

Evolving Education

Training the scientists and engineers of the future starts with teaching for the future. by Andrew Allan

As any evolutionary biologist will tell you, if you don't evolve, you perish. Throughout time, this has proved true not just for entire species, but for societies, organizations, companies, nations, and—especially—institutions of higher education, where change is essential to reaching the widest variety of students and to remaining competitive in an ever-expanding field of educational options.

And so, by modernizing the undergraduate core curriculum, restructuring the campus's writing center, founding a dedicated center for teaching and learning, and using the online arena to expand the Institute's educational reach, Caltech is undergoing an educational

evolution—an educational rewiring, if you will—that is changing the way students connect with faculty, faculty connect with students, and both interact with the information and ideas they're encountering together.

"One size fits all doesn't work anymore. We have a diversity of academic programs and a diversity of students, and the old way just isn't the solution," says Vice Provost Melany Hunt.

"There's a renewed vigor in the way we think about undergraduate education, and a commitment among the faculty to improve it," adds Jonathan Katz, chair of the Division of the Humanities and Social Sciences, who has been closely involved in Caltech's recent initiative to institute

a series of changes to update its core curriculum. This sequence of general education requirements has not been revised for nearly two decades.

"These changes have important implications not only for how our students will learn," Katz says, "but for how we as faculty will teach them."

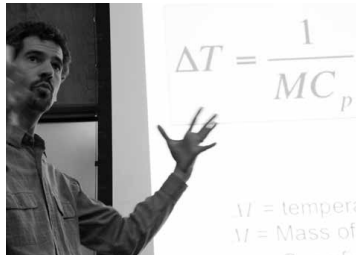
In the midst of all this reworking and rewiring, Minnesota photographer and educator Martin Springborg came to Caltech as part of his work on a nationwide photographic essay he's compiling; he spent three days taking shots of faculty and students as they went about the business of teaching and learning. The photographs on the next few pages are from that look at a day in Caltech's educational life.

At the Hixon Writing Center—under the leadership of campus writing coordinator and lecturer in writing Susanne Hall—students work one-on-one with professional and peer tutors to generate ideas, develop arguments, organize their thoughts, and enhance clarity in academic, technical, and personal writing.



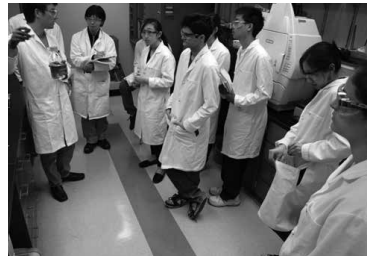
Cassandra Volpe Horii (left), director of the Caltech Center for Teaching, Learning, and Outreach, works with Professor of Biology and Geobiology Dianne Newman (on left at head of table, below) and her Principles of Biology course TAs to provide guidance in implementing the latest teaching methods, developing better lectures and more targeted homework assignments and exams, and obtaining and analyzing feedback from students.





Left: Caltech has a long history of exceptional teaching by faculty such as Professor of Geology and Geochemistry Paul Asimov, winner of the 2012 Richard P. Feynman Prize for Excellence in Teaching, who here is seen teaching freshmen in his geology survey course, Earth and Environment.

Right: Teaching and learning at Caltech take place as much outside the classroom as inside. Students taught by David Tirrell, Ross McCollum-William H. Corcoran Professor and professor of chemistry and chemical engineering, discuss their latest research in his Biomolecular Engineering Laboratory, which focuses on the design, construction, and characterization of engineered biological systems.



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The online arena is changing the way professors impart knowledge to students—both in university settings around the world and at home. Caltech is using burgeoning online technologies not only to improve the learning experience of students enrolled at the Institute but also to reach a wider audience of curious and science-literate individuals.

In mid-2012, Caltech joined with Coursera, an online education company that offers courses from the world's top universities and organizations free of charge. Through Coursera, Caltech launched a series of MOOCs—massive open online courses—at the end of last year. Bren Professor of Biology Henry Lester, Professor of Astronomy George Djorgovski, and Professor of Economics and Neuroscience Antonio Rangel

were the first Caltech professors to teach MOOCs through the Coursera platform.

“MOOCs provide the latest technology for several of our goals, such as developing Caltech students’ communication skills and pedagogical experience,” Lester says. “These activities will help to develop scientific professional careers in the 21st century.”

Vice Provost Hunt says that MOOCs have virtually unlimited potential for impacting teaching and learning, not only allowing Caltech faculty to share their research with a global audience but also enhancing education on campus by allowing students to go back and review lectures or brush up on previous lessons. Adding an online component also

allows teachers to rethink the structure of their classroom presentations.

“We hope that more and more of the passive process of listening to lectures happens at home on the student’s laptop,” says Hunt, “so that the classroom experience can become a more engaging, interactive process.”

It is with the goal of improving teaching and learning at Caltech—and ultimately the Caltech experience—that these types of additional resources are being made available to both students and teachers. This educational evolution, which is changing the way students and faculty connect and engage with each other and with information, will ensure that Caltech remains a uniquely challenging environment. [e&S](#)