New Calit2 Undergraduate Research Venture Calls All Hands for Hands-On Learning

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Tiffany Fox

Saura Naderi is a bit embarrassed to admit it, but when she first entered the Engineering Physics program at the University of California, San Diego's Jacobs School of Engineering, she didn't know what a transistor was.

"It's like being a journalist and not knowing the alphabet: An engineer should know what a transistor is," says Naderi, who graduated with a B.S. from UC San Diego in 2007. "But I'm half girlie-girl and half tomboy. While my classmates were taking toy electronics apart as kids, I was playing with Barbies."

Although UCSD's lower-division engineering courses provided theoretical insight into the world of electrical engineering, it was mainly imparted through complex formulas and abstract concepts. What Naderi wanted was hands-on "cookbook-style" learning, where she would get to not only read about a transistor, but play with one.

Naderi envisions CURV as the solution to that learning gap. A product of the California Institute for Telecommunications and Information Technology, the Calit2 Undergraduate Research Venture - under the direction of Calit2 Project Scientist Paul Blair - provides laboratory space and interactive workshops for students engaged in a variety of academic pursuits. CURV's first workshop taught more than 30 undergrads how to make their own electric guitar pedal using operational amplifiers, or "op-amps," to filter noise and amplify signals. It was so popular that 18 interested participants had to be deferred to a waiting list.

"As undergraduates, we don't have a lot of opportunities to get a visual, tangible understanding of what we're learning in our textbooks," explains Naderi, who now works with Calit2 Principal Development Engineer Phil Rios on the Veteran Affairs' San Diego Healthcare System's Virtual Health Clinic. "This guitar pedal workshop is the perfect example of how you can make the correlation between what you're learning in class and what it all means in the real world. We actually got to use this 'black box' that we hear about in courses to filter a guitar signal to create a different signal. Now the equations make sense."

In keeping with Calit2's mission to bring disparate academic disciplines together, CURV is open to students from all UCSD departments. The guitar pedal workshop, in fact, drew a significant number of students from the Departments of Music, Visual Arts and Biological Sciences, which led to some surprising collaborations, Naderi recalls.

"One of the things we're always hearing is that teaching others helps you learn the most," she notes. "What ended up happening is that we had electrical engineering (EE) students working with music and biology majors who didn't so much as know what a breadboard was. So the EE students would help the other two students, and learn something themselves. The nice thing is it all happened organically."

Present at the inaugural CURV workshop was Computer Engineering student Omeed Mirboud, who says the hands-on experience he received "gave me a reason to pay attention more in class."

"The workshop was definitely useful," he noted in a post-workshop questionnaire. "Some of the techniques I learned in class did become useful. But there definitely need to be more mentors, because I think it's the hands-on questions that are more important than the classroom ones." Naderi's reaction?

"I thought what he said was awesome. Now he knows why we're using these components. That's one student who is going to do better. That's effective!" Mabel Zhang, a computer science student and a Calit2 summer scholar, was also enthusiastic about the CURV workshop.

"It introduced me to some basic electronics - like identifying components and how a circuit works - in a way that was hands-on," she wrote. "It showed us what electronics can do. The people were helpful, including the participants. Although most people at our table didn't know what was going on at first, those who got it were happy to help others, so it seemed like no one felt intimidated or bored."

Naderi says that a few students approached her after the workshop and told her that simply identifying parts was a useful exercise. "Sometimes, pointing out what a capacitor is, what a breadboard is, can make all the difference," she notes. "It can be that fundamental, that basic."

The next CURV workshop will be May 28 and will feature a workshop on video game hacking All interested undergraduates are invited to attend. Although Calit2 allocates space to CURV on the sixth floor of Atkinson Hall, the organization is currently seeking funding. Naderi, in fact, spent $200 of her own money to fund the guitar pedal workshop.

"That's because I really want this to happen," she explains. "It's something that's great for students, but looking further down the line CURV could turn into an open lab where students could come in and work on their projects, things that have actual real-world applications. For me, just to be lab manager of something like that would be great. All I have to do is hang out in a lab and help students and work on my own projects? I think that would be so cool! I'd be set for life."

Media Contacts: Tiffany Fox, 858-246-0353, tfox@ucsd.edu