I love teaching. I also like having lots of students in class who let me explain stuff that they find difficult, yet stimulating. Yet when I look back on the years I spent as a student, it’s obvious to me that things aren’t as they used to be. This is even more evident when comparing students based on their nationality and the education they received. Within our faculty, we have staff and students from more than 40 countries worldwide. Notably, our department has a strong focus on recruiting staff and students from abroad. It seems to me that students from Western European countries are losing interest and core skills in “hard” subjects like mathematics, physics, electrical engineering, (traditional) computer science, and so on. In contrast, the students from Eastern Europe and Asia that I get to see in class are often proficient in these fields in the same way that we, as teachers, were when we started our careers. From what I hear from colleagues in the US, the situation on the other side of the Atlantic is no different: many students from the US often lack the basic skills that we were taught.

Changing Students, Changing Professors
Apart from whether my observations are correct, let alone scientifically justified, we’re witnessing an unwillingness of local students to enter our hard sciences, and only with substantial effort have we been able to sustain the same (relatively low) level of influx. Focusing on computer science, what happened? One thing’s certain: students have changed. Whereas many of us got carried away by cool stuff such as a Commodore 64 and the first PCs, we’re now facing a generation with computing devices as small as a pack of credit cards, yet far more powerful than the IBM XT I used for my PhD studies. I see my own children use their iPods, smart phones, and even laptops as replacements for desktops. Yes, desktops will vanish, and we’ll be faced with a generation of students who don’t have the faintest idea what a computer is. They see only interface devices to a world we still call virtual but which is just as real to them as meeting their friends at school.

And we want to teach these students computer science? Science of what? Computers? Never heard of them.

But there’s much more going on. In a recent survey our university conducted, many students indicated that they’d be interested in enrolling in a broad science bachelor’s program. The idea was that we could offer a general first year, followed by tracks toward specific master’s programs in physics, chemistry, math, and so on. Such a program would let students postpone their final decision on what to study, but that’s not why students were interested — rather, they were looking forward to taking courses across disciplines.

This isn’t how my fellow students and I were brought up. I studied applied math and then made a switch to computer science. Many of my peers have done something similar. We’ve been schooled in a tradition of monodisciplinarity, perhaps switching topics from time to time, but never truly and seriously looking over the fence. Fortunately, many exceptions exist to this rule, but playing in the field of interdisciplinary research isn’t something that my generation has been taught or often had a chance to do. We’ve learned how to pick an area, build a fence around it, and stay there. We expect others to do the same, and we can collaborate with our peers in the same area, or with others that stay on their side of the fence.

So, here we have it: with a bit of exaggeration, I see students deprived of the sight of computers who use them all the time, and who barely,
if ever, see a distinction between what we call virtual and real worlds. These young people seem to fail in understanding why we distinguish computer science from math from physics, but also from social sciences, psychology, and so on, and why we force them to make a choice. Makes you wonder.

A Changing Field, Changing Subjects

So, what do we do with computer science curricula? I just argued that the student population’s interest is changing with regard to both general science and what they perceive to be computer science. My first step would be to no longer talk in terms of computer science, but rather informatics. Wikipedia describes this field as “a broad academic field encompassing human–computer interaction, information science, information technology, algorithms, and social science.”

Hmm, no computers. Sounds good.

Let’s not fuss too much about this description because it’s not really the point. What it tells us, at least, is that our discipline comprises so much more than what we traditionally call computer science or, for that matter, information science. It tells us that the field is crossing fences. In particular, it’s crossing the fence between what we’ve been teaching our students so far and what they’re doing all the time: social networking. Informatics encompasses social sciences.

When you think about this, it makes a lot of sense. We all know about ubiquitous computing, and the fact is, it’s here and rapidly expanding.

As computer scientists, we see numerous computing devices (and call them computers), but end users, including our students, see something else. I could argue that what they see is food for thought for social scientists. Isn’t it time that we start looking seriously over the fence? Even better, let’s break it down.

To me, this means that subjects unfamiliar to computer scientists should flow into our curricula. Many such subjects are grounded in disciplines such as economics, psychology, or sociology. They’re related to an exciting new field that’s being tackled by many different researchers, coined network science. Indeed, the networked world forms the core of so many articles in *IEEE Internet Computing* that I have no doubt that we should educate our students...
about this world they’re already so familiar with. After all, it also fascinates them. So, let’s teach them, and ourselves, about this new world.

Where can we start? Let me give you just one example of an approach I’ve taken toward crossing fences into the networked world. It’s a modest one, and I’ll be the last to say it’s the best.

Three years ago, our department revitalized its computer science curriculum. Being raised in applied math, and in particular combinatorics, and by now a hard-core computer systems researcher, I volunteered to teach a first-year course on graph theory. So, do I teach graph theory? It depends on how you look at it. I could argue that I teach about social networks, or the topology of the Internet, or about random networks. To do so, you need to know something about nodes and how they’re linked (we call them graphs), about special structures (like trees), about how messages can be delivered (called routing), and it helps if you can be precise (that’s called math). Also, what scientists do a lot is run experiments. So, I let my students play with Mathematica in combination with the excellent Combinatorica package, and now they’re running small-scale experiments on large graphs. They universally find it difficult (especially the math), but they also universally find it exciting and rewarding. If you want to have a look at the material, be my guest (www.distributed-systems.net/gtcn); it’s free.

Of course, just because something fascinates students doesn’t make it a good reason to teach it. If you haven’t done so yet, check out www.fourthparadigm.org to see what Jim Gray had to tell us about interdisciplinary research and the many excellent examples and insights of people who are crossing fences. So much work has yet to be done in this networked world, and I sometimes think that many of the topics in network science deserve higher priority than some of the topics we teach today. In this sense, I firmly believe it’s time we start learning about these things that our students find so normal, to become better teachers for our succeeding generation.

Of course, just because something fascinates students doesn’t make it a good reason to teach it. If you haven’t done so yet, check out www.fourthparadigm.org to see what Jim Gray had to tell us about interdisciplinary research and the many excellent examples and insights of people who are crossing fences. So much work has yet to be done in this networked world, and I sometimes think that many of the topics in network science deserve higher priority than some of the topics we teach today. In this sense, I firmly believe it’s time we start learning about these things that our students find so normal, to become better teachers for our succeeding generation.

Selected CS articles and columns are also available for free at http://ComputingNow.computer.org.