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No Test Tubes? Debate on Virtual Science Classes
By SAM DILLON

When the Internet was just beginning to shake up American education, a chemistry professor photographed thousands of test tubes holding molecular solutions and, working with video game designers, created a simulated laboratory that allowed students to mix chemicals in virtual beakers and watch the reactions.

In the years since, that virtual chemistry laboratory — as well as other simulations allowing students to dissect virtual animals or to peer into tidal pools in search of virtual anemone — has become a widely used science teaching tool. The virtual chemistry laboratory alone has some 150,000 students seated at computer terminals around the country to try experiments that would be too costly or dangerous to do at their local high schools. “Some kids figure out how to blow things up in half an hour,” said the professor, Brian F. Woodfield of Brigham Young University.

Now, however, a dispute with potentially far-reaching consequences has flared over how far the Internet can go in displacing the brick-and-mortar laboratory. Prompted by skeptical university professors, the College Board, one of the most powerful organizations in American education, is questioning whether Internet-based laboratories are an acceptable substitute for the hands-on culturing of gels and peering through microscopes that have long been essential ingredients of American laboratory science.

As part of a broader audit of the thousands of high school courses that display its Advanced Placement trademark, the board has recruited panels of university professors and experts in Internet-based learning to scrutinize the quality of online laboratories used in Web-based A.P. science courses.

“Professors are saying that simulations can be really good, that they use them to supplement their own lab work, but that they’d be concerned about giving credit to students who have never had any experience in a hands-on lab,” said Trevor Packer, the board’s executive director for Advanced Placement. “You could have students going straight into second-year college science courses without ever having used a Bunsen burner.”

Internet-based educators are seeking to convince the board, and the public, that their virtual laboratories are educationally sound, pointing out that their students earn high scores on the A.P. exams. They also say online laboratories are often the only way advanced science can be taught in isolated rural schools or impoverished urban ones. Online schooling, which was all but nonexistent at the elementary and secondary level a decade ago, is today one of the fastest-growing educational sectors, with some half-million course enrollments nationwide.

Twenty-five states operate public, Internet-based schools like the Florida Virtual School, the nation's largest, which has some 40,000 students. Virtual High School, a nonprofit school based in Maynard, Mass., has 7,600 students from 30 states and many countries. Susan Patrick, a former Department of Education official who is president of the North American Council for Online Learning, estimated that 60,000 public school students were enrolled in some online science course.

John Watson, an education consultant who wrote a report last year documenting virtual education's growth, said online schools had faced lawsuits over financing and resistance by local school boards but nothing as daunting as the College Board.

"This challenge threatens the advance of online education at the national level in a way that I don't think there are precedents for," Mr. Watson said.

The board signaled a tough position this year.

"Members of the College Board insist that college-level laboratory science courses not be labeled 'A.P.' without a physical lab," the board said in a letter sent to online schools in April. "Online science courses can only be labeled 'A.P.' if the online provider" can ensure "that students have a guided, hands-on (not virtual) laboratory experience."

But after an outcry by online schools, the board issued an apology in June, acknowledging that "there may be new developments" in online learning that could merit its endorsement.

Mr. Packer of the College Board said in an interview that the board had set up three five-member panels composed of biology, chemistry and physics professors and online educators, which are to meet in New York next month to review the online laboratories offered by Internet-based schools for A.P. courses.

The board's rulings will determine whether high schools can apply the A.P. designation to online science courses starting next fall on the transcripts of students applying to colleges, Mr. Packer said.

In recent conversations with college science professors, the board has encountered considerable skepticism that virtual laboratories can replace hands-on experience, he said.

But educators at several prominent online schools pointed to their students' high scores on A.P. exams.

On the 2005 administration of the A.P. biology exam, for instance, 61 percent of students nationwide earned a qualifying score of three or above on the A.P.'s five-point system. Yet 71 percent of students who took A.P. biology online through the Florida Virtual School, and 80 percent of students who took it from the Virtual High School, earned a three or higher on that test.

"The proof is in the pudding," said Pam Birtolo, chief learning officer at the Florida Virtual School.

Still, there is tremendous variety. A 2005 guidebook, "Finding an Online High School," compiled by Vincent Kiernan, a senior writer at The Chronicle of Higher Education, lists 113 Internet-based secondary schools, 32 of which offered at least one A.P. science course. Online curricula are anything but standardized, and new approaches to online laboratories are emerging at a dizzying pace, said Kemi Jona, a computer science professor at Northwestern University.

"It's not a one-size-fits-all landscape," Dr. Jona said.

The science courses offered by some online high schools draw on multiple Internet sites that provide data, then lead students through an analysis. At one site, for instance, operated by the University of Arizona, students collect data from the cells of an onion root and use it to calculate the duration of each phase in the cells' division.

Chemistry and other science courses at many Internet-based high schools include laboratories often characterized as "kitchen science," in which students use household materials — ice, cooking oil, glass jars — to carry out experiments.

"Make sure we have potatoes in the house," my daughter told me before her last lab," in which students studied osmosis, said Mayuri Shah, whose daughter Sonia is taking A.P. biology from the Florida Virtual School. Sonia, 16, enrolled in the online course because her high school in Lecanto, Fla., north of Tampa, does not offer it.

That is one of the most common reasons students sign up for online classes, said Ms. Patrick, the North American Council for Online Learning president.

"Thousands of schools in rural areas don't have science labs, but they have kids who want to go to college and need that science inquiry experience," she said. "Virtual science labs are their only option."

ConVal High School in Peterborough, N.H., offers more than a dozen science courses, but zoology is not among them. So Katherine Lantz, a junior, is studying it online.

One recent evening she was at home, moving through a virtual pig dissection screen by screen. One image showed a pig kidney, outlined by pulsing yellow dots.

"Whoa, that's kind of gross!" Katherine said. She clicked her mouse, causing a virtual scalpel to lay the pig's kidney open, its internal regions highlighted by blinking labels.

"It's nice to have it enlarged because if we were dissecting this in my school lab this would be hard to see," Katherine said. "I learn a lot online — as much as I would attending a physical class."

But Earl W. Fleck, the biology professor who created the virtual pig dissection, believes otherwise. Dr. Fleck began working on the virtual dissection in 1997 to help his students at Whitman College in Walla Walla, Wash., review for tests and to offer a substitute for those who, for ethical reasons, objected to working with once-living specimens.

Dr. Fleck, who is now provost at Hampden-Sydney College in Virginia, said students worldwide found the virtual dissection useful. But he called it “markedly inferior” to performing a real dissection.

“You don’t get the look and the feel and the smell,” he said.

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