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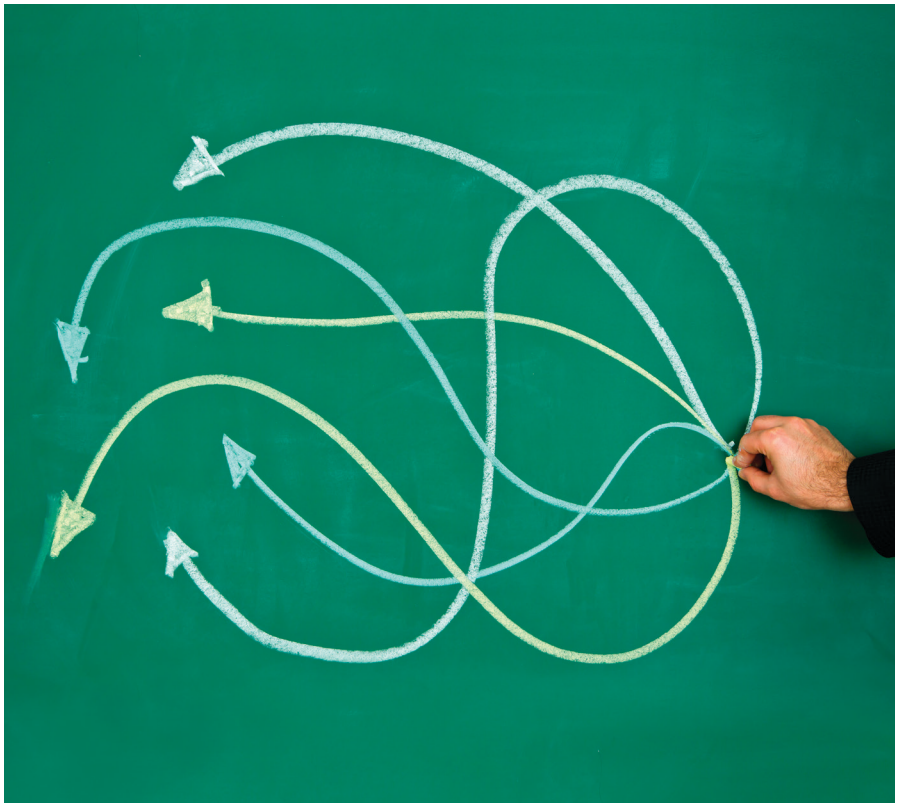
Viewpoint
Keeping Technology Promises

Considering new models for educational technology and methods.



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There is a collapse of confidence under way in U.S. colleges and universities. It is a collapse that has been documented in what seems like a steady stream of recent reports and books,[1,3,7,11] including my own.[5] Amid the many dire warnings there is one bright thread: advances in information technology are often viewed as a pathway to rebuilding public confidence in higher education by reducing costs, expanding access, improving outcomes, and increasing financial transparency. If technology could help rebuild public confidence, higher education would be better off for it, but without more engagement from the research community in attacking the problems facing the nation's colleges and universities I am not optimistic that will happen.

It would not be the first time that technologists have promised to improve education. The historical intersection of computing research and education is filled with examples that were more about computing and less about education. The result: a stream of educational technology that—at great expense—missed the mark, ultimately making promises that could not possibly be kept. Educational institutions were for the most part unfazed, but this time is different. The scale and size of the underlying problems are enormous. The pace of change is frightening, and there is genuine fear that higher education is an economic bubble that is about to burst. This time the system cannot withstand the shock of another generation of unkept technology promises.

I have found myself in recent months increasingly involved in strategic planning sessions, media conversations, and public debate of measures that might help stem the tide of bad news about high tuition, student debt, educational quality, and low completion rates. It is a national conversation in the U.S. that mainly engages economists, sociologists, and professionals who specialize in university administration. It is an important discussion and although there is a compelling argument for rapid innovation to disrupt the status quo, academic computer science has been on the sidelines for much of it.

Sentiment is strong for sweeping changes in higher education. Everything from financial transparency and greater scrutiny of intercollegiate athletics to clearer productivity and accountability standards is on the table. There is no shortage of "Big Fix" solutions that—improperly formulated—run the risk of doing massive damage to the great U.S. system of public and private universities.

Technology is what I would call a "Small Fix" solution. Technology's disruptive power does not necessarily require a Big Fix as a prerequisite. The right innovations—and the innova-

tions they in turn spawn—could push the discussion in a very different direction. Let's take the issue of reducing classroom costs as an example. In the public mind, technology is the surest path toward reducing overall costs.

It is a promising idea, but technology has had remarkably little impact on classrooms. For the past millennium classrooms have consisted of spaces for a teacher to stand, facing rows of seated students. Chalkboards did not make a classroom appearance until 1801. They were an immediate hit. They were inexpensive, easy to use, and they did not require much upkeep. Despite a constant flow of gadgets and renewed technology promises, the blackboard was the last invention that had such obvious pedagogical value that it became a ubiquitous classroom fixture.

A recurring technology promise is to reduce costs by replacing human teachers with automata. It is an elusive goal, but that has never kept us from designing computers to make live classrooms more efficient. The most spectacular attempt was called PLATO. Backed by Control Data Corporation, whose CEO Robert Norris predicted that most of the company's revenues would come from PLATO and related products and services, the total R&D investment in PLATO soon topped a billion dollars, a cost that CDC tried to recover by unrealistic pricing to universities. By the time Norris stepped down as Control Data CEO in 1986, the company was looking for an exit strategy for PLATO and the education market.

In the wake of PLATO, dozens of projects made more determined attempts to marry technology with traditional classrooms—in effect, to define the classroom of the future. But, aside from some minor tweaks to the blackboard's user interface, classrooms have remained virtually unchanged. Underneath it all, after few of the technology promises were kept, the classroom of the future had little to do with education. When I asked Classroom 2000 project director Gregory Abowd—who reluctantly shuttered the doors to his laboratory in 2002—about the apparent resistance of classrooms to change, he disagreed with my characterization. "I don't think the classrooms had been immune to technology," he told me. *There was lots of technology, but much of it was in the aid of the presenter of the material and not for the students who were struggling to keep pace with the increased flow of information.*[5]

And it is not only classroom technology that failed to live up to its promise. A parade of Learning Management Systems has given us a glimpse of how administrators would like to stitch together content, back-office infrastructure, and classroom delivery into the kind of enterprise-quality software behemoths that keep large corporations humming in compliance with hundreds of business and market constraints. It is an idea that has been rejected in certain terms by radical innovators like education technologist and self-described EduPunk Jim Groom at the University of Mary Washington in Fredericksburg, Virginia. He would like to see a very different approach: *The whole idea is a reaction to the over-engineered, badly designed, and intellectually constraining technology that has been foisted onto the American higher education system as a substitute for deep reflection about what the universities should be evolving into.*[5]

What are universities evolving into? Nobody knows for sure, but we know what is not working today. We in fact know a lot about the Failed Assumptions of our current system:

- A group-oriented vision of an instructor broadcasting to a classroom of pupils, passive except for recitations and exams.
- A factory model of efficiency in which 18–24-year-old cohorts with uniform interests and abilities are co-located and experience education in lockstep fashion.
- A language and culture of assessment that seems borrowed from a century in which a fascination with quality on the factory floor seeped into the administration of universities and their programs.

It is a common meme among non-technologists that technology is responsible for depersonalizing and sterilizing education. An impersonal, sterile learning experience is one of the failures of education, but it is difficult to blame technology for that. It is much more likely the real fault lies with the Failed Assumptions.[4] They are certainly what provoke rage among traditionalists like Humanities professor Laurie Fendrich: *Outcomes-assessment practices in higher education are grotesque, unintentional parodies of both social science and "accountability." No matter how much they purport to be about "standards" or student "needs," they are in fact scams run by bloodless bureaucrats who, steeped in jargon like "mapping learning goals" and "closing the loop," do not understand the holistic nature of a good college education. For all the highfalutin pronouncements accompanying the current May Day parade of outcomes assessment, in the end they boil down to a wholesale abandonment of the very idea of higher education.*[5]

Here is a set of principles, the basis for a set of assumptions for educational technology. It is not a complete list, but it has been enough to start a discussion at Georgia Tech, where the Office of the Provost has organized to place the newly chartered Center for 21st Century Universities at the center of a new ecosystem. It is an attempt to inject engineering-style experimentation into educational innovation by actively identifying, promoting, and supporting many—often competing—approaches to change.[10] Each of the principles summarizes a movement in higher education, and together they constitute a technology-driven change agenda.

▸ **Open CourseWare and Open Certification:** Universities have over the last decade lost their stranglehold as gatekeepers. Traditional universities that hold content too closely will find their value eroded.

▸ **Open and Democratic Systems:** Universities cannot beat the economies of scale of a global market and will have to adapt to whatever technology their stakeholders use to connect to courses, professors, and learning networks.

▸ **Digital Identities:** New college students approach their colleges with existing digital identities, and it will be the role of the university to recognize, preserve, extend, and enhance those identities.

▸ **Ascendance of Learning Communities:** Web-based delivery, new social theories of capital formation and flow, and the explosive growth of both students and schools in a world that has been flattened by economics and politics enables and rewards global learning communities. These communities challenge the exclusive authority of traditional campuses.

▸ **Transformative Power of Technology on Content:** It is a unique capability of information technology to act on itself, to discover hitherto hidden patterns, or even to accelerate the creation of new ideas, theories, and ways of thinking about the world.

Georgia Tech is unusual in its institutional embrace of disruptive change, but it is hardly alone. There is already a hotbed of innovation surrounding some of these principles. For example, MIT's intention to offer inexpensive credentials for satisfactory completion of its online offerings will certainly require business models and platform technologies that do not yet exist.[8]

The departure[6] of Stanford faculty whose Massive Open Online Course (MOOC) drew tens of thousands of students raises profound questions about how technology hollows out the value proposition of traditional institutions. Startups like OpenStudy use the value systems of online games and social networks to redefine the idea of a scholarly community.[9]

Still others aim to replace expensive, process-heavy learning management systems with lightweight open publishing models. The language of federated identities and intelligent tutoring seems to be everywhere. These are not ideas that are aimed at new gadgets or quick fixes. They threaten the status quo. They are important, but they do not represent a new wave of research.

What are universities evolving into? Nobody knows for sure, but we know what is not working today.

Most innovation is not taking place in computer science. In fact, areas like e-textbooks—low-hanging fruit for dramatic transformation—have been remarkably untouched by computing researchers. This is especially important for publications like *Communications*, because you would expect fundamental advances that transform content to be first visible here. There is a vanguard of change in scientific publishing but computing is not yet part of it.

UCSD Pharmacology professor and winner of the 2007 Microsoft Research Jim Gray e-Science award Phil Bourne has been at the head of an Open Science movement that has used new publication technology models to transform the pace of scientific discovery. A founder of PLoS, the Public Library of Science, Bourne has a deep belief that the idea of scientific text as a static object is already obsolete.

Bourne refers to this as "unleashing the full power of the Internet to transform research" by transforming the way science is reported and communicated to students[2] Bourne, for example, is a founder of SciVee.tv, a Web 2.0 platform for synchronizing written text and video in what bioinformaticists call PubCasts. This simple idea fundamentally alters the workflow of scientists, but it also places new burdens on authors who have to adapt to an unfamiliar way of authoring text.

PubCasting is an example of the transformative power of technology on content and makes fundamental use of open content and open system, but, to achieve its full potential, educators will have to teach students how to communicate using these new models. Our publications will have to embrace the new technologies.

How fitting it would be for *Communications* to become transformative for educational technology. It might be the seed for innovation that would move computing to the center of the U.S. national debate about the fate of colleges and universities and for once keep technology's promise.

Addendum

In the 12 months since this column was written, higher education has been rocked by computer scientists at top research universities. Stanford spin outs, Coursera and Udacity, and edX, a Harvard/MIT joint venture, are the kinds of experiments I called for in my original column submission and their principals have taken seats at the very tables I cited. These are important experiments, but they do not come close to scratching the surface of what computing technology might accomplish. It remains my hope that computing researchers will engage in the process of redefining higher education. C

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