Parkland College

Dr. Thomas R. Ramage Scholarship | Office of the President

2011

Chapter Nine: What is next? Futuristic Thinking for Community Colleges

Thomas R. Ramage
Parkland College, ramage@parkland.edu

Chapter Nine: What is next? Futuristic Thinking for Community Colleges

The times in which we live are marked by massive transformations; politically, socially, and scientifically, and on what feels like a daily basis. Our efforts to plan and forecast, even for periods as little as five years distant, have been predicated on the assumption that the *current rate* of progress will continue into impending periods.[1] Author and inventor, Ray Kurzweil calls this the “Law of Accelerating Returns”.

If we were to study a wide variety of technologies ranging from the electronic to the biological, via a multitude of gradations and measures, according to Kurzweil, we would find that our commonly held belief in a static rate of change is misguided. Change, progress, and advancement are occurring at an increasing rate.[2]

Yet for the volume and sheer impact of such transformations, it is a rare occasion that we discuss such startling change in the context of what it means to be an “educated person”. With a few exceptions, our ideas about what it means to be an educated person are virtually the same as they were in 1892, when the first university preparatory curriculum was developed in the United States.[3] This set of competencies remains largely intact today. You might agree in concept that the educated person should have an understanding of history and social issues, an appreciation of literature and poetry, be able to deal with matters of economics, understand scientific principles and the basics of mathematics, and as a crowning achievement, to be able to speak and write in more than one language.

Those descriptors were used to develop the high school curriculum in the United States in 1892. With the appointment of the Committee on Secondary

School Studies (commonly called the Committee of Ten) under the chairmanship of Charles Eliot, president of Harvard University, these objectives were considered foundational for anyone who wanted to attend a university. Additionally, the committee recommended the same universal course of study for everyone, including those who had no intentions of attending college.

During the past 120 years, our investment in K-12 education in constant dollars per student has grown by a factor of ten.[4] We've experienced and absorbed **a one hundred fold increase** in the number of students enrolling in post-secondary education. Why? For the past two centuries, according to Massachusetts Institute of Technology Economist Frank Levy, automation has been eliminating jobs at the bottom of the skill ladder while creating new and better paying jobs at the top, and it has caused the United States to exponentially increase investments in education at all levels.[5]

Globalization and automation has an effect on the job market as well. It has been a common theme, the assumption that these forces are "killing" the job market in the United States. While there is some truth to this, in our current economy, it seems to happen faster and affect a great many more people.

Today, China is the largest global producer of toys, clothing, and consumer electronics. Automobiles, telecommunications, computers, biotechnology, aerospace are next. China has a billion-and-a-half people whose factory wages start at 40 cents per hour. The minimum wage in the United States was set at 40 cents per hour on October 24, 1945.[6]

Today, there are 45,000 Taiwanese Contract Factories, there are 20,000 in Europe and 15,000 in the States.[7] Between 1995 and 2002, the world's 20 largest economies lost approximately 22 million industrial jobs. The United States lost about 2 million, mostly to China. In that same time frame, China lost 15 million, mostly to *machines.*[8] Competition comes in many different forms these days.

Economist Frank Levy also tells us that there is a simple rule for deciding if a job is going to last in the United States or not. “*If you can describe the job precisely, it’s gone.”*

For example, if you can write rule for a job that says “If this happens, then do that,” it can probably be sourced to a computer or outsourced overseas. Levy goes on to say that this concept will (is) disproportionately affecting what he calls the “middle area jobs”. Low skill jobs that involve a lot of interpersonal contact are probably safe for the short term. High skill jobs that require specialized knowledge, creativity and/or proximity to others are likely safe for now also. But those jobs that are in between, that operate under a set of rules or decision points, are at significant risk.

Today, public expectations and our high school curriculum remain remarkably static, with the exceptions of a call for accountability, national standardized assessments, and second-class status for any student who chooses a path other than traditional baccalaureate preparation. What actually is the future for which we prepare our students? What impact does rapidly accelerating change have on what it means to be an educated person today or in 5 years?

Change, progress, and advancement appear to happen at an accelerating rate, and our educational systems are stressed proportionally. A couple of generations ago, we could learn from our parents most of the things we needed to survive and thrive. Education, defined broadly, consisted of the passing of knowledge from one generation to the next in a somewhat linear and orderly fashion. Today, there are too many new things to understand: nanotechnology, DNA, networks and computers, genetically modified organisms, global and interconnected financial systems, and quantum mechanics, to name just a very few. Examples help. Let us start with the most profound: human life expectancy.

Kurzweil's law of accelerating returns, when applied to human life expectancy, illustrates the fact that in the eighteenth century, technology, in general terms, added a few days each year to human longevity. During the nineteenth century, Technology's impact on longevity grew to a couple of weeks each year. Today, we are adding almost half a year every year to life expectancy, due almost exclusively to the impact and availability of technology. Growth curves illustrating the number of human genomes mapped per year, the number of top-level Internet domains created every 12 months, and the decreases in size of mechanical devices (nanotechnology) have moved from a linear to an exponential scale.

Of course, this discussion is incomplete without reference to the fact that Moore's Law, which predicts that the number of transistors that can be placed on an integrated circuit and the corresponding speed at which these chips can compute will double every 18-24 months, seems to be alive and in force until at least 2015.[9]

The Human Genome Project

The first Human Genome Project Centers were created in 1990. When work began, it was thought that it would take about one hundred years to get the first human genome sequenced, based on the computational power available to the consortium at that time.[10]

Fast forward to April of 2003, some 13 years later, the first sequence was completed at a cost of more than $500 million. Using the same process, but with more advanced computers, a human genome could be decoded for a mere $10 million in 2006. Two years later, in February of 2008, a company called Illumina did it in four weeks for $100,000.[11] Five weeks later, Applied Biosystems accomplished it in a couple of weeks for $60,000.[12] As of June 2009, Complete Genomics, which offers DNA analysis services to drug makers and other companies, began sequencing human genomes for $5,000.[13] A $500 million process was reduced to $5000 in six years due almost exclusively to advancements in computer processing power.

Consider the trajectory of the gigaflop.

A “FLOP” or “FLOPS” is an acronym meaning Floating Point Operations per Second, and its use is a measure of a computer's performance. A gigaflop represents 10^9, or about 1 billion floating point calculations per second. Today, one thousand dollars will buy approximately two gigaflops. This is the equivalent computing capacity, in terms of calculations per second (two billion), of a mouse brain, for one thousand dollars.[14]

It took humanity roughly 108 years (1900 to 2008) for our understanding of computing to evolve from the very first concept of a computer to that of a mouse brain. In 1961, the extrapolated cost of one gigaflop of computing power was in neighborhood of $1.1 trillion dollars. In 2006, a gigaflop could be had for one dollar and today, it costs about ten cents.[15]

Assuming past performance is an indicator of future performance, it will take just 17 years to develop a computer that has roughly the equivalent computing capacity of a human brain. This would allow 20 million billion calculations per second, give or take, for one thousand dollars.[16]

The following year, it will double again, as is the nature of exponential growth. Another 20 years after that, it is predicted that we will have a device with the capacity to compute at a rate equivalent to the entire human collective, for about one thousand dollars. That seems a little far-fetched, doesn't it?

Today, if one has $65 million, one can build a computer that is capable of sustained operation at 10 petaflops (10^{15}), or one thousand trillion calculations per second. The University of Illinois at Urbana-Champaign, which is approximately 5 miles from our campus, will put such a device online in 2011.[17]

Given past performance, this $65 million device should cost in the neighborhood of $1000 in the span of about 14 years, and this path assumes no amazing scientific advances or economic events, positive or negative. In 14 years, $65 million dollars halved 14 times comes to just under $4000. How does this affect us and what does it mean? The implications are staggering. What in the world changes when this is possible? The short answer is <u>everything</u>.

Already, airplanes can take off and land on their own, the stock markets are monitored with predictive and recursive software systems, and doctors routinely use computer-aided diagnostics to care for their patients. What is the impact of all of this technology on our jobs, our lives, and our colleges?

First of all, there is a downside. The increasing complexity of our lives, without equal gains in our ability to manage, synthesize, and understand these impacts, is a major and growing concern. We human beings are not keeping pace well enough to avoid causing disasters due to human error. We need not look farther than the oil spill in the Gulf of Mexico for an example.

For all of our advancements, we have yet to develop a method of harnessing the technology to advance the field of education. We employ roughly the same model that we did in 1892. I am reminded of the phrase, “Were Rip Van Winkle to wake up today after sleeping for 130 years, probably the only thing he would recognize would be the typical school classroom”.[18]

Of course, this statement is not true. We are indeed in the middle of our own revolution, but it has far more to do with *access* to higher education made possible by technology and its advancement. Numerous studies exist that attempt to prove or disprove the impact of technology on the learner.[19] Perhaps the more significant question has to do with the number of people who are able to come to the well versus how deeply they drink. The classical tenet of access to higher education is fundamental and foundational in the community college.[20]

Our mission of access is illustrated in technological terms on our campuses every day. Our students expect robust bandwidth to power their netbooks, iPhones and iPads, and laptops. They expect wireless signals (both Internet and cellular) to reach into every nook and corner of the college. They expect far more than a simple syllabus with the email address of the professor.

At Parkland College, significant investment in both faculty development, course re-design, and the required support systems began fifteen years ago. The administration, at the time, wisely invested resources into the creation of one of the first student and course management portals and engaged faculty in the selection and management of hardware and software. Today, the vast majority of class sections offered at Parkland College rely on learning management software, blurring the lines between traditional on-campus courses and those labeled as online or hybrid sections.

Additionally, our faculty and staff have grown accustomed to electronic class rosters with student pictures and email addresses, automatic population of the learning management system, online grading, and the ability to generate a multitude of reports on-the-fly.

Our students insist upon networked access to their class schedule, financial aid portfolio, degree audit systems, and “live chat” with student services professionals, even at 1 am. Especially at 1 am. We attract students from all over the country as well as concurrently enrolled students at the University of Illinois at Urbana-Champaign, just five miles away. Access and convenience in conjunction with quality and transferability are imperatives.

Institutionally, the proportion of capital dollars expended each year to purchase new computers and to refresh network infrastructure and servers appears to be accelerating as well. Today, we speak in terms of terabyte storage when it seems like just last semester it was merely gigabytes. Yet at the very same time, employers in the community college districts that we serve lament the very real deficits in our graduate’s ability to communicate effectively, work in teams, and think critically. It seems as though we, in the community college especially, are squeezed between the dichotomy of understanding this rapid change with respect to curriculum, equipment, and labs, while watching our students stumble over the very basic work ethic skills instilled by our parents a generation before -- so much so that we have developed a stand-alone course designed to address what were once “basic training” skills taught at home and modeled by family.

If we are able to connect these dots –- accelerating returns, exponential growth in speed and capacity of computing, globalization and technology -- with a relatively static curriculum, should it surprise us that our most enduring mission in the community college is to provide pathways to work and to a decent living, our transfer mission included? It boils down to the fact that no matter how well intentioned our academic programs and rhetoric, a college education must provide the skills needed to get a job.

We need not be futurists to come to the conclusion that the whole endeavor of higher education has been forever changed by these forces, perhaps none more significant than technology in the form of networked information systems. Increasingly, from the student’s perspective, it should all be accomplished on a cell phone.

As our systems evolve and students’ expectations around access drive us, likewise, their insatiable appetite for quick and easy access to information drives our system designs. Today, I am sure of one thing: change is constant and its rate is accelerating exponentially.

References

1. Kurzweil, Ray. Law of Accelerating Returns. 2001. Retrieved January 3, 2010 from http://www.kurzweilai.net/the-law-of-accelerating-returns.

2. Kurzweil, Ray. *The Singularity Is Near.* New York: Viking, 2005.

3. Mitchell, Richard. *The Graves of Academe.* Boston: Little Brown, 1981.

4. Psarcharpoulos, G. and Patrinos, H. (2004) “Returns to Investment in Education: A Further Update.” Education Economics 12(2), 111-134.

5. Levy, F., and Murnac, R. (2005). “How Computerized Work and Globalization Shape Human Skill Demands.” In M. Suarez-Orozco (ed.), *Learning in the Global Era.* Berkeley: University of California Press.

6. Wikipedia.com. Economy of the People’s Republic of China. 2010. Retrieved January 10, 2010, from http://en.wikipedia.org/wiki/Economy_of_the_People's_Republic_of_China.

7. Einhorn, B. (2005). “Why Taiwan Matters.” BusinessWeek. May 16, 2005. Retrieved January 11, 2010, from http://www.businessweek.com/magazine/content/05_20/b3933011.htm.

8. Smart, J. (2005). “Catalyzing the Symbiotic Age.” PowerPoint presentation at the Las Vegas Future Salon, March, 2005.

9. Stokes, J. (2008). “Understanding Moore’s Law.” Ars Technica. Retrieved January 10, 2010 from http://arstechnica.com/hardware/news/2008/09/moore.ars.

10. United States Department of Energy. (2010). Human Genome Project Information. Retrieved January 10, 2010, from http://www.ornl.gov/sci/techresources/Human_Genome/home.shtml.

11. Lauerman, J. (2008). “Illumina Says It Sequenced Human Genome in Record Time,Cost”. Bloomberg. February 9, 2008. Retrieved January 10, 2010, from http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aAgJB2R0Wcqs.

12. Davies, K.(2008). “Applied Biosystems and the $60,000 Human Genome.” Bio-IT World.com. March 13, 2008. Retrieved January 11, 2010, from http://www.bio-itworld.com/BioIT_Article.aspx?id=73334.

13. Timmer, J. (2009). “Complete Genomics Produces a Cheap —Well, $5,000— Human Genome.” November 5, 2009. Retrieved January 10, 2010, from http://arstechnica.com/science/news/2009/11/complete-genomics-produces-a-cheapwell-5000human-genome.ars.

14. Cramster.com, Definition of Flops. Undated. Retrieved January 10, 2010, from http://www.cramster.com/reference/wiki.aspx?wiki_name=FLOPS.

15. Wikipedia.com. Cost of Computing. 2010. Retrieved January 10, 2010, from http://en.wikipedia.org/wiki/FLOPS#Cost_of_computing.

16. Moravec, H. 1997. “When will computer hardware match the human brain?.” *Journal of Evolution and Technology*, 1. Retrieved January 10, 2010, from http://www.transhumanist.com/volume1/moravec.htm.

17. University of Illinois. (2010). About the Blue Waters Project. Retrieved January 10, 2010, from http://www.ncsa.illinois.edu/BlueWaters/.

18. Dryden, G. & Vos, J. (1994). *The learning revolution*. Rolling Hills Estates, CA: Jaimar Press.

19. Ramage, T. (2002). The “No Significant Difference” phenomenon: A literature review. E-Journal of Instructional Science and Technology, 5(1). Retrieved May 8, 2004, from http://www.usq.edu.au/electpub/e-jist/docs/html2002/ramage.html.

20. Vaughn, G. (1999). *The community college story*. Washington, DC: Community College Press.

Thomas Ramage is President of Parkland College in Champaign, Illinois.