Stressing Liberal Arts

It started before I was born. My biological mother was a young, unmarried college graduate student, and she decided to put me up for adoption. She felt very strongly that I should be adopted by college graduates, so everything was all set for me to be adopted at birth by a lawyer and his wife. Except that when I popped out they decided at the last minute that they really wanted a girl. So my parents, who were on a waiting list, got a call in the middle of the night asking:

"We have an unexpected baby boy; do you want him?" They said: "Of course." My biological mother later found out that my mother had never graduated from college and that my father had never graduated from high school. She refused to sign the final adoption papers. She only relented a few months later when my parents promised that I would someday go to college.

And 17 years later I did go to college. But I naively chose a college that was almost as expensive as Stanford, and all of my working-class parents' savings were being spent on my college tuition. After six months, I couldn't see the value in it. I had no idea what I wanted to do with my life and no idea how college was going to help me figure it out. And here I was spending all of the money my parents had saved their entire life. So I decided to drop out and trust that it would all work out OK. It was pretty scary at the time, but looking back it was one of the best decisions I ever made. The minute I dropped out I could stop taking the required classes that didn't interest me, and begin dropping in on the ones that looked interesting.

It wasn't all romantic. I didn't have a dorm room, so I slept on the floor in friends' rooms. I returned coke bottles for the 5¢ deposit to buy food with, and I would walk the 7 miles across town every Sunday night to get one good meal a week at the Hare Krishna temple. I loved it. And much of what I stumbled into by following my curiosity and intuition turned out to be priceless later on. Let me give you one example:

Reed College at that time offered perhaps the best calligraphy instruction in the country. Throughout the campus every poster,
every label on every drawer, was beautifully hand calligraphed. Because I had dropped out and didn’t have to take the normal classes, I decided to take a calligraphy class to learn how to do this. I learned about serif and sans serif typefaces, about varying the amount of space between different letter combinations, about what makes great typography great. It was beautiful, historical, artistically subtle in a way that science can’t capture, and I found it fascinating.

None of this had even a hope of any practical application in my life. But ten years later, when we were designing the first Macintosh computer, it all came back to me. And we designed it all into the Mac. It was the first computer with beautiful typography. If I had never dropped in on that single course in college, the Mac would have never had multiple typefaces or proportionally spaced fonts. And since Windows just copied the Mac, it’s likely that no personal computer would have them . . . Of course it was impossible to connect the dots looking forward when I was in college. But it was very, very clear looking backwards ten years later.

Again, you can’t connect the dots looking forward; you can only connect them looking backwards. So you have to trust that the dots will somehow connect in your future. You have to trust in something—your gut, destiny, life, karma, whatever. This approach has never let me down, and it has made all the difference in my life.

Steve Jobs’s story underscores that the inspiration for technological breakthroughs is not always rooted in technological knowledge alone. Math and science are necessary—critically necessary—but they are not sufficient. I think one reason America has always been a leader in innovation of new products and services—from IBM to iPods—is that our society has always valued both technology and liberal arts. In our justifiable desire to leave no child behind, we need to make sure that we don’t leave art and music and theater and literature classes behind as well. It would undermine a critical source of our economic strength and our ability to generate good new middle jobs and the workers to fill them.

As Marc Tucker notes:

These countries that produce the most important new products and services can capture a premium in world markets that will enable them to pay high wages to their citizens . . . But that kind of leadership does not depend on technology alone. It depends on a deep vein of creativity that is constantly renewing itself, and on a myriad of people who can imagine how people can use things that have never been available before, create ingenious marketing and sales campaigns, write books, build furniture, make movies, imagine new kinds of software that will capture people’s imagination and become indispensable to millions.

This is a world in which a very high level of preparation in reading, writing, speaking, mathematics, science, literature, history and the arts will be an indispensable foundation for everything that comes after for most members of the workforce. It is a world in which comfort with ideas and abstractions is the passport to a good job, in which creativity and innovation are the key to a good life, in which high levels of education—a very different kind of education than most of us have had—are going to be the only security there is.

A world in which routine work is largely done by machines is a world in which mathematical reasoning will be no less important than math facts, in which line workers who cannot contribute to the design of the products they are fabricating may be as obsolete as the last model of that product, . . . in which software engineers who are also musicians and artists will have an edge over those who are not, as the entertainment industry evolves. [A world] in which it will pay architects to know something about nano-technology and small businessmen who build custom yachts and fishing boats will be able to survive only if they quickly learn a lot about the scientific foundations of carbon fiber composites.

As I have said, India and China have provided large numbers of their young people with solid foundations in math and science, and it has been
extremely important in their rise out of poverty. But it is no accident that when you talk to Indian and Chinese businesspeople and even educators, some now openly express their concerns that if math and science are not leveraged by art, literature, music, and the humanities, their countries will be at a competitive disadvantage as they try to get to the next level of global competition.

Jerry Rao, the cofounder of Mahindra, the big Indian outsourcing firm, put it to me this way: "We have no one going into the liberal arts and everyone going into engineering and MBAs. We're becoming a nation of aspiring programmers and salespeople."

Fifty years ago, the Sanskrit scholar was respected in India, Mr. Rao noted, but today it is all about becoming an engineer, a programmer, an MBA, or a doctor. "More people will get Ph.D.'s [in the study of] Sanskrit in America this year than in India," Mr. Rao asserted, "and Sanskrit is the root of our culture."

"If we don't have enough people with the humanities, we will lose the [next generation of] V. S. Narayan and Amartya Sen," he added, referring to the Indian-Tamilian author and the Indian economist, both Nobel laureates. "That is sad and dangerous."

Right Brain

Finally, if creativity depends on connecting disparate dots, then we need to be educating our young people not only in more dots, à la the liberal arts, but also in the ability to think horizontally—to mesh together different perspectives and disciplines to produce a third thing. That skill is something that happens on the right side of our brains—and educators need to think about how we nurture that. Daniel Pink, author of A Whole New Mind: Moving from the Information Age to the Conceptual Age, explains:

Scientists have long known that a neurological Mason-Dixon line cleaves our brains into two regions—the left and right hemi-

spheres. But in the last 10 years, thanks in part to advances in functional magnetic resonance imaging, researchers have begun to identify more precisely how the two sides divide responsibilities. The left hemisphere handles sequence, literality, and analysis. The right hemisphere, meanwhile, takes care of context, emotional expression, and synthesis. Of course, the human brain, with its 100 billion cells forming quadrillion connections, is breathtakingly complex. The two hemispheres work in concert, and we enlist both sides for nearly everything we do. The structure of our brains can help explain the contours of our times.

Until recently, the abilities that led to success in school, work, and business were characteristic of the left hemisphere. They were the sorts of linear, logical, analytical talents measured by SATs and deployed by CPAs. Today, those capabilities are still necessary. But they're no longer sufficient. In a world upended by outsourcing, deluged with data, and choked with choices, the abilities that matter most are now closer in spirit to the specialties of the right hemisphere—artistry, empathy, seeing the big picture, and pursuing the transcendent.

If we want more of our young people to be untouchables—that is, people with jobs that "a computer or robot cannot do faster or some talented foreigner cannot do cheaper and just as well," we need to focus education on constantly developing our students' right-brain skills—such as forging relationships rather than executing transactions, tackling novel challenges instead of solving routine problems, and synthesizing the big picture rather than analyzing a single component," argues Pink.

We're not all going to lose our jobs tomorrow... But as the cost of communicating with the other side of the globe falls essentially to zero, as India becomes (by 2010) the country with the most English speakers in the world, and as developing nations continue to mint millions of extremely capable knowledge workers, the professional lives of people in the West will change dramatically. If
number crunching, chart reading, and code writing can be done for a lot less overseas and delivered to clients instantly via fiber optic cable, that's where the work will go.

But these gusts of comparative advantage are blowing away only certain kinds of white-collar jobs—those that can be reduced to a set of rules, routines, and instructions. That's why narrow left-brain work such as basic computer coding, accounting, legal research, and financial analysis is migrating across the oceans. But that's also why plenty of opportunities remain for people and companies doing less routine work—programmers who can design entire systems, accountants who serve as life planners, and bankers expert less in the intricacies of Excel than in the art of the deal.

"Now that foreigners can do left-brain work cheaper," Pink argues, "we in the U.S. must do right-brain work better." You cannot stress that enough. "Now that foreigners can do left-brain work cheaper, we in the U.S. must do right-brain work better."

He elaborates:

Last century, machines proved they could replace human muscle. This century, technologies are proving they can outperform human left brains—they can execute sequential, reductive, computational work better, faster, and more accurately than even those with the highest IQs. (Just ask chess grandmaster Garry Kasparov [who lost a match to a chess-playing computer].)

To flourish in this age, we'll need to supplement our well-developed high-tech abilities with aptitudes that are "high concept" and "high touch." High concept involves the ability to create artistic and emotional beauty; to detect patterns and opportunities; to craft a satisfying narrative; and to come up with inventions the world didn't know it was missing. High touch involves the capacity to empathize, to understand the subtleties of human interaction; to find joy in one's self and to elicit it in others; and to stretch beyond the quotidian in pursuit of purpose and meaning.

Developing these high concept, high touch abilities won't be easy for everyone. For some, the prospect seems unattainable. Fear not (or at least fear less). The sorts of abilities that now matter most are fundamentally human attributes. After all, back on the savannah, our caveperson ancestors weren't plugging numbers into spreadsheets or debugging code. But they were telling stories, demonstrating empathy, and designing innovations. These abilities have always been part of what it means to be human. It's just that after a few generations in the Information Age, many of our high concept, high touch muscles have atrophied. The challenge is to work them back into shape.

But how exactly do you go about nurturing your right-brain skills? I have to leave the details to education experts. But I would guess that one way you nurture your right brain is by doing something you love to do—or at least like to do—because you will bring something intangible to it, something out of your right brain, which cannot be easily repeated, automated, or outsourced. As Pink put it: "The sorts of abilities that matter most now it turns out are also the sorts of things that people do out of intrinsic motivation. Relatively few people become accountants out of a sense of intrinsic motivation. But intrinsic motivation is what propels people to become creators and empathizers, to become designers and storytellers and counselors and consultants. This weekend there will be accountants painting watercolors in their garages. There will be lawyers writing screenplays. But I guarantee you that you won't find any sculptors who on weekends will be doing other people's taxes for fun. In other words, there is a growing congruence between the sorts of things that people do because they love doing them and the sorts of things that confer economic advantage."

And so, concludes Pink, when you hear your parents or your college graduation speaker telling you to "do what you love," they are not giving you some syrupy pablum. They are giving you a survival strategy.
TUBAS AND TEST TUBES

So let's work backward now just one more step. If the jobs of the new middle require you to be a good collaborator, leverager, adapter, explorer, synthesizer, model builder, localizer, or personalizer, and these approaches require you, among other things, to be able to learn how to learn, to bring curiosity and passion to your work, to play well with others, and to nurture your right-brain skills, what does that mean specifically for education?

Again, I am not an educator, so I come to this question with great humility. I am a reporter, though, and I can report that there are some real educators out there who have tried to address this question head-on. I am impressed by the amount of experimentation I have seen on college campuses as they try to design the "right education" for the new middle. I am going to focus on one school—Georgia Institute of Technology, based in Atlanta—to illustrate one thoughtful approach.

G. Wayne Clough, Georgia Tech's president, had to rethink education in a flattening world and without necessity. Clough took over as president in 1994. "When I came to Tech as an overrated freshman back in the sixties," Clough told me, "they had this drill for the incoming students. They would tell us: 'Look to your left. Look to your right. Only one of you will graduate.'"

Georgia Tech was not as selective in admissions back then as it is today, and it relied instead on a sort of Darwinian weeding-out process, focused entirely on grades. As Clough tells it, it was a very cold社会 and academic environment—not a lot of fun. Even by the early 1990s, Georgia Tech was graduating only 65 percent of its incoming students. Students were not finishing because they found both the curriculum and the atmosphere rather gray—and the school a place that did not celebrate student success.

Clough's view as he assumed the presidency was that our country desperately needed more good scientists, engineers, and entrepreneurs, so his school couldn't afford to be losing one-third of its prospective grads by graduation day. Clough realized that only by offering the right education, not just more education, "would we get more students applying and more students graduating."

THE RIGHT STUFF

Clough began rethinking Georgia Tech's approach by reflecting on his own experiences as a working engineer. Some of the best engineers he had collaborated with over the years had not been the best engineering students. "They knew how to think creatively," he said. "They might not be the ones who could solve the calculus equation better than anyone else, but they were the ones who could define the problem that the calculus had to solve better than anyone else.... They were often people with character and that something intangible."

The more time he spent on campus, the more Clough also noticed that an "awful lot of the talented students were interested in creative outlets other than what they were experiencing in the classroom"—filmmaking, music making, or some other offbeat hobby. "These students were interesting people when you talked to them. I began to think, 'Boy, wouldn't it be nice to have more of these sorts of interesting people around campus. It makes the place more enjoyable and it helps make the student who is more one-dimensional more multidimensional. by having him or her bump shoulders with these other kinds of kids."

So beginning in the late 1990s, Clough gradually altered the admissions policies at Georgia Tech, having his admissions office focus specifically on recruiting and admitting good engineering students who also played musical instruments, sang in a chorus, or played on a team.

"The idea was that people who have other interests tend to be able to communicate, tend to be more social, tend to ask for help more readily when they need help, tend to help others more who need help, tend to think horizontally, ... tend to be able to tie things together from different disciplines and fields."

The result, said Clough: Today more than 50 percent of Georgia Tech's entering freshmen have played musical instruments or participated in some kind of musical group—so many that Clough's biggest challenge now is building more recital rooms and concert areas on campus. "I created a monster," he joked. He also created more graduates. Graduation rates rose from 65 percent when he arrived to 76 percent by 2003. And they are different kinds of graduates.

"The student response has been great," said Clough. "We have seen a large increase in students taking music courses. We had little in the way
there is going to be a big demand for engineering around photonics—
turning sunlight into electricity. That requires students who are trained in
basic engineering, chemical engineering, and electrical engineering.
Clough quoted the head of a big engineering firm, who told him recently,
"Don't send me engineers who can be duplicated by a computer. I am
sending that work to India. Send me engineers who are adaptable—who

As above, so below. Georgia Tech's College of Computing has picked
up on these broad themes and has translated them into specific courses.
After the dot-com bubble burst, computer science enrollment at Georgia
Tech started to drop precipitously. "Everyone was reading the articles
about all the jobs going to India and China," said Rich DeMillo, the
former HP chief technology officer, who is now dean of the College of
Computing. "The number one question from parents was, 'What will my
kids do if all the programming jobs go offshore?'" So DeMillo and Merrick
Furst, the associate dean, who was brought in from the International
Computer Science Institute at Berkeley, went out into the business world
and asked employers two simple questions: Who were they looking to hire
and how were computer geeks being used to add value at their companies?
They visited CNN's headquarters in Atlanta, for instance, and were
exposed to the massive amounts of digital and analog content the network
had piled up. It became obvious that managing all of this content via
computing, and finding ways to deploy it, from televisions to cell phones
to video iPods to Web sites, was going to be a huge growth industry for the
right computer science grads—one who could help tell stories with

After thinking all this through, in 2004 DeMillo and Furst redesigned
the computer science major at Georgia Tech around nine "threads," as
they refer to them. Each thread is a combination of computing with an-
other field, producing a synthesis of knowledge—where the real value is
going to be created.

"Threads represent a departure from a vertically oriented curriculum
whose goal is the creation of students with a fixed set of skills and knowl-
edge," explained Furst in his course description. "A thread is a fundament-
ally horizontal idea whose goal is to give students the broad collection of
skills and learning experiences they need to thrive in the globally competitive Conceptual Age. A thread provides an intuitive, flexible, and mutually strengthening set of courses that allows a student to craft his or her own distinctive future.

The nine threads are Computing and Intelligence, Computing and Embodiment, Computing and InterNetworking, Computing and Platform, Computing and Information, Computing and People, Computing and Media, Computing and Modeling, and Computing Foundations. You need to take two threads to get a degree in computer science today from Georgia Tech.

The Computing and Media thread, for instance, requires students to take courses in computer science, communications, writing, and liberal arts. The idea behind this thread, said Furst, is to teach students “what they need to know to tell stories and create experiences for humans through technology.” Here you’ll see courses on topics ranging from computational graphics to Hamlet, from human perception to interactive fiction engines, Furst added. So, for instance, if you want to be a top-notch game designer, this is where to start.

The Computing and People thread prepares students by helping them to understand the theoretical and computational foundations for designing, building, and evaluating systems that treat the human being as a central component. The student who pursues Computing and People might want to combine it with Computing and Embodiment to study human-robot interaction. There are almost as many mixed-and-match permutations of these threads as there are coffee options at Starbucks.

Imagine,” wrote DeMillo in an essay describing his program, “a Georgia Tech undergraduate computer-science student in her sophomore year interested in computer security. She might combine the Computing and Information thread—to learn how data is stored, retrieved, encoded, and transmitted—with the Computing and People thread—to learn how people use technology and how to run experiments with human subjects … She will craft a valuable computing identity and become someone able to design, invent, and build secure computing systems enabling people to securely manage their information.” The point about each of these threads, individually and in combination, said DeMillo, is that they provide a skill set and a credential base that allows graduates to create value in ways beyond what would be possible with only a narrowly focused tool set—and that skill set is certain to have value in the emerging flat-world marketplace.

Twenty-five years ago, computer science was easy, said DeMillo. “There was a clear stack—hardware, software, and algorithms—and if you could fit in anywhere in that stack, you had a job. You just picked one of those sweet spots to specialize in and you were off and running. You could work on hardware, you could program system software, or you could work on application algorithms. Now fast-forward twenty-five years. There is no clear-cut hardware, software, algorithm stack. Instead there is business process, change management, and ERP. Now it is all horizontal and in constant motion. So if you are an educator, what do you do? What remains unchanged is the need to be able to tell stories, to be able to build things that have intelligence in them, and to be able to create networks. All that remains constant. But now the way you do that is by aggregating pieces horizontally. The threads are aimed at putting things together that make sense. That is why you need to run a whole university this way. The whole notion of separate departments is crazy. You really need to change the whole approach. This is not about small tinkering.”

What the Georgia Tech model recognizes is that the world is increasingly going to be operating off the flat-world platform, with its tools for all kinds of horizontal collaboration. So schools had better make sure they are embedding these tools and concepts of collaboration into the education process. “It has to run through the whole curriculum,” said Furst. “It can’t just be a single course; otherwise we will never nurture a high enough percentage of the population to be competitive.”

The Right Country

So if these are the jobs and the pathways to the new middle, how well suited is America generally, in this flattening world, to creating these jobs and paving these pathways? The short answer is that we have—in