UC SANTA BARBARA

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George Yatchisin

Computer Science for All

In his final State of the Union speech, President Obama exhorted the American educational system to ensure that every student in the country gets hands-on computer science and math training to set them up for success in college and careers alike. Shortly thereafter, he announced the Computer Science for All Initiative to increase access to just such courses.

The Gevirtz School at UC Santa Barbara is responding to the president's call by studying how elementary school students learn computer science, in an effort led by Danielle Harlow, an associate professor of education at Gevirtz, and Diana Franklin, a former UCSB computer science faculty member now at the University of Chicago.

Working with graduate students and local teachers, Harlow and Franklin created Kids Engaged in Learning Programming and Computer Science (KELP-CS), a modular curriculum for fourth- through sixth-graders. The modules consist of 13-14 hours of computer science instruction, during which students complete activities either in the classroom or in a computer lab.

For the activities, students use a block-based programming environment called LaPlaya, where they snap together commands, or blocks, to create longer lines of code, or scripts. It's a more intuitive and basic method, educators say, than typing individual lines of code as one would in traditional programming languages such as Java or C++.

“Students are always excited to share what they’ve created, or help others who are struggling,” said Ali Hansen, a UCSB graduate student who teaches KELP-CS at a local elementary school. “I don’t think a class period goes by without hearing a student exclaim, ‘Aha!’ or ‘I figured it out!’ or ‘I did it!’”

In the first KELP-CS module, students learn the computer programming skills they need to create a digital story. Module two instructs them in the skills required to design a game. And in both modules, students complete lessons in the engineering design process — a key component of the Next Generation Science Standards for K-12.

“Although researchers are beginning to understand how best to teach computer science at the high-school level and middle-school level, we know comparatively little about effective instruction at the K-5 level,” Harlow said. “Our team, in its fourth year of research, has examined how children in fourth- through sixth-grade understand various computer science concepts, such as initialization, and what skills, such as language/reading, physics and mathematics, are required to complete our curriculum.”

The work goes beyond teaching computer science. As Harlow added, “Underrepresented groups have also been studied in our work, including English Language Learner (ELLs) and students with disabilities. We have also been helping teachers incorporate computer science in the classroom by connecting our curriculum to Common Core and Next Generation Science Standards and providing other tips for teachers.”

The knowledge and skills imparted by computer science also enable innovation and open doors. Many fields of science and business depend on computer science and an increasing number of jobs require skills in computing technologies — a trend sure to grow as computing becomes embedded more deeply in everyday commerce and society. As Diana Franklin puts it, “If K–12 schools are seeking to make students college- and career-ready, computer science should be part of the core curriculum.”

Obama’s Computer Science for All Initiative recognizes that increasing the opportunities for elementary school children — especially girls and other underrepresented minority groups — to learn computer science is an essential aspect of preparing students for computer science careers as well as technology-centered society. Gaining a deeper knowledge of computer science and its

fundamental aspects is essential not only to have a clear understanding of “what is going on under the hood” of computer software or hardware, but also to develop critical thinking skills that will serve a student throughout his or her life.

About UC Santa Barbara

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