a top-ranked state magnet high school specializing in math and science and may already have a general interest in STEM. Our findings indicate that the camp increased the percentage of students who are very interested and extremely interested in a semiconductor career by 22.2% and 10.5%, respectively. Gaining more knowledge about semiconductors may have helped confirm and deepen their interest in this career path.

	Somewhat Interested	Interested	Very Interested	Extremely Interested
Pre-Camp	7.10%	57.10%	35.70%	0%
Post-Camp	16%	15.80%	57.90%	10.50%

Table 2. Camp participants' interests in choosing a future career in semiconductor.

3. Future Work

The chip camp in the fall is successful. In a short period of time, we were able to recruit 30 students from a variety of high schools, including both public and private schools. Built on this success, we plan to offer another chip camp in the summer of 2025 that will engage more high-school students. The evaluation results and feedback from students will be used to enhance the next chip camp.

Acknowledgement: This project was partially funded through an NSF SFS microelectronics supplemental grant NSF 2145929.

References:

[1] Prachi Patel. US universities are building a new semiconductor workforce. The CHIPS Act could require 50,000 new engineers. IEEE Spectrum, May 13, 2023.