CAUGHT IN THE WEB OF VIRTUAL EDUCATION

Peter J. Heaney

There is a scene in the movie *Jurassic Park* that must send a shudder down the spine of every reader of this journal. No, not the moment when a lightning storm disables the electronic security system and frees the *T rex* to enjoy a murderous rampage. It occurs when John Hammond, the evil genius who cloned extinct animals to make an amusement park, first shows his creation to a select band of incredulous scientists. Ian Malcolm, the brilliant mathematician who specializes in chaos theory, reacts in horror as he envisions the tragic cascade that will inevitably follow this act of hubris.

"Don't you see the danger, John, inherent in what you're doing here? … You stood on the shoulders of giants to accomplish something as fast as you could, and before you knew what you had, you patented it, packaged it, slapped it on a plastic lunch box, and now you want to sell it."

An annoyed Hammond retorts, "You don't give us our due credit. Our scientists have done things no one could ever do before."

Malcolm scathingly replies, "Your scientists were so preoccupied with whether or not they *could* that they didn't stop to think if they *should*."

When I first watched *Jurassic Park* in a movie theater off Route 1 in central New Jersey, I was taken aback when the audience spontaneously burst into whistles and sustained applause when it heard this line. Of course, Michael Crichton's career is wildly successful because he so skillfully taps into Americans' love–hate relationship with scientific innovation. The public adores high-definition television sets, and ipods, and laptops, but it simultaneously rebels against the stream of new discoveries that require constant assimilation. Scientists are equally confronted with the need to absorb black-box technologies. But we are bred to be comfortable with uncertainty and to embrace the unknown, and so we tend to react to these changes with a higher ratio of excitement to fear.

Still, there are some advances that place me uncomfortably back within that audience in the New Jersey cinema. This issue of *Elements*, dedicated to education in mineralogy, petrology, and geochemistry, provides an opportunity to open a forum on an explosive pedagogy that might lead us to ask whether we *should* even though we *can*: teaching courses using only the worldwide web.

Any criticism of classes that employ the web as the sole means of exchanging ideas with students must begin with a large number of concessions. One must acknowledge that web-based instruction has become extremely versatile with respect to the delivery of course content. Instructional text can be reinforced using images, animations, audio files, digital video, and hyperlinks to other websites. Assessments of student understanding can be automated through online exams that provide instantaneous feedback, which itself promotes learning. Most obviously, the web is universally accessible, and web-based courses can reach a diversity of students that is infinitely larger than can be touched by traditional lecture courses.

It is impossible to teach in Pennsylvania, with its vast rural population, and not appreciate the power and the generosity of the web as an instrument for higher education. Coal miners in Elk County may have neither the financial resources nor the time to enroll at the main Penn State campus, but the miracle of the worldwide web can bring the professor's lectern to their nearest computer. Any person who believes that education is the most effective means of raising one's quality of life can only applaud a technology that connects teachers and students over geographic, cultural, and economic distances that once proved intractable. Nobody questions the importance, even the nobility, of a medium that brings education to those who would otherwise not receive it.

But let's be honest. At my university and many others, web-based courses are not merely offered but are *tailored* to students who are living on campus. The rationale for this practice seems uplifting. Internet courses allow our students to avoid scheduling conflicts, and web instruction permits them to work at their own pace. And on-campus students sign up for these courses in droves. Two recently introduced web courses within my college each garnered nearly 2000 students per semester. This response in turn has sparked a positive feedback loop of the kind that the prescient Dr. Malcolm warned against. At Penn State as at most schools, departments are rewarded for placing large numbers of students in classroom seats, even when that term is used in its most figurative sense. Consequently, deans and department heads are encouraging faculty to develop more web-based courses that will drive our enrollment numbers to ever-higher levels.

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A professor risks being tagged a pedagogical Luddite if he or she suggests that we pause before proceeding with this revolution. Nevertheless, it strikes me that the community of Earth scientists is especially burdened with an obligation to resist this latest wave, because internet-based instruction is antithetical to almost every insight that experts in geoscience education have championed over the last decade. A digital image on a flickering computer screen cannot convey the essence of the actual object, and a knowledge of mineralogy and petrology can only be communicated when students are required to heft, touch, smell, see, in some cases even taste rocks and minerals using all of their senses. Similarly, electronic text cannot impart an understanding of processes like mineral growth and dissolution in the way that the hands-on doing of them can.

Web-based courses not only ignore the vital role of experiential learning, they also deny the central presumption on which universities were founded—that the personal give-and-take between teacher and student provides an educational bond that is unique and irreplaceable. Here is a telling comment from a laudatory review of one of our web-based courses from RateMyProf.com: "Never saw the guy, he's like the Wizard of Oz." Isn't it an abdication of our responsibility as teachers when the students reduce us to black boxes along with their ipods?

At a time when specialists in college education are exhorting professors to incorporate "active-learning" exercises in classes that are "student centered," it is ironic that universities are urging their faculty to develop courses that terminally separate the student from the kinds of sensory and personally interactive experiences that we know are the most effective means of transferring knowledge. I have sampled a number of online courses at several universities, and I would argue that this innovative mode of instruction is not substantively different from that most ancient form of learning: reading a book.

What's the latest by Michael Crichton?

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