THE NEW ENGLAND JOURNAL OF HIGHER EDUCATION

NEBHE's Connection

SUMMER 2007 VOLUME XXII, NO. 1

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EDITOR'S MEMO

Changing Names

Your *Connection* to New England higher education and the economy is now *The New England Journal of Higher Education*. … As we were working through the "re-branding" of the journal this past spring, I had the privilege of participating in a roundtable discussion on "Education of Black Youth in Boston" at the University of Massachusetts Boston. The educators and community activists who descended on the university's Dorchester campus that muggy afternoon were worried about the standard fare of achievement and standards of course. But they were also asking questions that are foreign to white suburban discussions of school success and college readiness.

How is it that gangs do a better job "retaining" members than schools and colleges do? How can immigrant parents collaborate with their children's teachers when a visit to the school might prompt a visit from Immigration and Customs Enforcement agents? Is it fair to expect a non-English-speaking student arriving in Boston Public Schools in 9th grade to attain government-defined "proficiency" in four years? How might an effective truancy system help steer urban youth away from courts and jails and toward college instead? How does Endless War play out in the schools and the streets?

UMass professor Denise Patmon sums up the roundtable proceedings for us in the lead story of this inaugural issue of *The New England Journal of Higher Education*. That the voices in Patmon's piece belong to neighborhood youth organizers, an urban sheriff and frontline teachers should serve to confirm that our name change does not signal a shift to the tweedy insularity of scholarly journals.

Nor have we entered some sort of witness protection program for magazines. To the contrary, our goal is to build on *Connection's* 20 years of hard-hitting commentary and analysis with a brand whose serious look and feel matches its content. Readers can expect more of the best practices pieces, more of the trend analysis and more of the visionaries and gadflies that made *Connection* must-reading for New England decision-makers from its emergence as a newsletter in the 1970s through its graduation to journal/magazine in 1986.

In this issue, Nick Donohue, Jamie Scurry and Dennis Littky are thinking way outside the box. Donohue explains how reinventing education means much more than reforming schools. Scurry and Littky explain how the Providence-based Big Picture Company, having transformed the American high school experience for low-income, urban students, is girding for a new challenge: redesigning the American college.

Economist Ross Gittell, whose knack for turning dry numbers into powerful imperatives has made him a valued *Connection* contributor over the years, offers a grim demographic warning for New England—we're losing our young people. John Humphrey, a journal editor and father, urges colleges to say no to credit card companies. And in this issue's "Forum" section, Patricia Flynn, Zorica Pantic, Brigid Sullivan, Bernard Gordon and James Brett look for ways to unclog New England's science, technology, engineering and math (STEM) pipeline.

So why the new tag? Put simply, there are a lot of *Connection* magazines out there, from "The Good News Magazine" to "The #1 Reggaeton Magazine" to "Your Worldwide Link for Swinging" (don't ask). Our content often distinguished itself but our name didn't.

Moreover, it's not lost on us that just as New England's pre-eminence in medicine has made it a uniquely suitable home for perhaps the world's most authoritative medical journal, *The New England Journal of Medicine*, the region's pre-eminence in higher education, though threatened mightily, makes it the only home for *The New England Journal of Higher Education*.

It's all a work in progress, mind you. As befits a nonprofit publishing operation, there'll be no slick media campaign or chichi launch party, just a pledge: to earn the authority our new name implies, while we build on the relevance and accessibility our old name came to stand for.

John O. Harney *is executive editor of The New England Journal of Higher Education. Email: jharney@nebhe.org.*

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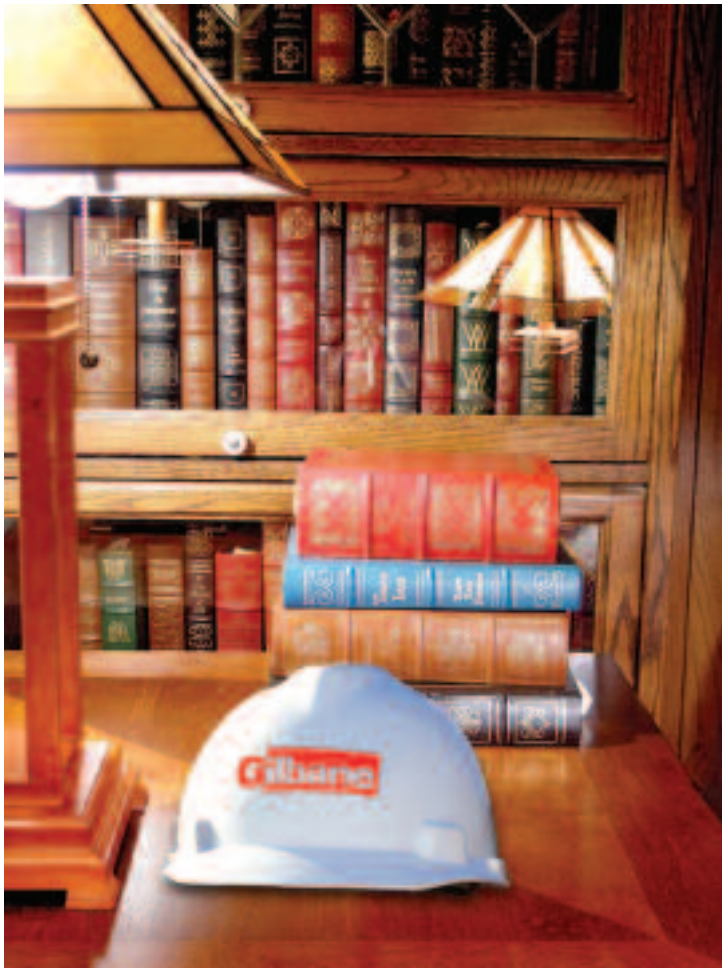

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A Limited Engagement?

The most recent national High School Survey of Student Engagement raises alarms about how U.S. students view their learning environments and their own work. Nearly half of the 80,000-plus students in 26 states surveyed by the University of Indiana do not feel they are an important part of their high school communities, and many are bored. Two in three reported being bored in at least one class every day.

In addition, two survey questions asked students how much time they spend on particular activities and how important these activities are to them. Juxtaposing their answers to these two questions sheds light on something many parents may already suspect: students have a difficult time allocating time to what they know is important.

High School Students: Stated Priorities vs. Time on Task

Activity	Percentage who Consider it very important or a top priority	Percentage who Spend 6 or more hours a week doing it
Written homework	46%	17%
Reading/studying for class	40%	9%
Reading for self	22%	14%
Participating in school-sponsored activities	34%	30%
Practicing a sport/musical instrument	46%	35%
Working for pay	40%	34%
Volunteer work	17%	5%
Exercising	50%	33%
Watching TV/playing video games	14%	31%
Surfing/chatting online	14%	23%
Talking on the phone	23%	28%
Socializing with friends outside school	62%	54%

Internal Injuries

Businesses need to do a better job allowing student interns to follow through on tasks while giving them the ability to set their own priorities and explore careers in other areas of the organization, according to the *2007 Internship Data Report* released in May by the college relations and intern staffing firm Intern Bridge Inc. and Babson College.

The highest-paid interns by academic major are accounting students, earning an average of $15.48 per hour, the study found. By industry, the highest paid are in finance and banking, earning an average of $17.31 per hour.

More than 32 percent of interns reported that their supervisors sometimes did not provide adequate explanations of assigned tasks, 35 percent reported that they were not given a meaningful introduction to their fellow employees, and more than 30 percent reported that they were not given adequate training to complete their assignments or tasks. For more, visit: http://internbridge.com/research.htm

Accountability

"The Barry Luciers of the world are entering a minefield of knowledge. Who knows what destructive information they'll be confronted with next. That's why all colleges should be forced to advertise every element of their curriculum so students are guaranteed that when they leave college they'll be exactly the same as when they went in."

—Stephen Colbert on his May 17, 2007, Comedy Channel program "The Colbert Report," satirizing Roger Williams University student Barry Lucier, who complained to Fox News that he was forced to watch Al Gore's film on global warming, "An Inconvenient Truth" in class.

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Ed in '08: New England's Favorite Son

EVAN S. DOBELLE

As the New England Board of Higher Education proudly marks the transformation from 20 years of *Connection* to the new look of *The New England Journal of Higher Education*, we also cast our attention toward a national campaign to raise the profile of education itself. Ed in '08 is a $60 million campaign to engage everyday American citizens in the education debate. Check your tax bracket and political affiliation at the door.

The campaign, supported by the Eli and Edythe Broad Foundation and the Bill & Melinda Gates Foundation and chaired by former Colorado Governor and Los Angeles school Superintendent Roy Romer, is designed to raise education to the top of the country's domestic priorities. The campaign challenges the 2008 presidential candidates to begin a serious dialogue about how they will improve American schools.

Since New England will be sustained and grow on the strength of its education, Ed in '08 is surely among the region's favorite sons in this race. Like NEBHE's College Ready New England initiative, the Ed in '08 campaign, which opened its New England office in New Hampshire this month, uses creative media strategies to excite the public about educational success. Ed in '08 is asking communities and their members to join town meetings, PTA discussions and a national debate on education.

With this high-level push, it could be education's year. Just five years ago, the president and Congress gave us the deepest federal involvement in schools in nearly 30 years with No Child Left Behind legislation.

But to be realistic, while NCLB has cast much-needed light on some of the challenges facing American schools, it has also underscored the problems of using one set of standards for students with multiple learning abilities, diverse learning styles and a range of demographics. Further, NCLB encourages school systems to "teach to the test," depriving youngsters of the best, *spontaneous* moments in their education.

Ed in '08's main platform is to promote sensible American education standards, offer incentives for effective teaching and provide students with more time for in-depth learning—all critical goals. New England voters will also have an interest in several other education planks. For example, they will look for leadership that:

- Demands higher achievement while valuing the "multiple intelligences" students bring with them.
- Helps property tax-poor school districts experiment with new teaching and learning methods.
- Reaches New England's fastest-growing new populations, including English-language learners.
- Directs limited student aid resources to the students who need them most.
- Promotes the region's higher education enterprise, with its 270 colleges, quarter-million employees and $20 billion annual budgets, as a crucial American industry—indeed, a major, but often overlooked, *export* industry.

And remember, a focus on education does not suggest a single-issue campaign. Far from it. Many students are remarkably unprepared for school every day the morning bell rings. An appalling number of elementary and secondary school students come to school without breakfast in their stomach, school materials or the peace of mind that comes from a stable home environment. Today's schools aren't just responsible for education. Teachers are asked to be social workers, identifying instances of abuse and neglect. Many schools in poor communities provide two-thirds of children's balanced meals each day. When a child hasn't had breakfast, feels unsafe or is totally unprepared, the classroom is a prison.

An "education president" will also be an anti-poverty president, a health care president, a science and technology president and a creative economy president. These are issues that deeply affect our College Ready program, and this national campaign provides a stage to spark real change. In 2008, we need answers from the candidates on these pressing needs and a platform that makes real learning possible for all.

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Sparking an Interest in STEM Fields

MARY R. CATHCART

New England's public and private research universities, hospital labs and technology-based firms are buzzing with discovery, as scientists and engineers work to develop new treatments for diseases, "green" building products, alternative energy sources and other innovations.

Yet, the "pipeline" of future scientists and engineers is plagued by bottlenecks. Too few New England schoolchildren are excited about science, technology, engineering and math (STEM) subjects, and too few college students major in these fields to sustain the region's innovation-based economy. Moreover, as the "Forum" articles in this inaugural edition of NEBHE's "re-branded" journal suggest, the region and the nation are falling dangerously behind others in STEM education.

My state of Maine has a comparatively small scientific research enterprise by New England standards, but the priority Maine places on scientific innovation is changing, thanks in part to the so-called "Faculty Five." These highly respected University of Maine professors took it upon themselves a dozen years ago to educate Mainers on the need for greater state investment in university research. Today, scientists and engineers across Maine are developing high-tech composite materials for the state's traditional boatbuilding industry, exploring the use of canola seed and wood-based biomass for biofuels production, converting potato waste to polylactic acid used to make bioplastics and much more.

But even the most inspiring research success will be fleeting unless we strengthen the STEM pipeline. That will require, more than anything else, good teachers. Our colleges need to prepare teachers who understand how to spark student interest in science and math through meaningful hands-on research projects and real-world problem-solving but who also have extensive knowledge of the subject they teach. Our schools must be able to offer competitive salaries to attract college graduates who excel in STEM fields.

New England colleges and universities are addressing these challenges. At UMaine, a Master of Science in Teaching program reaches out to in-service teachers but also to STEM graduates who want to prepare for teaching careers and STEM professionals who want to change careers. UMaine science professors collaborate with education professors and scientists from private institutions such as the Jackson Laboratory to help these aspiring STEM teachers integrate exciting research projects into their classrooms.

With support from the National Science Foundation (NSF), UMaine has also structured several K-12 programs around the theme of *sensors*—those little electronic information sumps that play a critical role in everything from personal computers to traffic lights. Because they're so important in our daily lives, sensors are of real interest to secondary school students.

In one program, Maine middle school and high school teachers are awarded eight-week summer fellowships, where they become involved in cutting-edge sensor science. Graduate students in sensor-related fields help the teachers develop courses, then work in their classrooms during the school year. Besides improving learning, the program gives fellows and teachers a valuable opportunity to describe their interactions in conference presentations and refereed publications. Most importantly, initial evaluations suggest exposure to the sensors program motivates students to pursue science and engineering further.

We're also attracting middle-school students to the field of "whole-earth modeling." UMaine modelers use the university's supercomputer to generate large amounts of data on the oceans, the atmosphere, geology and glaciers. These data can be "visualized" with high-tech equipment and linked to the laptop computers provided to all Maine 7th and 8th grade students. Soon, students will be able to develop scenarios for sea level rise, glacier movement and storms in the Gulf of Maine and view these impacts on their laptops individually and in teams.

Still, Maine and other New England states inspire only a small percentage of teachers and students to love science and math. More must be done. For starters, we all should urge New England's congressional delegation to support funding for NSF programs that spark a passion for science. We also need to engage state education departments and educators in a dialogue about improving STEM achievement in schools. And NEBHE can promote STEM on a regionwide basis by helping New England institutions share best practices for getting children excited about science and math.

Mary R. Cathcart *is chair of the New England Board of Higher Education. She is a senior policy associate at the Margaret Chase Smith Policy Center and former four-term Maine state senator. Email: maryorono@verizon.net.*

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Learning While Black

Community Voices on Race, Education and the Boston Public Schools

DENISE PATMON

For the educators and community activists spilling out of the "Education of Black Youth in Boston" roundtable discussion held last April at the University of Massachusetts Boston, Charles Desmond's whirlwind tour of Boston's future demography put stark numbers to the faces many see everyday: *More than half of the city's children age 5 and under live in homes where the householder's highest educational level is a high school diploma or less. … Nearly half live in homes where the householder was born outside of the United States and does not speak English well. … A quarter live in homes where the householder's income is below the poverty line. … Fully 17 percent live in a household headed by someone other than a biological parent. …*

The Trefler Foundation executive vice president along with longtime Boston education activist Hubie Jones and colleagues affiliated with UMass Boston's William Monroe Trotter Institute, convened the discussion to explore ways to improve the academic achievement of Boston public school children from diverse backgrounds. Trotter Institute director Barbara Lewis emphasized that by "black," the organizers meant to explore the challenges facing not only African-Americans, but also Haitians, Caribbean islanders and the Afro-Latinos who make up the a majority of Boston students in crisis—and, in many ways, all underserved students.

The Boston Public Schools feature a standards-based curriculum in accordance with the Massachusetts Curriculum Frameworks and the federal No Child Left Behind Act. The goal is to get *all* children to "proficiency" by 2014. But in Boston, as elsewhere, the academic achievement gap is widening between poor black, white and Latino students and their white middle-class counterparts. Boston school Superintendent Michael G. Contempasis conceded that the school system loses 1,500 to 1,900 students a year, many of them English-language learners and African-American males. "We are seeing that a lot of our kids feel disfranchised from the school system as early as the 5th grade," said the superintendent. "We need to create an environment in which folks recognize that it is part of their responsibility to intervene when they see things happening that may not be 'up to snuff.'"

"There are far too many children of color, especially African-American boys, in 'subset' programs such as special education," added Contempasis. "Most are there because no one knows how to handle them, not because they don't know how to do the work. We need to develop a full-scale alternative education program that is not about merely warehousing children. And we have to find ways to bring back children who have dropped out."

An imbalance of white middle-class teachers teaching black children from poor families often translates into behaviors and comments that students misinterpret as, "My teacher doesn't like me," thus shutting off interest in learning. Or the teacher interprets a student's boredom in class as inability to do the work. (Jawanza Kunjufu states it simply in his book *Black Students. Middle Class Teachers*, "I don't become what I think I can, I don't become what you think I can, I become what I think you think I can.")

Former Massachusetts Education Secretary Paul Parks, who taught a course in Boston schools for seven years, noted, "One thing that hit me working in Nigeria, Liberia and the Ivory Coast was the ability of Africans to sense where people are coming from. Very quickly, they understand your emotional patterns and why you're acting the way you're acting. We have children sitting in classrooms in Boston who will tell you, 'The teacher doesn't like me. Nobody likes me.' More than likely the teacher standing in front of the classroom is white. A child often comes into the classroom angry. Maybe he's been told white folks are going to 'do you in, take you apart. They are not going to treat you fairly.' A teacher sees that child's actions as antisocial." More often than not, the child described by Parks ends up in a special education class—especially if he is a black male.

"One of the things I've seen working at Madison Park High," added Adiya White-Hammond, "is that black males, especially those who have anger management issues unrelated to learning abilities but can't relate to their teachers, are automatically put into special education classrooms, where they spend all their time doing crossword puzzles and word problems. A lot of young people don't make it to their senior year because as far as they're concerned, they are labeled—they feel they are a lost cause and there's no hope for them going to college."

Teacher education programs, meanwhile, are not doing enough to prepare teachers to teach children who do not look like they do. Sabrina Gray, a doctoral student at UMass Boston and teacher at Boston's Nathan Hale School, noted: "I have to humble myself and acknowledge that I don't know how to teach young

black males. I am a female, not a male. Just as I learn differently, I have to teach differently to young black males. These young men are eager to learn, yet bored. The challenge is not to entertain them but to engage them. The question is how do we teach teachers to challenge young black males."

Schools are also hampered by the culture of incarceration. Noting that the vast majority of visitors to the Suffolk County House of Correction are women and children, Sheriff Andrea Cabral lamented, "Children are becoming familiar with and comfortable with a stranger requiring them to turn their pockets inside out and part their hair to check for contraband. It doesn't matter how friendly the person is or how well we train them, this is not good for children." Added Cabral, "The criminal justice system is the outcome of a failed educational system."

Donna Stewartson, a community activist and UMass Boston staffer, had two children in Boston Public Schools last year but now she's had enough. "My son was in second grade last year and they had him in detention, which I feel is setting him up for corrections," said Stewartson. "It's a mentality we really have to change."

Three years and a month into the occupation of Iraq, "war" emerged frequently as a metaphor for teaching black children in Boston Public Schools. Angela Paige Cook, who founded Paige Academy with her husband a quarter century ago in Boston's Roxbury section, observed, "We need to also understand that it's hard to do this stuff and be in the midst of a war."

"When you think about how much money it costs to keep that war going, consider that is money that is not invested in our children," added Lynson Moore Beaulieu, director of programs and strategic leadership at the Cambridge, Mass.-based. Schott Foundation for Public Education. "You also have to ask what it would really cost if all our children stayed in school and were really being educated the way they need to be."

Ulric Johnson, founder of Teens against Gang Violence and assistant dean of Springfield College's Boston campus, worried that student voices are rarely heard in discussions about education and race. "We have an educational system that does not treat young people as intelligent human beings," he said. "I have students who suffer from post-traumatic Boston Public Schools syndrome. They do not have the ability to write and think critically nor analyze critically. We do things *to* them, not *with* them."

"There's a direct correlation between young people shooting each other in school and how we see them but do not relate to them," Johnson said, adding ironically: "Gangs have a better history of recruiting and retaining young people than the educational system does."

Immigration and citizenship issues are among the tensions played out in the Boston schools. Community activist Gary Hicks asked how can immigrant parents work with their kids' teachers when showing up at school may expose them to a raid by ICE (Immigration and Customs Enforcement) agents. "What kinds of systems have been established for parents so they can go and talk about the issues regarding their children in safe circumstances?"

Roundtable organizers hope to spark a public outcry about the problem of children becoming disengaged from learning and eventually dropping out of school. Hubie Jones reminded the audience, "In the '60s, black and Latino leaders in this town were basically on the outside dealing with Boston Public Schools. We couldn't get anywhere and were not listened to. That has all changed. We are on the inside in many ways." Jones urged black leaders to work with the mayor, the governor and the school system to forge a comprehensive educational strategy.

School systems nationwide look to Boston and New England's colleges for leadership in pedagogical models, instructional paradigms and applied research. And effective programs are developed constantly. In Dorchester, the O'Hearn Elementary School's inclusion program, for example, successfully teaches children with disabilities and significant developmental delays in regular classrooms with their non-disabled peers. In Jamaica Plain, the Hennigan School's early childhood outreach program brings 2- and 3-year olds to the school twice a week for structured programs in which they learn how to play and how to learn. Importantly, their mothers or fathers are *required* to attend as well.

New ideas also need exploring. The youth-led Project Hip-Hop uses accessible topics such as hip-hop culture and *The Wire* television program to engage at-risk students in a process of critically analyzing the past and present so they can learn and organize to resist injustice. Parks is working to establish a public boarding school for poor children. Ron Walker, associate director of ATLAS Communities, a Cambridge, Mass.-based school reform initiative, urged colleagues to explore single-sex education models for young black men.

Paige Academy, an independent elementary school that emphasizes ethnic diversity and family involvement in its work with children from birth to age 12, sees fully 99 percent of its graduates go on to finish high school; 85 percent graduate from college. Parent-teacher meetings at Paige enjoy a 99 percent parent participation rate. "Parents come to meetings and learn something to take home and use with their children," according to Cook. But there's added incentive: if parents don't show, their children are expelled from school for a week. "We are able to make children love school. We start school at 7 a.m. and close at 6 p.m. At the end of the day, the kids don't want to go home. They love it. They want to be there," said Cook, concluding: "A lot of children diagnosed with ADD are not ADD. They are like today's fastest computers. They are 'DSL.' And they don't want a dial-up teacher."

Denise Patmon *is associate professor at the University of Massachusetts Boston Graduate College of Education. Email: denise.patmon@umb.edu.*

Reinvention, Not Reforms

Current School Structures Are Obsolete

NICHOLAS C. DONOHUE

New England's reputation for world-class educational excellence is well-earned but tenuous, especially as a changing world demands increased levels of learning for a much broader population.

We know our current K-12 system is not producing enough students with the knowledge necessary to succeed in college. Too few enter higher education. Too few of those who do matriculate persist through to graduation. By some estimates, only 18 of every 100 students who enter ninth grade graduate from college with at least an associate degree, the minimum level necessary to be competitive in tomorrow's world. For students of color, the numbers are even worse.

Education reform efforts, meanwhile, have been well-intentioned, but alarmingly incremental in their gains. The slow pace of progress, coupled with a need for higher levels of achievement from many more of our learners, leads to a sobering conclusion: we need a new approach. The obsolete nature of current school structures is evident in the way large groups of students with the same birthdays move from subject expert to subject expert in incremental blocks of time, in the way success is measured by seat time and rote return of information, and in the way what is learned during the "school year" is lost during the summer, perpetuating the difference in learning levels for various socioeconomic groups. Rather than continuing to try to improve our existing education "systems," we need to fundamentally rethink how we organize to educate many of our citizens. And we'd better do it soon.

As a first step, we need to abandon the convenient excuse that "this is a K-12 problem" or "that is a higher education problem." It is both. We need to continue the K-16 articulation efforts underway in various forms in all six New England states. But the resulting education continuum will need to be different and more rigorous than today's if we are to ensure that New Englanders possess the variety of 21st century skills demanded by the global economy. The recent study *Tough Choices or Tough Times* states, "the best employers the world over will be looking for the most competent, creative and innovative people" and "this will be true … up and down the length and breadth of the workforce." These employers will be looking not for a specific type of degree, but rather for a set of skills that allows students to succeed.

Next, we must significantly rethink the educational experiences we organize for learners in a world defined by this dramatically different endpoint.

Our success in this reinvention will be determined in part by how well we: maximize access to technology in order to personalize student engagement; establish wider varieties of educational experiences by demanding experimentation that goes beyond improved classroom-based models; promote applied learning in real-world settings as the norm rather than the exception; and move beyond the bounds of the "school day" to embrace the notion that learning based on high standards happens in many different places, facilitated by many different people.

While classroom instruction will always have its place, we must finally and honestly align education with what we know about how people learn—especially if we are to bolster the achievement of underserved learners.

As we recast standards for the world we live in, and modify instruction to keep pace, it will also be necessary to create a sensible alternative to current approaches to student assessment. We must embrace experimentation with fair and robust, creative instruments that assess complicated and important skills. We must investigate measurements that complement or eventually replace current narrow testing regimens with measurements that effectively gauge individual progress and competency through evidence and demonstration. If we want to nurture complex problem-solving, then we will have to teach it and value it enough to actually measure it.

In addition to being the right thing to do for alignment's sake, this next venture in re-examining how we measure student performance could inform the emerging battle over accountability and assessment in *higher* education. While we have learned much about the positive aspects of a universal accountability system in K-12 in recent years, we must not transfer an incomplete system to higher education without the benefit of retooling from our hard learning experiences.

Our goal should be to build a shared, portable instrument that would permanently bridge K-12 and higher education—one that would capture what students know and are capable of, while telling us how much value individual institutions are providing toward those important ends.

This alignment between K-12 and higher education may mature from a series of bridging exercises—shared standards, dual-enrollment programs, varied pathways that blur the lines between the levels and a shared

assessment process—into a thoughtful effort to blend systems. This should amount to a redefinition of educational opportunity that is aligned with the emerging threshold all citizens must achieve—skills and knowledge commensurate with a two-year degree.

Eventually, this will lead to a serious conversation about the future of the high school diploma and a new role for our community colleges. If the skills and knowledge that come with a high school education are inadequate today for almost everyone, then why do we perpetuate the myth that this level of achievement is sufficient for anyone?

Some people still seriously debate whether the vast majority of citizens need to achieve at high levels. Some even attribute our society's economic success to date to a paradigm of economic winners and losers.

To be sure, championing high standards does not mean suggesting that everyone achieves at the same levels, but rather that everyone can achieve at a high level—with variation of attainment above the bar.

We cannot give up on those whom the system fails. We have been stuck in refashioning a system that many agree had original purposes of culling, sorting and, by default, failing some of its participants. We have not exhausted our creativity in terms of fashioning educational opportunities in which vastly greater numbers of learners succeed.

High expectations, investments in quality and a commitment to increasing opportunity are consistent with our ideals of an equitable society. But our quest for equity is not a moral matter only. Given our collective needs for greater achievement by more of our fellow citizens, it is now a pragmatic proposition as well.

Historically, New England has been the home of practical pioneers. Our region is experienced in innovation and risk-taking for social gains, and the time could be ripe for fundamental change. There are already policies and practices that suggest we are capable of changing how people view education. The "extended learning time" movement in Massachusetts has changed perceptions of the K-12 school day. Early learning is taking hold regionwide. The campaign around increasing the number of college graduates in Maine acknowledges the type of public buy-in necessary for true systems change. New Hampshire is exploring different ways of assessing success through competency. Many postsecondary institutions are exploring alternative approaches for "nontraditional" students who are soon to be the majority. These and other efforts point to a growing movement to rethink basic assumptions about schools and schooling. Instead of working together to fix an outdated system, New England could become the national model for the creation of a new standard—a new system, a new way of educating our citizens.

The Nellie Mae Education Foundation is positioning itself to spur reinvention by investigating and re-evaluating long-held assumptions about the basic structures of our education systems. We will work with New England's private, public and philanthropic sectors to help grow an approach to improvement that is different. It will be an approach focused on what we know about how people learn and what they will need to know in tomorrow's world in order to be successful. It will be an approach that addresses what we know about our region's emerging workforce needs and builds on the quality of education—especially higher education. Reinvention is important for the entire region and for all who care about the future of education. And it is possible.

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The Big Picture College

A model high school program graduates

JAMIE E. SCURRY AND DENNIS LITTKY

Picture this: 100 African-American students sitting in ninth-grade classrooms. Four years later, only 40 have graduated. The next fall, 20 enter college. Five years later, just four have earned degrees. What happened to the other 96?

Statistics show there are more African-American males in jail than in college. Many others languish at the lower end of the socioeconomic scale, unemployed or underemployed. Some think the problem is the students. It is not. The problem is the system.

Some blame high schools for failing to prepare our most challenging students for the rigors of college-level academics. In truth, many urban high schools face massive struggles just to keep their students in school until graduation day. While the overall U.S. high school graduation rate is 68 percent, less than half of students in high-poverty, racially segregated and urban districts complete high school. But inadequate preparation is only part of the picture.

Those who do go on to higher education face a serious disconnect. The traditional university model serves white, upper middle-class students. Seventy-four percent of the students in the 146 most selective universities come from the top socioeconomic quartile, according to the Century Foundation. First-generation college students confront an array of insurmountable obstacles along the traditional path to postsecondary achievement. Less than 10 percent of students from the lowest socioeconomic quartile graduate with a four-year degree, according to noted higher education analyst Thomas Mortenson. Clearly, the nation's colleges and universities have misread the high school landscape. They have failed to understand the problem or develop a solution so that their graduation rates align with their enrollments.

Consider that by 2020, Asians, African-Americans and Hispanics will make up 30 percent of the U.S. workforce. At the same time, our economy will demand a more highly educated workforce. As Charles Kolb, president of the Committee for Economic Development, observed: "As our need for educated workers grows, the American workforce is going to come increasingly from the ethnic groups that have been least well served at all levels of American education. Unless we improve our performance in educating minority students, the average education level of the American workforce in 2020 will actually be lower than it is today." We cannot afford to leave so many of our young citizens behind.

We at the Big Picture Company believe it's time for a new paradigm in higher education—one that not only attracts low-income students and students of color but also empowers them to be successful in college and in life. While our program will primarily serve low-income students and students of color, the teaching and learning style will also attract high-potential individuals who may be uninspired in a traditional college setting—mavericks, perhaps the next Steve Jobs or Bill Gates.

Template for Success

Our philosophy is rooted in Providence, Rhode Island, where the Big Picture Company took on the task of redesigning large urban high schools more than a decade ago. In 1995, the Metropolitan Regional Career and Technical Center opened its doors to some of the city's most academically at-risk adolescents. Today, the Met School, as it is called, serves 720 students in grades 9 through 12, primarily low-income Hispanic, African-American, white and Asian students. Our outcomes resemble those of affluent suburban communities. Virtually all Met School graduates go on to college.

How has the Met School helped low-income, urban students become academic successes? Not by tweaking established formulas here or adding some advanced placement classes there. We started from scratch in Providence and 20 other cities by asking a very fundamental question: *How do adolescents learn?* Examining existing research on motivational psychology and brain science, the Big Picture Company developed a model that stresses three new Rs: Relationships, Relevance and Rigor.

In practice, this means all students are assigned to an "advisory"—a small cohort of 15 students and one advisor that they stay with for all four years. Big Picture's advisory system allows at least one adult to really know each student and make a small school smaller. Big Picture students work with advisors, parents and mentors to build a personalized curriculum around their individual needs and interests. The personalized curriculum allows students to create projects and select internships that are relevant to their lives and aligned with their passions. Students work at internships two full days per week and are "in school" the remaining three days. These academically integrated internships take students out into the community to do real work around their learning plans in closely accountable relationships with professional mentors. A student may learn math skills by selling a house or physics by building a boat. These projects demonstrate real proficiency in those skill areas and create a culture where students take pride in their work and internalize high standards. On non-internship days, students are back at school, working with their advisors to build and reinforce the skills and knowledge needed to complete their internship projects.

Students also meet with math and literacy specialists to gain necessary knowledge and skills in these subject areas. There are no formal classes or tests. Students are evaluated through portfolio assessments and

quarterly, dissertation-style defenses before a panel of teachers, parents, mentors and peers. Written narratives by a student's advisor take the place of letter or number grades.

The results have been astounding. While Providence public schools post a 73 percent graduation rate, the Met School boasts a 95 percent rate—one of the highest in the state. And on many other significant education indicators, the Met School and its students meet or exceed the state and federal standards and the community's expectations.

With funding from the Bill and Melinda Gates Foundation, we have developed 40 more schools using this student-centered design in cities such as Chicago, Denver, Detroit and Oakland.

The time has come for the Big Picture Company to move forward—into postsecondary education. We made this decision after years of seeing many students who were extremely successful in high school fail to graduate from college. The impersonal, lecture-based format of many traditional colleges simply has not been working for many underserved students.

Yesterday's Curricula

Higher education has been slow to change. Year after year, decade after decade, colleges and universities deliver the same curricula in the same basic format. They have resisted new technology and failed to adapt to a new generation of college students.

While pockets of innovation exist throughout American higher education, most professors teach as they traditionally have, confident that what worked in the past will continue to in the future. Despite their grounding as researchers, many in higher education ignore the accumulating body of research suggesting that methods which actively engage students in the learning process are more effective than conventional methods in teaching critical thinking and problem-solving. As former Harvard President Derek Bok says, "In essence, colleges don't do what they say and don't let anyone look too closely."

A handful of institutions have begun to take baby steps out of the box. Brown University, for example, allows individual students to design their own curriculum, with no general course requirements. At Alverno College, students are required not only to master course content, but also to demonstrate mastery of skills such as problem-solving and communication. Instead of grades, they complete rigorous written assessments. Classes almost never exceed 20 students, the teaching component is highly interactive, and students constantly take part in group discussions and group projects. Despite such innovative programs, dropout rates remain high.

Redesigning College

The Big Picture Company's experiences with at-risk high school students make it uniquely qualified to take on the challenge of redesigning college.

As we did at the Met School, the Big Picture Company will build its college on a foundation of research on how adolescents and adults learn. And the Big Picture College will be built around today's student—not the student of 50 years ago.

Our curricula will emphasize students' interests, uniting personal motivation and discipline with progressive coursework and real-world learning. Starting their freshman year, students will work in companies alongside mentors who will help evaluate their performance. Groups of 15 students will live together and take part in team projects guided by a faculty advisor. In addition, we will weave in international experiences and internships abroad to enrich our students' understanding of other cultures and the global economy. At select points during the program, students will be grouped into teams that work together on real-life, collaborative projects.

Unlike most colleges and universities, ours will support students emotionally and academically. Each student will have an individual study/work plan as well a personal tutor. The personalized group and individual work will enable students to learn deeply and become liberally educated adults, well prepared to meet 21st century challenges. Students will be evaluated through formal exhibitions of their work. Panelists will include college faculty, professionals from the business and international community, as well as local community members and other students. Panelists will assess academic rigor, personal growth and evidence of progress toward mastery of set learning outcomes. Our outcomes will not only be proficiency in the core academics of sciences, arts and English, but also the development of a strong work ethic and problem-solving skills.

Our students will thrive in this environment. More importantly, they will be prepared for life and work after college. We will produce students who can get things done.

The Big Picture College will enroll a large number of first-generation and underrepresented students. Our admissions policy will be based on students' past school work, abilities and commitment as demonstrated through their high school portfolios, interviews, recommendations and an intensive candidate weekend, not on SAT scores and class rank.

We do not undertake this journey lightly. As we did for our high schools, we will launch an in-depth longitudinal study to determine what factors and programs ensure our students' achievement from graduation day to middle age. We will convene an advisory committee of college people and business leaders to guide the business model and strategic plan. We will open The Big Picture College in September 2009, either as a free-standing institution, or as a college within a college.

The time is right. We must not be afraid to discard the old formulas that are failing our low-income students and students of color. Colleges must change, and we are ready to lead the way.

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Demographic Demise

The Declining Young Adult Population in New England

ROSS GITTELL

Young adult workers provide businesses with the dynamic labor force and fresh ideas they need to innovate and grow. With their contributions to cultural, intellectual and social life, young adults also make New England a vibrant and interesting place to live. And young families support local schools and demand a strong educational system. Yet New England is losing this young adult population.

Data recently made available by the U.S. Census American Community Survey suggest a troubled demographic profile for the New England states. The region's overall population has grown less than the U.S. average over the past 15 years, increasing by just 8 percent from 1990 to 2004, compared with 18 percent nationally. Though the region's growth lags the national average for all age levels, the most alarming change is in the 25- to-34-year-old group. The population of this cohort, which today we would consider "young adults," declined by nearly 25 percent in New England from 1990 to 2004. This compares with a national average decline of 7 percent and contrasts sharply with the significant growth of more than 10 percent in the young adult population in seven Mountain, Northwest and Southeast states over the same period.

All six New England states rank among the bottom 10 nationally in population change in this important group and all have lost one-fifth or more of their young adult populations. (See Figure 1.)

This loss of young adults has occurred throughout New England. Of the 67 counties in New England, every one except tiny Nantucket County in Massachusetts experienced some decline in the young adult cohort. (See Figure 2.)

The decline in New England's young adult population, and the nation's, can be attributed partly to the aging of the large baby boom population, those born between 1946 and 1964. In 1990, more than half of New England baby boomers were in the age 25-to-34 cohort. By 2004, these baby boomers were no longer young adults.

But why is the distribution of the young adult age cohort so unequal across regions—growing by 20 percent to 60 percent in some of the Mountain, Northwest and Southeastern States while declining at double-digit rates in New England?

The dramatic differences suggest that New England is not an "attractive" place to live and work for young adults, including many of the U.S. and foreign students who continue to flock to the region for college. Indeed, while New England accounts for nearly 6 percent of U.S. full-time college enrollment, more than 6 percent of bachelor's degrees granted and more than 7 percent of graduate degrees granted, the region is home to just 4.5 percent of the nation's 25- to 34-year-olds—an even smaller share than its 4.7 percent of total U.S. population.

Figure 1

States with the Largest Percentage Gains and Declines in Young Adult Population

Rank	State	1990-2004 Percentage Change Ages 25-34	2004 Population Ages 25-34
1	Nevada	60%	354,894
2	Utah	45%	399,210
3	Arizona	31%	830,117
4	Idaho	21%	184,610
5	Colorado	17%	717,277
6	Georgia	16%	1,363,671
7	Oregon	12%	505,997
8	North Carolina	9%	1,241,888
9	Texas	8%	3,335,725
10	Tennessee	2%	828,111
	United States	**-7%**	**40,031,938**
41	Rhode Island	-20%	139,077
42	Massachusetts	-20%	880,404
43	Maryland	-21%	710,846
44	North Dakota	-23%	80,531
45	Pennsylvania	-23%	1,471,113
46	Vermont	-27%	69,580
47	New Hampshire	-27%	148,953
48	Alaska	-28%	81,152
49	Maine	-29%	145,686
50	Connecticut	-30%	409,393

Figure 2

Bottom 10 New England Counties in Population Growth for Ages 25-34, 1990-2004

County Name	State	1990-2004 Percentage Change for Ages 25-34
Aroostook	Maine	-52%
Windham	Vt.	-41%
Newport	R.I.	-41%
Piscataquis	Maine	-40%
Bennington	Vt.	-38%
Rutland	Vt.	-38%
Rockingham	N.H.	-38%
Coos	N.H.	-38%
Windsor	Vt.	-37%
Sagadahoc	Maine	-36%

Source: U.S. Census Bureau; http://www.census.gov/popest/datasets.html

To understand what's at stake, consider two recent University of New Hampshire graduates. Alexis Dascoulias graduated with a bachelor's degree in Theater Education in 1995 and is now a certified speech and drama teacher. She headed the Drama Department at the Dover, N.H., high school for seven years where she taught theatre arts, public speaking and English. Dascoulias is now the education director for the Seacoast Repertory Theatre's Portsmouth Academy of Performing Arts program. She has directed, produced, taught and performed throughout the Seacoast area. Eric Esposito, a 1999 graduate, is a founding principal of an online, customized marketing company in Manchester called SilverTech. He is responsible for all technology initiatives, including research and development, security, infrastructure management, custom application architecture and development and hosting. Esposito's company has donated more than $500,000 in in-kind services to nonprofits and community groups. Prior to joining SilverTech, he designed and developed operating systems for NASA-funded projects as part of the CAT-SAT Satellite Project.

Dascoulias and Esposito exemplify the young adults who fill one-third of New England information technology, science, arts, design and entertainment industry jobs. Still, too many of their peers are slipping away from the region after earning their college degrees. In 2003, the Boston Chamber of Commerce and the Boston Consulting Group surveyed more than 2,000 area college graduates and found that half of them leave the area after receiving their degrees. A recent University System of New Hampshire analysis of graduates yielded similar results.

In the Chamber survey, 80 percent of college graduates who left Boston indicated that they did not have strong ties to other areas but that the attractions and opportunities were greater elsewhere. Among specific reasons graduates leave, the report cites the quality of job opportunities, the connections between employers and soon-to-be graduates, the affordability of the region (particularly of housing), and the "experiences" offered in the region, including exposure to diversity and options for entertainment and socializing.

New England colleges and universities can act on several of these fronts, particularly on the connections between employers and soon-to-be-graduates. More opportunities for internships and improved placement services can help stem the out-migration of graduates. Colleges can also help alumni who do stay in the region to connect to important social and career networks. Colleges can open their doors and contribute to the quality and diversity of cultural and social experiences available to not only their own alumni but also the graduates of other institutions. And colleges can work with business groups and others to better market the region to students, recent graduates and young alumni.

Of course, there are also leakages in the pipeline *to* higher education within New England. Vermont and Maine high school graduates matriculate to college at below-average rates, while Rhode Island and New Hampshire are only about average. Moreover, 82 percent of high school graduates nationally matriculate at colleges in their home states. In the New England states, fewer than 70 percent do, and Vermont, New Hampshire and Connecticut see higher percentages of high school graduates leave their states for college than any other states in the country.

In addition to providing a critical pool of hard-working entry-level and specially skilled workers for technology and creative industries, young workers often bring fresh ideas and energy to the workplace. They make New England more interesting

and dynamic and they can be magnets that attract others, young and old, to visit and live in the region. Without more of them, New England will struggle to achieve significant employment growth and new business development.

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Pushing Plastic

JOHN H. HUMPHREY

As they send their teenage kids off to college in the fall, parents will probably counsel them on the dangers of accepting credit card offers and the risks inherent in credit card debt. Most probably assume that the university will be their ally in warning students about such dangers. But instead, most universities actually try to get their own students to take out a credit card. The Massachusetts state treasurer, who has launched a "Caution with Credit" program for students, estimates that 80 percent of schools do this.

Within the first year of our son's enrollment at Brandeis University, he received at home the following letter written and signed by the president of the Alumni Association:

"Dear Graham, Imagine the convenience of being able to purchase supplies for your classes, without worrying about carrying a lot of cash. You could pay school fees—or get quick cash in an emergency—and put it on one easy-to-use account. That's the kind of flexibility every student can appreciate, and it can be yours with the Brandeis University credit card! This unique financial tool can help you save money, simplify your life, build a good credit history, and show your pride every time you make a purchase."

A postscript adds that the credit card issuer helps support Brandeis with every account opened and for every purchase made with the card.

The Brandeis credit card is just like any other (but it has a nice picture of the university on the front). In 2006, the interest rate (APR) for most students was 15.99 percent, but in 2007 it was raised to 19.24 percent. If the student is late on a single payment, the APR switches to 25 percent and can't be lowered again. The fee for a late payment is up to $35. But surely a teenager would never forget to pay a bill on time?

We were surprised to receive this solicitation, since our family had already taken every opportunity to opt out of credit card solicitations. We wondered how the credit card company, Bank of America, knew our son was at that particular university and how it had obtained his personal information. Inquiries to university officials revealed that every year the university registrar gives Bank of America its database with the names and home addresses of the students. The solicitations have come twice a year.

Administrators give us a range of justifications for pushing credit cards on undergraduates, ranging from helping students "become responsible about managing their own finances" and creating good credit records, to providing a way to encourage students and graduates to stay connected to their college.

Brandeis is not alone. Brown University solicits its undergraduates twice a year in this way. It claims that it "offers credit counseling" and that the cards are "low credit limit/low balance" but carefully adds "depending on their circumstances."

As for the privacy issue, one university administrator I contacted told me that "students' personal information is not considered private unless a student formally requests that limits be placed on the categories of information that the university may choose to make available." He warned further that "not allowing the university to release their names casts [students] into total anonymity within the university's system ... they will be totally blocked from the student directory."

Happily, there are a few colleges out there still practicing old-fashioned values. Bryn Mawr and Kenyon are two colleges that do not target their own undergraduates to take out a credit card. Ironically, college administrators complain they get very little out of their "partnerships" with credit card companies. So why don't more colleges just refuse to push more debt on their students?

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For decades, New England's innovation-based economy has depended upon a supply of people with science, technology, engineering and math (STEM) skills. But there is growing concern that New England's poorly flowing STEM pipeline will cause the region's high-tech leadership to dry up. ***THE NEW ENGLAND JOURNAL OF HIGHER EDUCATION*** *asked five experts to reflect on education issues related to the region's science and technology economy. …*

Red Flags in High-Tech

PATRICIA M. FLYNN

The United States has long been a world leader in education, innovation, high-tech employment, and research and development (R&D). Its future status, however, is not secure. This is the conclusion of more than two dozen reports in recent years from a variety of groups of business leaders, educators and government officials. There also is consensus that science and engineering (S&E) skills—now grouped under "science, technology, engineering and math" or "STEM" skills—and a strong R&D foundation are essential if the United States is to remain competitive in the increasingly knowledge-based global economy. This high-tech infrastructure is at risk in the United States, at a time when several other countries, especially those in Asia, are investing aggressively and strategically in these areas.

The findings are especially disconcerting for New England. For decades, the region has drawn its competitive advantage and economic prosperity from its dynamic high-technology infrastructure. The region's extraordinary network of colleges and universities lies at the heart of this infrastructure, providing a plethora of academic degree programs in STEM and other fields, and contributing to a highly skilled workforce, a strong foundation of R&D and a vibrant pool of entrepreneurs. In addition to a significant inflow of private venture capital, federal funds in areas from defense to health care have been instrumental in generating an ongoing mix of innovations, patents and new technologies in the region. Thus, much is at stake for New England, in particular, if the United States loses its leadership role.

S&E Education

S&E education in the United States is still strong, according to the latest data from the National Science Foundation (NSF). S&E degrees represent about one-third of all bachelor's degrees and two-thirds of all doctoral degrees awarded in the United States. While the *share* of worldwide undergraduate S&E degrees awarded in the United States is on the decline, the number has been rising for the past two decades. At the doctoral level, S&E degrees awarded in the United States peaked in 1998; but *enrollments* in such programs have been rising since 1999, NSF reports.

Foreign nationals play a major role in S&E programs in the United States, especially at the graduate level. In 2003, foreign students accounted for 60 percent of the doctorates awarded in the United States in engineering, and 50 percent of those awarded in mathematics and science, according to the American Electronics Association (AEA). China and India are major contributors to these pools of students.

U.S. colleges and universities, however, can no longer depend on a steady inflow of foreign students. Several Asian countries are building S&E educational infrastructures at home. China, for example, now graduates about four times as many engineers as the United States; South Korea, with approximately one-sixth the population of the United States, is producing about the same number of engineers as the United States, according to AEA. In addition, competition for foreign S&E students has intensified from countries such as Canada, Australia, Germany and the United Kingdom. And since September 11, 2001, it has been more difficult for foreign nationals to obtain visas to study in the United States.

The impacts of these trends are already being felt. First-time foreign graduate student enrollment in S&E programs in the United States fell by 13 percent between 2001 and 2003, according to the 2006 Economic Report of the President. A survey by the Council of Graduate Schools cites a 36 percent decline in the number of foreign student graduate applications in engineering in fall 2004 from a year earlier.

Compensating for these gaps in S&E college enrollments with U.S. residents would be a major challenge. U.S. students continue to lag their peers in many developed countries in tests of math and science performance. In 2003, for example, the United States ranked 24th of 29 industrialized countries in math performance among 15-year-old students, according to the Organization for Economic Co-operation and Development (OECD).

The S&E Workforce

The potential loss of foreign S&E graduates in the United States comes at a time of high and rising demand for these skills. From 1980 to 2000, S&E occupations in the United States expanded by more than 4 percent a year, while the total number of S&E degrees awarded grew on average by just 1.5 percent annually, according to NSF. U.S. employment in S&E occupations in the decade ahead is projected to continue to expand well above the average for employment overall. Retiring baby boomers will generate additional vacancies; NSF reports

that approximately 30 percent of all S&E degree-holders in the U.S. workforce are now age 50 or older.

Immigrants account for a growing share of the S&E workforce in the United States. More than one in four college-educated workers in S&E occupations is foreign-born, according to NSF. The higher the education level, the larger the share of immigrants. In 2002, for example, immigrants comprised 17 percent of U.S. S&E workers with bachelor's degree's only, but 43 percent of those with doctorates, according to the 2006 Economic Report of the President. At U.S. universities, meanwhile, about 20 percent of S&E faculty are foreign-born, including more than one in three engineering faculty.

Historically, most foreign S&E doctoral degree recipients intended to stay in the United States after graduation. By 2003, this share had risen to 68 percent, the NSF reports. However, the booming economies in countries including China and India increasingly provide attractive work options for these well-educated, highly mobile workers. Even if the United States is able to attract these individuals as S&E students, growing numbers of them may chose to return home upon graduation.

R&D

America's leadership role in R&D also is being challenged. With R&D expenditures amounting to 2.68 percent of gross domestic product (GDP), the United States ranked fifth in the world by this measure in 2004, following Sweden, Finland, Japan and Iceland, according to OECD. Since 2000, however, R&D's share of GDP has been rising in the European Union and in Asian countries including China, India and Japan, but declining slightly in the United States. Moreover, federal funding of R&D in the United States peaked in the 1980s. Even the NSF, itself, long a supporter of basic research and S&E activities, proved vulnerable in 2004, as Congress voted to reduce its funding for the first time in 16 years.

More than two-thirds of domestic R&D expenditures in the United States are now private-sector investments, which, while important, tend to be cyclical and focused on shorter-term results rather than basic research.

In terms of the number of researchers employed, a key factor in the R&D system, the average rate of growth in OECD countries in recent years has exceeded that in the United States by about one-third.

By other research and innovation measures, the historic dominance of the United States is also at risk. For example, U.S. patent applications from Asia have outpaced those from within the United States in recent years. The U.S. share of S&E papers published worldwide and the share cited by other scientists are also falling, according to the Task Force on the Future of American Innovation, comprised of industry and academic officials. These trends suggest the United States will increasingly depend upon R&D and innovations from other countries. In addition, while long a leader in innovation, the United States has often lagged other countries in the *adoption* of new technologies, especially those developed elsewhere. Thus, a change in mindset and behavior may be required of U.S. managers, workers and consumers if the United States is to remain technologically competitive. Alliances with companies and governments beyond our borders as equal partners may be needed to ensure access to S&E talent and ideas, and for the United States to remain a serious player in the knowledge-based global economy.

Globalization is here to stay. In the years ahead, we are likely to see further dispersion worldwide of R&D, S&E degrees awarded, the production of goods and services, and of better, more highly skilled jobs. The United States must be willing to make the long-term investments in education and research that provide the foundation for its high-tech leadership, or risk watching its competitive advantage fade away. The future of New England and its high-tech economy is very much at stake.

Nearly nine in 10 U.S. students in kindergarten through second grade are interested in specific careers in science and/or math. But starting in grade 3, interest begins to wane, and more than one-third of students in grades 2 through 12 are not interested in any careers in science, math, technology or engineering, according to the an online survey of 270,000 K-12 students and their teachers and parents facilitated by Project Tomorrow, a California-based nonprofit education group.

The survey also found that the students want to learn science and math through real-world problem-solving, visiting places where science is in action, talking to professionals in those fields and using multimedia and interactive simulations. For more, visit: http://www.tomorrow.org/index.html

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STEM Sell

ZORICA PANTIC

Between 1994 and 2003, employment in science, technology, engineering and math (STEM) fields grew by a remarkable 23 percent, compared with 17 percent in non-STEM fields, according to federal data. The Bureau of Labor Statistics predicts continued strong growth in STEM job openings through 2014, with emphasis on life sciences, environmental sciences and engineering. The median salary of STEM workers is 66 percent higher than that of non-STEM workers, according to the National Association of Colleges & Employers. Clearly, STEM workers fuel our economy not only with high incomes and spending, but, more importantly, through innovation and entrepreneurship.

Yet there is a growing gap between the supply of students graduating from U.S. college science and engineering programs and demand for STEM workers. This is exacerbated by international competition. In 2006, the United States graduated 70,000 engineers, but China graduated 300,000 and India, 150,000. In addition, Chinese and Indian engineering students now prefer to stay in their countries after graduating, contributing to the high growth of their economies and competing directly with the United States.

If the United States is to preserve its scientific and economic leadership in the global knowledge-based economy, we must increase the number of college graduates trained in STEM disciplines. That means creating and sustaining a STEM pipeline stretching from pre-kindergarten through grade 12 to college and on to industry.

National Science Foundation (NSF) studies indicate that three factors contribute to building a strong pipeline: early exposure to STEM careers via role models and mentors; solid K-12 math and science preparation; and effective college retention programs.

Successful pre-college programs generate excitement for STEM careers by helping students solve real-world problems using science, math and engineering principles and incorporating hands-on experiences. One exemplary program is the West Point Bridge Design Contest. The contest has provided tens of thousands of middle and high school students with a realistic and engaging introduction to engineering by allowing them to design a virtual bridge and test it. This spring, Wentworth Institute of Technology, in collaboration with Boston's Museum of Science, launched a Design Initiative program in which students from Shawsheen Valley High School and Hyde Park High School (also known as Engineering Park) visited the Wentworth campus to perform laboratory experiments with our faculty and to brainstorm about and build projects with our engineering students.

Early exposure to STEM programs is especially important for minority and female students. Although women comprised nearly half of all U.S. paid workers in 2000, they held just one quarter of U.S. STEM jobs, according to the Commission on Professionals in Science and Technology. NSF research indicates that girls perform in math as well as boys in middle school but lose confidence in their math abilities in high school. Moreover, Goodman Research Group has shown that college women opt out of engineering in their freshman or sophomore year not because they are unable to perform, but because they lose self-confidence.

Partnerships among institutions of higher education, industry and other interested groups can change this. Through the NSF Alliance for Minority Participation, Wentworth has partnered with the University of Massachusetts and several Massachusetts community colleges in outreach and retention efforts aimed at tripling the number of STEM students over the next five years. This summer, approximately 60 high school students will travel to Wentworth to work on "Green Building Design."And the institute's Students Loving Adventures in Mathematics (SLAM) enrichment program, sponsored by the Mathematical Association of America, will expose 25 to 30 underrepresented students from Boston high schools to the beauty and importance of mathematics as well as careers available to graduates with a solid understanding of math.

Wentworth has also reached out to female students. We recently hosted "A Day of Magic: Engineers in Training," in which 40 young women from Boston's Parkway Academy of Health and Technology, Urban Science Academy and John D. O'Bryant School of Math and Science got a chance to meet outstanding women engineers and participate in technical workshops such as "Create Your Own Electricity," "Spaghetti is Stronger Than You Think," "Math in the Real World," and "Chemistry You Didn't Know About." We are also working with the Girl Scouts and United Way's "Today's Girls … Tomorrow's Leaders" initiative to provide exciting gender-specific STEM programs that will build girls' self-confidence while stressing how engineering and technology improve lives.

Building interest in STEM careers is important, but we also need to ensure that K-12 students receive adequate math and science preparation. The 2005 *Nation's Report Card* shows students are not sufficiently prepared for STEM-degree programs. Only 23 percent of 12th-grade students perform at the level of proficiency in math. The 2003 Trends in International Mathematics and Science Study (TIMSS) shows U.S. 4th- and 8th-graders lagging their international counterparts in both math and science preparation (in 12th and 15th place in math for 4th and 8th graders, respectively, and 6th and 10th place in sciences). A few states, such as Texas and Massachusetts, have

embarked on efforts to improve pre-college education by requiring more emphasis on STEM curriculum. The 2001 Massachusetts Science and Technology/Engineering Curriculum Framework is an example.

Higher education must also be an active partner in efforts to ensure proper preparation for rigorous STEM curricula. At a recent summit organized by Wentworth for 10 high school headmasters from the Boston Public Schools, the message I heard repeatedly from administrators was clear: schools are looking to build long-term sustainable partnerships with institutions of higher education to help address the challenges faced by students.

Partnerships can identify and develop innovative ways to pair resources, funds, materials, expertise and support to provide enrichment experiences that expose students to STEM fields, strengthen skills in specific subjects and preview the college experience for students who may be the first in their family to consider college.

Partnerships with other public- and private-sector organizations will be another key factor in recruiting and retaining students in STEM programs. A good example is the Texas Engineering and Technology Consortium, a public/private partnership of companies, higher education and the state of Texas formed to increase the number of engineering and computer science graduates through outreach and retention programs. The state appropriates up to $5 million annually to match contributions from industry, the federal government and other non-state sources.

To preserve U.S. economic competitiveness, educational institutions at all levels, the government, professional societies and the private sector have to come together to share best practices and support outreach activities for all, but particularly for underrepresented students. We must identify local high schools to build lasting relationships with and enable our college students to serve as mentors and tutors. We must encourage opportunities to share and leverage faculty resources for teacher training and course development support. And we must partner with industry to build financial support for STEM education, demonstrate the excitement and possibilities the field offers and arm our students with the tools for academic, personal and professional success.

STEM fields, particularly biotechnology, are big with regional economic boosters. But not all is a celebration. When Boston hosted a major gathering of biotechnology firms in May, a group called BioJustice launched a weeklong series of teach-ins, workshops, protests and marches to draw attention to the biotech industry's work making genetically engineered foods, question the industry's role in developing an accessible health care system and support community resistance to plans for a federal bioterror lab in Boston's low-income Roxbury neighborhood. In fact, activists have shadowed the annual conventions of the Biotechnology Industry Organization, the world's largest biotech gatherings, with their own campaigns and protests since 1999, according to Brian Tokar, director of the Biotechnology Project at Vermont's Institute for Social Ecology. For more, visit: http://www.biodev.org/

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Closing the Engineering Gender Gap: Viewers Like You

BRIGID SULLIVAN

Giselle Eng was a high school junior with a penchant for the performing arts when she first learned about auditions for a new children's television series to air nationwide on PBS. Her interest wavered, however, when she learned the focus of the new series: engineering. "I definitely had a lot of misconceptions about engineering," says Eng, who recently graduated from Boston Latin High School. "I thought it was all technical and computers and programming. I never really imagined myself doing anything related to engineering."

Despite her misgivings, she went through with the audition, and eventually was selected from hundreds of high school students to appear in the first season of *Design Squad*, a new PBS reality series from Boston public broadcaster WGBH that follows two teams of high-schoolers as they solve a series of engineering challenges.

Eng's initial hesitation about engineering is symptomatic of a longstanding problem in America's innovation-based economy: women pursue college degrees and professional jobs in engineering at much lower levels than men. According to the National Science Foundation, just 16 percent of the 2005 college

freshmen majoring in engineering were women, down from an unremarkable 20 percent a decade earlier.

What's behind this gender gap? A study published in the *Journal of Women and Minorities in Science and Engineering* found that girls are completing high school science and math courses at the same rate as boys: 94 percent of girls took biology (compared with 91 percent of boys), 64 percent took chemistry (57 percent for boys) and 26 percent studied physics (32 percent of boys). Yet despite similar rates of participation and achievement in high school science and math courses, young women continue to lag behind their male peers in pursuing degrees in many science, technology, engineering and math (STEM) fields.

Thea Sahr, who heads WGBH's Extraordinary Women in Engineering initiative aimed at changing the way high school girls view the engineering profession and the way the profession positions itself before this potential workforce, attributes the gender gap to perceptions. "Our research found that high school girls don't really have an understanding of what engineering is," says Sahr, whose team interviewed college-bound high school girls as well as science and math teachers, guidance counselors, college engineering students and engineers. "Among all the audiences involved in our research, we found that engineering was perceived to be a 'man's profession' and that there is little or no encouragement for girls to consider engineering."

Of particular note was the perception among high school girls and their teachers and counselors that engineering was a less "people-oriented" profession that had less direct impact on people's lives than other scientific fields such as medicine or biology. "Girls and their educators did not have a clear picture of engineering," Sahr says. "We learned they believe that, to be a successful engineer, you must be highly superior in both math and science, a message that does not resonate with them.

"We also were surprised to learn," she says, "that the engineering community is spreading this message, focusing on the process of becoming an engineer rather than the societal value and rewards of being an engineer."

Changing perceptions

Changing these perceptions is the focus of the Extraordinary Women in Engineering initiative. Working in collaboration with nearly 50 professional engineering associations, universities and corporations, WGBH is developing an extensive multimedia campaign emphasizing ways the engineering field helps improve people's lives.

Sponsored by the National Science Foundation and Northrop Grumman, the project is developing an interactive web site that will use streaming video portraits of successful female engineers to combat the misperceptions many girls have about the profession. Outreach materials will enable science and math teachers and school counselors to guide girls who may be interested in engineering. And resources for engineers will be used to launch a dialogue on the need to redefine the profession as a desirable career option for high school girls. The initiative will also give America's more than 1 million engineers new tools to reach out to high schools, teachers, counselors and high school girls to encourage interest in pursuing a degree in engineering.

On the national level, a flurry of STEM-related bills in Congress would provide everything from scholarships and loan forgiveness to tax incentives and teacher training grants aimed at encouraging students to pursue degrees and consider teaching in STEM fields.

Before tomorrow's high school students can start taking advantage of such incentives, however, we must find new ways of engaging even younger students in math, science and engineering.

Public television reaches 98 percent of all U.S. households and is uniquely positioned to help create the STEM pipeline.

In the past year, WGBH has debuted three new television series that focus on STEM-related content: *Fetch!*, a reality/game show for kids ages 9 to 13 with a focus on math and science; *Curious George*, a half-hour animated series that uses the misadventures of everyone's favorite little monkey to teach preschoolers basic concepts in math, science and engineering; and *Design Squad*, with its focus on engineering.

The common thread running through these programs is the presentation of STEM content in unexpected and entertaining formats that engage and excite young viewers. "*Design Squad* is targeting 9- to 12-year-olds because we want to show them what engineering is really about—how creative and exciting it is—before they decide that math and science are 'boring,'" says senior executive producer Kate Taylor.

"Our target audience loves reality shows, so we've taken what's best about them—the competition, the intensity, the people you start to care about—and married it to serious content," adds executive producer Marisa Wolsky. "Our goal is to break down negative stereotypes—that engineers are nerdy, or that it's too difficult, or for boys only—and expose young people, especially girls, to the idea that engineering is something they might want to consider as a career."

When male scientists marry and have children, their chances of landing tenure-track positions in the sciences increase, but when women do the same, their chances of moving up the academic ladder decrease, according to a study by economists Donna Ginther of the University of Kansas and Shulamit Kahn of Boston University. Having a child under age 5 lowers the probability of a tenure track appointment by 8 percent for women scientists. For more, download: http://www.nber.org/~sewp/Ginther_Kahn_revised8-06.pdf

As New England develops a STEM agenda, public broadcasting should be an active partner in helping to spark a passion for the field among what is inarguably our region's most valuable resource: the boys—and girls—who will make up the STEM workforce of tomorrow.

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Colby-Sawyer is among New England colleges where the liberal arts curriculum has traditionally required only one course in math, and no academic major or minor in math is offered. Recently the New London, N.H., school received a three-year $149,290 grant from the National Science Foundation to incorporate teaching of basic math and reasoning skills across its liberal arts curriculum. One of 100 programs funded under the NSF's Course, Curriculum and Laboratory Improvement program, the Colby-Sawyer initiative's goal is to ensure that students can routinely use basic math concepts and skills considered critical in an information-centered global society. For more, visit: http://www.colby-sawyer.edu/news/nsf.html

Engineering Education Must Get Real

BERNARD M. GORDON

Private industry lives and sometimes dies by a demanding credo that honors results and constantly tests people and ideas against a public that can vote with its economic might. Academia, on the other hand, insulated by a steady, if sometimes unpredictable, flow of cash from government programs and endowment funds, has learned to be slower and more methodical. This can certainly produce reflective, careful thinking and sometimes deep analysis—results that are rare in the private sector and usually regarded as a luxury good. But far too often, the output is not what it should be. It really does seem that academics are altogether too happy to inhabit those fabled Ivory Towers. These habits of mind are further hardened by an inward-looking system of promotion and management that places academic achievement—study and research—on a plane above actual accomplishment in the non-academic world. Thus, too often what passes for innovation and forward thinking in an academic program turns out to be merely a trimming of the sails to catch the breeze of a new fashion or nostrum, rather than an act of real commitment and innovation. This is a particularly pernicious problem with regard to fields of study that are often accurately and sometimes disparagingly referred to as "practical."

My own profession, engineering—a field that should always be rooted in pragmatism even as it reaches to stretch the limits of what is possible—is a case in point. Recently, at one of the region's engineering colleges, I encountered an example of academic fashion that simply missed the boat. The president of the school told me with pride of the college's new, multidisciplinary teaching methods, and then confessed that half or more of his graduates would probably end up in other careers, such as marketing—implying that the changes in the classroom had little to do with creating better engineers.

Today, academics spend a great deal of time—and money—fretting over the state of "STEM" education. STEM—a clever acronym for science, technology, engineering and mathematics—attempts, wrongly in my view, to tightly associate educational enterprises that should be distinctly delineated. To be sure, STEM aims to promote study in areas that share similarities and are sometimes interdependent. However, the fact that engineering—a critically important profession—is thereby lumped with three very broad subject areas is troubling and indeed symptomatic of all that is wrong with engineering education today.

In fact, the history of engineering education since World War II is, by and large, a chronicle of retreat—with experienced, hard-nosed practitioners, who used to comprise a significant element of the engineering faculty, gradually banished from sight. Moreover, a growing emphasis on science and research rather than on, say, a hands-on familiarity with machine tools or the ability to rapidly and intuitively compute, with reasonable accuracy, the impedance of an electronic circuit (without the help of a machine), has in most engineering programs led to the production of cadres of young engineers whose skills are fatally limited.

In addition to failing to adequately teach solid engineering skills, there has been an even more precipitous retreat from the inculcation of values such as determination, resourcefulness and integrity that are essential to economically successful engineering. In fact, values are almost as crucial to a successful engineer as specific technical training. For instance, it takes deep wellsprings of determination and tenacity to pursue a project

through to the end, to build with careful conservatism when that's needed, and to risk thinking far out of the box when something new is required. Sadly, were one to write a very brief history of engineering education since World War II, it could be boiled down, with some notable exceptions, to the old saw about *those who can, do, and those who can't, teach.*

This is not intended to impugn anyone's good intention. The point is that in fields such as engineering, there is absolutely no substitute for the hard-edged technical and business skills that are required to bring products and projects to market. It is an unforgiving and demanding environment and, for students to succeed as engineers, they must acquire skills that go far beyond theories, simulations and exam-taking. Those best able to prepare students are those who have labored, survived and succeeded in competitive endeavors not those who have only studied and studied and studied.

Through a vague recognition that something needed to be done—or perhaps spurred by the private sector, which employs most engineers—periodic efforts have been launched at various institutions to reinvigorate and reinvent engineering education. (I have been involved with some of these, including establishing the Gordon Institute and funding the Gordon Prize for Innovation in Engineering and Technology Education.) Yet, for most in academia, the fundamental perspective has remained unchanged. Academics hire other academics, and the educational experience offered to students, instead of being a hard-edged boot camp, remains little more than a gussied-up science fair. Even when projects are assigned to students in an effort to mimic the real world, failure is often regarded as having nearly equal value to success from a didactic perspective. This is a dangerous lesson. In the real world, engineers can't fail. Lives depend upon them. To drive home this point the education of civil engineers in Canada is capped by the solemn presentation, to those deemed worthy, of a ring made in part from steel recovered from the Quebec Bridge, which collapsed in 1907, claiming dozens of lives. The message is clear: welcome to the world of engineering but don't ever forget that the lives of others depend on your judgment and correctness. Failure is not an option.

Here in the 21st century, with all the issues of global competitiveness and pressing technological challenges, it is high time for American engineering academics to recognize these issues and truly embrace change. Perhaps professors should take a sabbatical and spend it in the cutthroat world of Silicon Valley or Detroit. Or better yet, colleges should hire some star engineers fresh from a competitive, save-the-company, 24/7 product development effort. Students need to understand viscerally that all professions—but particularly those proudly called "practical"—demand real results from their practitioners. Only when we can convey that message successfully will our graduates be equipped with the drive, energy and purpose to successfully apply knowledge in today's real world.

And when academia learns to enlarge its own conception of mission to include that values message, it will have earned itself a new position of power and respect in our society.

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Toward a Federal STEM Policy

JAMES T. BRETT

Key New England industries including information technology, defense technology, biotechnology, environmental services, health care and university research rely upon people with skills in science, technology, engineering and math (STEM) fields. Yet, just 20 percent of New England high school students who took the SATs in 2005 indicated a desire to major in a STEM field. That's below the U.S. average of 26 percent and significantly below the rate of North Carolina, a major competitor where 33 percent of SAT-takers said they were interested in a STEM major. Moreover, if current trends continue, by 2010, more than 90 percent of all scientists and engineers in the world will be living in Asia, according to a presentation by Rice University chemist Richard Smalley to the President's Council of Advisors on Science and Technology.

To head off labor shortages in crucial STEM fields, New England needs to shore up the pipeline of talent with a long-term strategy that focuses on K-12 and higher education.

While there are roles for state governments and the private sector to play in improving STEM education, we urge New England's congressional delegation to propose a significant *federal* initiative to encourage and promote STEM education nationally. A model for this could be the National Defense Education Act of 1958, which was enacted in response to the former Soviet Union's launch of Sputnik. This law provided new funding for mathematics and science education and training at all education levels. It inspired generations of U.S. students to pursue study in fields vital to national security and aided the nation in establishing its dominance in science and technology for the next half century.

As part of a newer initiative, we urge New England's congressional delegation to support more specifically:

- **Increased investment in STEM teachers.** This could involve scholarships, loan forgiveness and tax incentives for STEM graduates who commit to teaching, as well as training for current teachers and mid-career professionals and retirees who might like to teach STEM in public schools. Many STEM graduates go into fields other than teaching in part because of better pay. The legislation should also include market- and performance-based compensation and incentive packages to attract and retain effective STEM teachers at all levels. It could also launch a "Finally, Science, Technology and Engineering" initiative as a logical next step to the U.S. Department of Education's focus on "Reading First" and "Math Next".

- **Increased investment in technology in schools.** We propose a National Technology Funding Program that would help schools purchase educational tools and require school leaders and teachers to focus on strategies to increase interest in STEM fields of study. This should include requiring school districts to develop STEM plans indicating goals and strategies and a guarantee of continued funding only if schools meet key milestones for each year.

- **Increased investment in STEM higher education**. The federal government can provide more incentives and support for programs aimed at getting a greater number of college students to major in STEM fields. These should build upon a range of existing scholarships and loan-forgiveness programs for students who pursue STEM fields. The National Science Foundation's STEP program providing grants to colleges for increasing the number of students majoring in STEM fields should be expanded. Centers for Undergraduate Education in STEM fields should be established at universities to improve the quality of undergraduate courses and increase the number of students taking these courses. Congress should also expand financial incentives for colleges and universities to partner with industry in creating science master's degree programs that respond to local and regional demand for workers with skills beyond a bachelor's degree, and for community colleges to increase the success of students in transferring to four-year STEM programs. And funding should be expanded to programs that succeed in graduating women and minorities in STEM fields

There are additional ways the federal government can bolster the infrastructure for STEM education. Steps should be taken to increase federal research and development funding, which has grown by only 1.5 percent since 2004, compared with 37 percent between 2000 and 2004, and to reform immigration laws to expedite permanent residence for foreign students who receive advanced degrees in STEM. Additional incentives should also be offered to business to develop more partnership roles with schools, donate technology, promote mentoring and provide training. Moreover, federal cabinet secretaries with a stake in STEM—Defense, Education, Homeland Security, Commerce, Labor and Energy—should develop a strategy to raise public awareness of STEM education.

New England must have an adequate supply of workers with skills to support an innovation economy. As other regions and countries focus investment toward innovation, it becomes even more pressing that New England and its representatives in Washington act now to prepare for the future.

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DATA CONNECTION

- Change in average real income for top 5 percent of New England households between 1989 and 2004: **+27%**
- Change in average real income for bottom 20 percent over that period: **-5%**
- Percentage of total New England income earned by top 20 percent: **47%**
- Percentage of trustees of U.S. private non-denominational colleges who have annual incomes of $500,000 or more: **28%**
- Percentage of trustees of U.S. private non-denominational colleges who are black: **6%**
- Percentage of Maine workers who are not entitled to *any* paid sick days at their jobs: **46%**
- Percentage of Maine residents ages 25 to 54 who report being victims of violent crimes in the past 12 months: **6%**
- Percentage of Mainers ages 18 to 24 who do: **12%**
- Percentage of Maine residents with annual incomes of more than $50,000 who are victims of violent crimes: **3%**
- Percentage of Maine residents with annual incomes of $20,000 or less who are: **9%**
- Percentage of Connecticut residents who live in Fairfield County: **25%**
- Approximate increase in population density of Connecticut municipalities for every 10 percent decrease in distance to New York City: **8%**
- Percentage of college-bound parents who say they would insist on visiting a campus themselves before allowing their child to attend: **45%**
- Percentage of college-bound parents who count "seeing the dorms" as a top priority on the campus visit: **2%**
- Number of *The Princeton Review's* top 20 colleges in the United States for campus food that are located in Maine: **4**
- Number of consecutive national championships won by the Trinity College men's squash team: **9**
- Number of consecutive matches the team had won as of April 25, 2007: **165**
- Rank among the longest current winning streaks of any U.S. college team in any sport: **1**
- Number of countries where there are more cell phones in service than there are people: **30**
- Percentage of U.S. students in grades 9 to 12 who use a cell phone daily: **73%**
- Percentage of K-12 teachers who think cell phones should be allowed at school for emergencies and connecting with parents: **56%**
- Percentage of parents who think so: **77%**

Sources: 1,2,3 University of New Hampshire Carsey Institute; 4,5 Maguire Associates survey for *Chronicle of Higher Education*; 6 Maine Center for Economic Policy, Institute of Women's Policy Research; 7,8,9,10 University of Southern Maine Muskie School of Public Service; 11,12 University of Connecticut Department of Economics; 13,14 StudentProspector; 15 *The Princeton Review* (The colleges are Bowdoin, Colby, College of the Atlantic and Bates.); 16,17,18 Trinity College; 19 The Aspen Institute; 20,21,22 Project Tomorrow

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