


# iLabs: Bringing High School Science Back to the Future



If you could transport yourself back 50 years to attend a high school science fair, chances are that you'd see a few volcanoes exploding from the chemical reaction of vinegar and baking soda. Perhaps you'd even spot some experiments involving testing water on litmus paper with an eyedropper, or the rolling of a small car down a ramp to test friction.



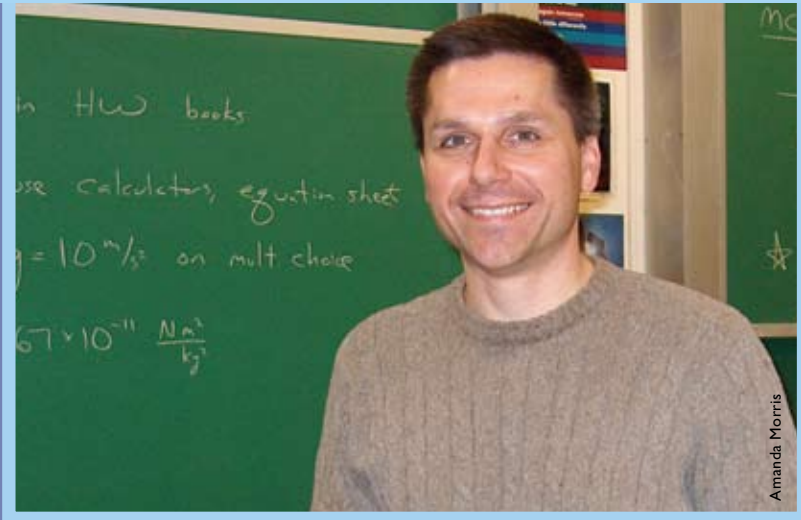
Kemi Jona, education and social policy and OSEP director

But now with the major advances in science and technology that have brought us the Internet, DNA sequencing, and electric cars, one would expect a modern-day science fair to look far more advanced. The sad truth, however, is that although the world has changed a lot scientifically in the past 50 years, the standard high school science course—in all of its test tube and Bunsen burner glory—has changed very little. And a science fair today would look shockingly similar to those of prior decades.

## Closing the Gap

“There is a growing gap between the practice of science that’s happening by researchers at Northwestern and other institutions, and what science looks like in high school,” says Kemi Jona, research associate professor and director of the Office of Science, Technology, Engineering and Math Education Partnerships (OSEP). “And that gap keeps getting bigger and bigger.”

To help close this ever-expanding gap, Jona—along with colleagues in OSEP at Northwestern and the Center for Educational Computing Initiatives at the Massachusetts Institute of Technology (MIT)—received a



Mark Vondracek, physics teacher at Evanston Township High School

\$1 million grant from the National Science Foundation to take the concept of online laboratories, or iLabs, and put them into high schools.

### Access Anytime, Anywhere

iLabs are experimental facilities that can be accessed through the Internet, allowing students to complete experiments from anywhere at any time via a webcam and remote controls. But the labs are not to be confused with the virtual world. The high-tech equipment is real and yields real scientific data. Moreover, due to its highly accessible nature, these labs can even be assigned as homework, allowing students to run more reports at home and collect more data.

“Students are always online and very tech-savvy now,” says Jona. “So the fact that they don’t get to touch the device doesn’t faze them at all.”

While iLabs are currently being used by large research institutions and universities as a way to share expensive scientific equipment, Northwestern is the first to make these remote labs accessible in high schools. Jona cites the example of the Large Hadron Collider in Switzerland, which is the world’s largest and highest-energy particle accelerator. “Scientists everywhere are able to run

experiments, collect data from the collider, and then analyze it without actually going there,” he says. “That’s probably the biggest example in the world. Now, sharing it for educational purposes is the piece where we’re really out in front.”

Of course, returning to the earliest stages of the universe with the Large Hadron Collider is material that students probably will never get to in any high school. But Jona has begun testing more appropriate instruments in the class of Mark Vondracek who teaches advanced physics at Evanston Township High School. Vondracek—who has known Jona for 13 years through Northwestern’s Center for Talent Development—and his class of juniors and seniors were able to access a Geiger counter and use it to measure a radioactive source at the University of Queensland in Australia to complete an experiment in radioactivity.

“The fact that you can control it from 8,000 miles away is cool,” says Vondracek, a former particle physicist and 2005 finalist for Illinois Teacher of the Year. “You can’t do true science within a classroom environment anyhow. Nowadays people don’t have the time or the facilities or the equipment.” >>



Map showing locations of iLabs around the world. Courtesy of MIT.

And lack of resources has been the biggest challenge facing science classes of today. Jona hopes that iLabs will help close the gap between schools with many facilities to share and those with less to work with.

“My vision is to level the playing field in terms of providing better and more equal access for students regardless of where they live. For example, there’s already some work going on with iLabs in Africa where there really are few resources available,” he says. “Ultimately, I hope to create a worldwide resource that bring more students into science and scientific careers.”

Vondracek adds that another problem with high school science is the reluctance for teachers to bring technology into the classroom. Whether it’s having colleagues from a different country give podcast lectures or taking virtual tours of science museums, he says that technology is a powerful learning tool that should be embraced rather than feared. “Even if students don’t go into science,” he says, “iLabs expose them to video conferencing and communication skills that are things they have to be comfortable with.”

### **iLabCentral.org**

To integrate iLabs into regular high school science curricula, Jona hopes to turn the web site iLabCentral.org into a hub where students and educators can go to

find, share, and access facilities, similar to an eBay-type marketplace. “Right now, you have to go fishing around on different web sites to find instruments, and it’s a real pain for teachers and students,” says Jona.

The site will also facilitate the payment of small fees that an institution might need to charge for usage. Right now, there are nine instruments available on the site: an inverted pendulum at the University of Queensland and several at MIT: a microelectronics device characterization lab, a dynamic signal analyzer, an educational laboratory virtual instrumentation suite, a polymer crystallization experiment, a shake table, a heat exchanger, force on a dipole lab, and neutron spectroscopy labs. Jona says that Northwestern will put some of its devices online starting this summer.

Next, Jona and his group in OSEP will perform a formal pilot test with 20 or 30 teachers and their students from around Chicago and the country. Vondracek hopes that once iLabs are made a more permanent part of the classroom, they will help students learn to think more like scientists.

“True research isn’t something you can get from a half-hour lab, from out of some book, that you do only one time,” he says. “Unless kids work on a single problem over a long period of time, they can’t get the gist of what science is all about.”

—By Amanda Morris