



# **One Nation Under-Taught**

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**Solving America's Science, Technology, Engineering & Math Crisis**

**Dr. Vince M. Bertram**



**Beaufort Books**  
**New York**

FIRST EDITION

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Educate and inform the whole masses...They are the only sure reliance of the preservation of our  
liberty.

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—*Thomas Jefferson*—

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# Foreword

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by Steve Forbes

As a nation, we have known for decades that our K-12 education system is in serious trouble, that our students routinely lag their counterparts in numerous other countries in language and mathematical skills. This is especially worrisome in an era in which high tech is becoming more and more critically important for advancing economically. That millions of our children are not being taught effectively—or at all—in the crucial areas of science, technology, engineering and mathematics, popularized by the acronym STEM, is a moral outrage. Their opportunities to get ahead, to “improve their lot in life,” as Abraham Lincoln put it, are being seriously harmed and our future well-being as a nation is being jeopardized.

Thankfully, America has a tradition dating back to Colonial times of not being passive when serious challenges arise. Vince Bertram is a splendid example of this can-do, let’s-roll-up-our-sleeves-and-do-something-about-it characteristic. His organization, Project Lead The Way (PLTW), has been tackling the STEM deficiencies in our primary and secondary schools for a decade and a half. PLTW has become the leading provider in the U.S. of STEM programs for kids in grades K-12. In addition to coming up with world-class curriculums Dr. Bertram and his colleagues have created superb professional development programs for teachers. More than 6,000 schools around the country have benefitted from PLTW’s crucial work.

Dr. Bertram understands that it’s not enough to come up with solutions, that you must also actively work with students, parents, teachers, administrators, parents, universities, businesses and foundations, as well as community and government leaders to affect lasting, positive change. Interacting with all parties—brainstorming, if you will—can also generate new ideas on how to move forward.

While PLTW has made powerful contributions, so much more remains to be done throughout the nation. Hence, the crying need for Vince Bertram’s new book. It couldn’t be more timely, and recognition of our STEM educational deficits is growing. Dr. Bertram brings immense knowledge and expertise to the subject and speaks from frontline experience.

Dr. Bertram lays out the irrefutable evidence of the crisis: of how, since the mid-1960s, American students have been slipping in what they actually learn in our schools, especially in the STEM fields. According to the National Assessment of Education Progress, only 26 percent of American high school seniors in 2010 scored at or above the proficiency level in math. More ominously, a staggering 36 percent had failing scores. Worse, only 3 percent scored at an advanced level in math, and a pitiful 1 percent in science.

No wonder so few U.S.-educated high school students go on to pursue STEM courses in college. No wonder our high-tech centers, epitomized by Silicon Valley, must recruit literally hundreds of thousands of foreign-educated people to try to fulfill their needs for skill-based workforces. Even with that, huge gaps remain, which is why companies have to set up facilities overseas to meet the requirements.

All of which, of course, begs the question: Why don’t our schools do a better job?

It’s not as if we don’t know we have an enormous problem. Back in 1983, the state of education had gotten so bad that the then relatively new Department of Education released a report titled “A Nation at Risk.” The ominous opening words from that report were powerful and tough and are worth quoting at length:

*Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility. We report to the American people that ... the educational foundations of our society are being presently eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people. What was unimaginable a generation ago has begun to occur—others are matching and surpassing our educational attainments.*

If an unfriendly foreign power had attempted to impose on America the mediocre education performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in student achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament.

Our society and its educational institutions seem to have lost sight of the basic purposes of schooling, and of the high expectations and disciplined effort needed to attain them.

Alas, while we have poured immense sums into our education bureaucracies, these increased resources have had little or no effect. We experimented with reforms that were as bad in conception as they were in reality. And we continued to adjust down to mediocrity—or worse. As those numbers from the National Assessment of Education Progress attest, our students' scores over the past two generations have been, as education expert Chester Finn Jr. put it, "Flat, flat, flat."

We largely failed in fighting back against this "rising tide of mediocrity." Mediocrity does not sustain itself: One is either advancing or sliding backward. It's been said that what goes on in a nation's classrooms will eventually work its way up to a nation's governance and economy. We see that, we live with that today.

Of course, we have pockets of excellence in some of our nation's schools—Dr. Bertram and his team have been immensely helpful here. But they are pockets, not the norm. Too many of our students drop out of STEM fields, seeing them as boring or too difficult, and this aversion starts in the earliest elementary grades.

It's here that we get to what makes Dr. Bertram's book such a timely gem and an exciting contribution. Vince Bertram does far more than lament our predicament. He provides a blueprint for enabling students to fall in love with STEM subjects—subjects that don't have to be dreary and intimidating. He shows how teachers can break away from the rut of traditional teaching and kindle in kids that inspiring curiosity that will lead them to becoming passionate about learning.

Dr. Bertram is no armchair reformer. He's been in the trenches as a teacher, principal and superintendent. Through PLTW he has implemented programs that actually work. And, very importantly, his programs have equipped teachers with the intellectual and practical tools necessary to teach STEM subjects well. Students quickly come to see the true relevance of these subjects in today's world. They become inspired.

This is why we, as a nation, must "ramp up" the kinds of reforms Dr. Bertram and his colleagues have so successfully put into practice. The time for talk and ineffectual actions is long, long past. Vince Bertram shows us the way.

## Author's Note

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When problems arise, many people are inclined to blame someone or something. This book is not about assigning blame. It is about clearly articulating the problem and taking responsibility to solve it.

We have many highly effective educators who are doing extraordinary work with students; local, state, and federal policymakers who care deeply about their communities, states, and countries; mission-driven non-profit organizations working to enhance the lives of those they serve; and businesses striving to win in a highly competitive global marketplace. But, despite all these efforts, we are falling behind in educating our youth and our future workforce and we must do something about it.

This is a different kind of business and education book than most may be used to, and it is not just about science, technology, engineering, and math (STEM). Those subjects are a series of courses and disciplines. This book is about the importance of those subjects, yes, but, more: it is a book about how we integrate and use STEM knowledge. It is about how we inspire a thirst for STEM education. It is also a book about American greatness and our economy. This book is a call to action: asking teachers, principals, counselors, parents, business and community leaders to impart knowledge and experience that they may very well not have had themselves.

This is a call to nurture our children's natural curiosity, inspire them, and insist they use their minds to solve problems. This book asks us to rethink the way we think about school. It asks that we abandon the mindset that second grade is a preparation for third grade or of teaching content merely to prepare for a test. Instead, I am asking for a new mindset about school, a mindset that our schools can be places of confidence, places that inspire a love of learning, promote curiosity, and convince students that skills and knowledge matter—not because they are on a test or necessary for the next year, but because they matter for a lifetime.

I wrote this book because I believe if we do not change our present course, we are preparing to fail many of our children—and too many in our country—for a lifetime of poverty. That is why we must be realistic and tell our children, and our graduating high school and college seniors, the truth. Commencement addresses at these graduations are rife with advice telling students to “follow your dreams”—this is often misguided advice, often very bad advice. For us to live in a world where that advice were applicable or led to success, there would need to be a lot more jobs for professional athletes and Broadway performers. The reality is, dreams may be incongruous with real job prospects with simple reality. For example, throughout school, many children spend their evenings at sports practice, and even more nights dreaming of being a professional athlete. However, ninety-nine percent don't make it.

It sounds harsh, but it is the reality. Only a very small percentage of students will ever play in the NFL. In fact, according to Business Insider and the National Collegiate Athletic Association (NCAA), only 1.7 percent of college football players will play in the NFL, and only 1.2 percent and 0.9 percent of basketball players go on to play in the NBA and WNBA, respectively. This is of those who make it to the NCAA in the first place. The best opportunity is baseball, which Business Insider/NCAA reports offers an 11.6 percent chance for college athletes to go pro (for many, that means playing years in the farm system, hoping to be called up to the major league). And it's not just athletics. The same small percentages apply to music and the arts—Adele and J.K. Rowling are exceedingly rare talents, and so were Pablo Picasso and Frédéric Chopin.

So what do we tell our kids? We tell them to pursue their passions, whatever those passions might be—the arts, music, sports—because you never know who might be talented and lucky enough



make it to the big leagues. We also need to be honest with our children and tell them that while they can choose which path to take, others will likely decide whether they will get paid to do it. Life will be easier—much easier—if they have the appropriate skills aligned with the greatest opportunities.

So in what fields will students find the greatest potential for success? Forbes highlights the most in-demand college majors—the fields that will present our graduates with the most job prospects and highest earnings. Engineering and math fields dominated the list, with engineering concentrations making up one-third of the most valuable majors. Biomedical engineering ranked #1; software engineering was #4, followed by environmental engineering (#5), civil engineering (#6), and petroleum engineering (#7).

These findings are nothing new, however. I've written often about the issues the STEM skills gap is creating and how they greatly threaten America's economic competitiveness. By 2018, STEM jobs are expected to grow at a rate nearly double that of other fields—17 percent versus 9.8 percent. An estimated 1.2 million STEM jobs will go unfilled because the workforce will not possess the skills to fill them. And, as the world continues to innovate and as new technologies emerge every day, the job gap will widen. So what can we do?

The answer is clear. We must reach our students earlier, introduce them to math and science, and show them the engaging, exciting, and practical applications of those subjects. We must continue to foster curiosity and collaboration, critical thinking and problem-solving skills, and stress to our students that the purpose of education is to prepare for the global economy, an economy that is demanding more graduates with STEM knowledge and skills. We must counsel our students from an early age, introduce them to available career options, and guide them on the path to pursue those careers with the appropriate course work and activities. We must encourage our students to begin thinking about their careers long before they finish high school.

The bottom line is this. Students should continue to pursue their passions and the dream of becoming the next Peyton Manning or LeBron James. But let's also set them up with a solid academic foundation for a successful and stable life just in case the scouts don't call. And if your child or student does end up within that rare .08 percent of athletes who go pro, a strong academic foundation will give them security. Studies show that within two years of retirement, seventy-eight percent of former NFL players have gone bankrupt or are under financial stress. We must help our children have a brighter future through a career they can pursue once their dream career ends. And for the other group—the majority 99.02 percent—opening their eyes to the career possibilities of their future will excite them and inspire them, and give them a new dream to pursue. A dream that leads to a successful life.

Like many of my colleagues, I was attracted to education because of influential people in my life who inspired me to be more than I thought I possibly could be. Now, we need to be that inspiration for millions of children across our great nation.

This book is about the problem and the solution. Let's go to work.

# **One Nation Under-Taught**

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## Failing Ourselves

In 2013, the National Assessment of Educational Progress (or NAEP, known as “The Nation’s Report Card”) revealed that only twenty-six percent of our nation’s twelfth graders were scoring at or above proficient in math while thirty-five percent were failing.<sup>1</sup> To put it another way, almost forty percent of Americans about to enter the workforce, military, college, and achieving voting age do so unable to perform basic mathematics. That is, they cannot, among other things, “compute, approximate, and estimate with real numbers” or “order and compare real numbers and perform routine arithmetic calculations with and without a scientific calculator or spreadsheet.”<sup>2</sup>

Here, astoundingly to me, is a sample question from a recent NAEP math test for high school seniors, a sample question nearly forty percent of our nation’s seniors got wrong:

$$360 \times .03 =$$

a) 10.8

b) 108

c) 120

d) 980

e) 1,080<sup>3</sup>

Almost fifteen percent of the respondents selected answer “d” or “e,” which is to say almost fifteen percent of our nation’s high school students thought three percent of 360 was a number greater than 360.

The larger point here is that the state of American STEM education is not good. Indeed, it is terrible. As a result, we are depriving millions of children the opportunity for productive and great careers, and depriving our country the workforce and brain-power we need. We are in crisis—a crisis that it is imperiling our future economy and position in the world.

This is not to say that good STEM teachers, students, or programs do not exist. They do. What I am saying is that, as a general matter, our country is failing our students and itself. Consider a few more statistics.

In measuring our fifteen-year-olds against their peers in other Organization for Economic Cooperation and Development (OECD) countries in the field of science in 2012, our students came in twenty-first, below such countries as Estonia, Poland, and Ireland.<sup>4</sup> In measuring our fifteen-year-olds against peers in other OECD countries in the field of math, our students came in twenty-sixth, below such countries as Liechtenstein, Iceland, and the Czech Republic.<sup>5</sup> Over and over again, the places that come in at the top? Shanghai, Singapore, Taiwan, South Korea, and Japan. Upon the release of the rankings and scores, the *Wall Street Journal* editorialized: “Perhaps most depressingly, the data show no statistically significant U.S. achievement improvement over time. None. In an era when it pays to be thankful for small mercies, at least we’re not getting worse, but America’s relative standing is falling as other countries improve.”<sup>6</sup>

While every test has its critics, the OECD test, known as the “Program for International Student Assessment” (or PISA), is highly respected. U.S. Secretary of Education Arne Duncan said of the results from the 2009 test, which showed results similar to those of the 2012 test, “We can quibble, but we can face the brutal truth that we’re being out-educated.”<sup>7</sup> Secretary Duncan is right, but he could go

further. We are being out-educated because we are simply not realizing our potential. We are a nation under-taught and under-educated. The fault is ours.

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When it comes to our own scores at home, the news looks even worse. NAEP, as mentioned above, measures our students in a variety of subjects at different grade levels; it is administered to hundreds of thousands of students in America and is known as “the gold standard” of testing. Almost all education experts hold it in high regard.<sup>8</sup> In the most recent assessment of fourth and eighth graders released in 2013, we found that only thirty-four percent of our nation’s fourth graders were “proficient” at math—that is, they were at an achievement level one would think of as “competent” or higher—and seventeen percent were “below basic” in their mathematics abilities. In other words, almost one out of five fourth graders were failing math.<sup>9</sup> By eighth grade, the numbers were even worse: twenty-seven percent of our nation’s eighth graders were performing at the proficient level, while a full twenty-six percent were scoring below basic, or failing.<sup>10</sup> By high school, as we saw above, the numbers were worse yet.<sup>11</sup>

Given all the resources we have at our disposal today, given all the money we pour into school systems (over \$600 billion a year in America in elementary and secondary education funding alone) and into studies on how to educate, it is nothing short of tragic that a majority of our nation’s students score below a standard of competence, or proficient. Looking at the trend where fourth graders score better than eighth graders, who score better than twelfth graders, former U.S. Secretary of Education and Project Lead The Way (PLTW) Senior Advisor William J. Bennett observes: “The longer our students stay in school in America, the worse one does.”<sup>12</sup>

When it comes to science education, we do dismally as well. In fourth grade, the latest NAEP scores (from 2009) show a thirty-four percent proficiency rate and a twenty-eight percent failure rate.<sup>13</sup> In eighth grade, the most recent NAEP (from 2011) reveals thirty-two percent of our students scoring proficiently and thirty-five percent failing.<sup>14</sup> And our twelfth graders? The most recent assessment for them (2009) shows a twenty-one percent proficiency rate and a full forty percent failure rate<sup>15</sup>—worse than they do in math and, still, an upside-down trajectory where the longer students stay in school, the worse they perform.

The state of our STEM education does not have to be this way, but more importantly, it cannot stay this way. The good news is, while there is rampant failure and mediocrity throughout our nation’s education system, there are great examples where this is simply not happening, where success is the norm. However, if America is going to remain the—or just a—leading nation, we must ignite a fierce urgency throughout our nation’s education system. We must move from pockets of excellence to a system of excellence.

To highlight the need for this fierce urgency, we only need go to the most recent White House report from the President’s Council of Advisors on Science and Technology (or PCAST). The President’s Council opened its February 2012 report stating, “Economic projections point to a need for approximately one million more STEM professionals than the U.S. will produce at the current rate over the next decade if the country is to retain its historical preeminence in science and technology. To meet this goal, the United States will need to increase the number of students who receive undergraduate STEM degrees by about thirty-four percent annually over current rates.”<sup>16</sup> We are not on course to do this - not at the elementary, secondary, or post-secondary levels of education.

This is a challenging proposition given our students’ lack of interest and poor performance in science and math. A recent report suggested that about twenty-eight percent of high school freshmen (one million high school students) declare an interest in STEM-related fields each year, but some fifty-seven percent of them will lose interest over the course of their high school careers.<sup>17</sup> We lose about 570,000 STEM-eager high school students each year by their senior year in high school. We are turning off over half a million brains to the fields of math and science in high school alone...even

year!

And, nowhere near a majority of high school students are even competent in subjects like math and science, never mind advanced. Only three percent of our nation's high school seniors score at an "advanced" level in math on the NAEP test,<sup>18</sup> while only one percent of our nation's high school seniors score at an "advanced" level in science.<sup>19</sup> A portion of these are the students who most likely will go on to attain graduate degrees in those fields, attend the best colleges and universities in those fields, and ultimately go on to become leaders in their fields in academics, medicine, research, and industry. One recent report puts that portion at about seventeen percent!<sup>20</sup>

So, by the time we have high school seniors competent in science and math, and still interested in STEM fields and careers, we have a woefully inadequate pool or pipeline. Then they get to college. And there, less than forty percent of college students who enter college intent on a degree in the STEM fields stay on course and graduate with that STEM degree.<sup>21</sup> We lose students' interest in high school if we were fortunate enough to have encouraged those students in elementary and middle school in the first place; and then of those who stay interested, we lose a majority of them in college.

We simply cannot go on this way, not if the serious reports on the future needs of this country are to be taken seriously, and they should be. The current STEM workforce is about 7.4 million employees with an estimated 8.6 million employees needed by 2018.<sup>22</sup> And that is just a minimum projection. America cannot win by simply maintaining the number of students who pursue STEM-related degrees; we need to inspire over one million more, and that is just to stay the course with the current economy. But, we are not on that trajectory. We are nowhere near it.

## The American Economy of Today and Tomorrow—Still the Last Best Hope?

Abraham Lincoln famously declared the United States “the last, best hope of earth.” Other leaders have said much the same in the past. Ronald Reagan put his twist on it by calling us “the last, best hope of man on earth.”<sup>23</sup> The Russian human rights hero and Nobel laureate Aleksandr Solzhenitsyn said, “The United States of America has long shown itself to be the most magnanimous, the most generous country in the world.”<sup>24</sup> And in his time, the novelist Thomas Wolfe said America “is a fabulous country, the only fabulous country; it is the only place where miracles not only happen, but where they happen all the time.”<sup>25</sup> I could go on and on with these kinds of quotes about America’s greatness. But what all the giants of leadership and letters were testifying to was not just our nation’s political philosophy, dedicated to liberty and equality as it was and is. They were speaking to the significance of the equal opportunity and freedom that had led us and the world, in their time and before, and could continue to lead us in the future. This notion of “best hope,” or greatness of nation and international leadership, of exceptionalism, can only continue to apply and abide if America is to remain an economic powerhouse—if it continues to be a place of industry, financial strength, growth, employment, startups, innovation, and entrepreneurship.

But the fundamentals of our economy today are not strong; indeed, they bode serious trouble and concern. Let us take a look at the landscape of our recent recession and state of economic affairs. Most people over the age of fifty can remember the 1970s, or what is loosely referred to as the “Carter years,” as a time of economic hardship and failure. The standard line that then-governor Ronald Reagan used in talking about unemployment in his campaign against President Jimmy Carter in those years was: “A recession is when your neighbor loses his job. A depression is when you lose yours. A recovery is when Jimmy Carter loses his.”<sup>26</sup> Ronald Reagan got a lot of mileage out of that line. But for as bad as our economy and the state of unemployment was in those years, the numbers are almost enviable when contrasted to today.<sup>27</sup>

The highest unemployment rate in the Carter years, the late 1970s, was 7.5 percent and by 1980 unemployment was in the five-percent-to-six-percent range.<sup>28</sup> When the American economy went into free-fall in 2008—President George W. Bush’s last year in office—and the presidential campaign became so much about the economy, unemployment was heading toward seven percent again (after it had been in the four-percent- and five-percent-range for many of the previous years).<sup>29</sup> When President Barack Obama took office in 2009, unemployment was already at 7.8 percent and would surge up to eight, nine, and then ten percent.<sup>30</sup>

When the “Recovery Summer” was declared by the Obama administration in 2010, unemployment was still over nine percent. Through the summer of 2013, America was showing the worst GDP growth rate for a full fifteen quarters since World War II.<sup>31</sup> And today, with a rate still over six percent, many do not believe this is the real unemployment rate, given how many Americans are underemployed or have simply stopped looking for work. Some have argued the real unemployment rate may be as high as fourteen percent or greater.<sup>32</sup> This is double the rate than when most Americans thought the economy was in terrible shape.

Other fundamentals today reveal an equally worrisome landscape. Our economic growth, measured in Gross Domestic Product (or GDP), stood at about 2.3 percent over the last few years.<sup>33</sup> While that is better than no growth, or “negative growth,” it is still an anemic number. By contrast, in the 1950

there were years with seven percent and eight percent growth; in the 1960s we had years with five percent and six percent growth, in the 1970s and 1980s, we had years with over five percent and sometimes seven percent growth, but now we are lucky to get up to 2.3 percent GDP growth.<sup>34</sup> And, recently as June of 2014, the *Wall Street Journal* had this headline: “U.S. Economy Shrinks by More in Five Years.”<sup>35</sup> Yes, with all the talk of “recovery,” indeed it truly runs weak to sporadic with one step forward and two steps back. To give a little more of an idea on how this is occurring, here’s more from the story:

Gross domestic product, the broadest measure of goods and services produced across the economy, fell at a seasonally adjusted annual rate of 2.9% in the first quarter, the Commerce Department said in its third reading of the data Wednesday.

That was a sharp downward revision from the previous estimate that output fell at an annual rate of 1%. It also represented the fastest rate of decline since the recession, and was the largest drop recorded since the end of World War II that wasn’t part of a recession.<sup>36</sup>

Growth is what both encourages and indicates innovation and overall economic health. We simply are not healthy today. Indeed, we are, as of this writing, in the summer of 2014, just coming out of a first quarter contraction!<sup>37</sup> I fear we may be forgetting what “healthy” looks and feels like.

This is all much more than troubling. Take a look at our average high school or college senior. Assuming high school or college graduation in the first place (which is a topic of concern I will address later): What are our seniors’ job prospects? What are his or her opportunities? While today’s student debt is at an all-time high, surpassing one trillion dollars, with many struggling to pay off that debt, many believe that number alone could constitute the next economic bubble to burst.<sup>38</sup> But the outlook was discouraging for 2013 graduates. A Google scan of news headlines: “College Grads Overconfident in Job Prospects,”<sup>39</sup> “Job Picture Looks Bleak for 2013 College Grads,”<sup>40</sup> “The Class of 2013: Young Graduates Still Face Dim Job Prospects,”<sup>41</sup> “Half of College Grads Can’t Find Full-time Work...”<sup>42</sup> And these headlines came as the 2013 market was actually better than the 2012 market.

Where, however, is there a potential bright spot? According to a report by the National Association of Colleges and Employers, “employment areas with the greatest demand for this year’s graduates include business, engineering, computer sciences and accounting.”<sup>43</sup> But this is only a potential bright spot because while there is demand, there is not supply:

A survey of 500 hiring managers by recruitment firm Adecco, found that a majority—66 percent—believe new college graduates are not prepared for the workforce after leaving college. Fifty-eight percent said they were not planning to hire entry-level graduates this year, and among those managers hiring, 69 percent said they plan to bring on only one or two candidates.

“Too many students are graduating with a weak background in science and math,” said Mauri Ditzler, president of Monmouth College.

“We need to make sure our graduates know the basics and many don’t.”<sup>44</sup>

Graduates do not know the basics in the areas where there is and will be actual job growth and demand. And those are the “graduates.” The drop-outs have an even poorer shot at the American dream, a sad commentary given that we have a forty-three percent college graduation rate in America placing us eleventh among the OECD list of countries.<sup>45</sup> As for high school graduation? One million high school students a year drop out, “a loss of 5,500 students for every day on the academic calendar.”<sup>46</sup>

There is a healthy, ongoing debate in our country about the actual economic worth of a college education, and many of my friends and colleagues have important and diverse views on the subject. But, three things are indisputable: 1) high school completion is simply not enough; 2) if you want

dramatically increase your options for gainful and sustainable employment—even in a down economy with bleak job prospects—the odds are heavily tilted toward those with a college or advanced degree and, 3) the types of skills, knowledge, and degrees matter.

The odds are simply better with degrees in “business, engineering, computer sciences, and accounting,” or what many call or label “the hard sciences.” Even most of my friends who question the worth of college education do not question it in those fields or for those who go to top colleges. The entrepreneurial geniuses Bill Gates and Steve Jobs, who dropped out of college to create vast empires, are the rare exceptions. As William Bennett and David Wilczel stated in *Is College Worth It?*, “If you are accepted into the Colorado School of Mines, Harvey Mudd, Stanford, Plan II at the University of Texas, and dozens of other places...then go. And if you want to study petroleum engineering or any kind of engineering and have an aptitude for it, then go.”<sup>47</sup>

But therein lies the problem: aptitude. Not enough of our high school students are ready or even interested in post-secondary education like that. There is a reason, after all, that so many high tech companies and chambers of commerce want to expand the number of H1B visas granted every year in America. The H1B visa is the high-skilled non-immigrant work visa, especially common in the area of engineering and math.<sup>48</sup> So badly are these workers needed that one recent report found that “in the absence of green cards and H1B visa constraints in the 2003-07 period, roughly 182,000 foreign graduates of U.S. colleges and universities would likely have remained in the country and raised the gross domestic product (GDP) by roughly \$13.6 billion.”<sup>49</sup> By the way, the vast majority of the H1B visas go to students from Asia, mostly China and Korea—no great surprise given the numbers presented in the opening of this book.<sup>50</sup> More than half of the science and engineering graduates working in America today are from other countries.<sup>51</sup>

Of the nearly 1.8 million bachelor degrees awarded in America each year, only about one-third are in STEM-related fields, while a majority of China’s bachelor degrees and over sixty percent of Japan’s bachelor degrees are in those fields.<sup>52</sup> “South Korea graduates more engineers than the United States...and in many Asian countries, 21 percent of college graduates are engineers, compared to 11 percent in Europe and 4.5 percent in the United States,” reported Charles Vest, president of the National Academy of Engineering and MIT president emeritus.<sup>53</sup>

I write “so badly are these workers needed,” above because of reports just like this one, showing that we simply are not raising our own graduates able to take these jobs and boost our GDP. I support expanding the H1B visa program, but I do so knowing the tragedy of the decision: we do not train our own students well enough to take these jobs and raise our GDP. In other words, it is both a shame and a necessity that we have to import talent. I am, however, an optimist, supporting the expanded visa program on a temporary basis, because I firmly believe we can reverse course and, in fact, “grow on our own.” Indeed, I know that if we are to remain the last best hope of earth, we have no other choice. We cannot survive on temporary and imported talent forever, we cannot consign our own citizens and children to average and less than average educations any longer, and certainly not at the same time other nations are beating us.

This is not just a matter of education for education’s sake or for the mere desire and preference that we employ our own citizens while unemployment is high instead of having to import from other countries the talent our own corporations need. No. This is about staying competitive in the global economy and not allowing any country to beat us as an economic and education engine or powerhouse. I am not an expert in international economics or in international relations, nor is this book focused on those topics, but it does not take such an expert to tell us that we need to be concerned about our own economy for our own sake, and that we need to be concerned about our competition.

I believe it is fair to say that the last several presidential administrations—both Republican and Democratic—have viewed China as an economic competitor and certainly a large portion of the wor



does as well. A recent Pew Global Attitudes survey found, for instance, that “53 percent in Britain say China is the leading economy, while 33 percent name the U.S. In Germany, 59 percent say China occupies the top place, while only 19 percent think the U.S is the global economic leader.”<sup>54</sup> And here in America? What do we think of ourselves? We are not so sure, but we are thinking less and less of ourselves compared to China: “Americans are divided, with 47 percent saying that China has or will replace the U.S. and 47 percent saying this will never happen. That is a significant shift of U.S. public opinion from 2008 when only 36 percent said China would become the top global power and 51 percent said China would never replace the U.S.”<sup>55</sup>

One can certainly make the case, as many have, that China’s days as an economic powerhouse are numbered for several reasons. But there are a few indisputable facts that still remain, aside from China’s education prowess and achievements (especially as compared to our own): The Chinese economy is the second largest in the world, and as one economic respondent to the prognosticators of China’s collapse put it:

[W]hile China’s economy may slow to less than the 8-10 percent growth it normally averages, a real collapse, to growth rates of 2 percent or 3 percent, or less, is highly unlikely. For one, China’s state and private companies may be getting too easy credit from state banks, but that does not mean these businesses are actually unproductive, like some of the Thai and Indonesian companies caught up in the 1997 Asian finance crisis. The truly unproductive Chinese state-owned and state-linked enterprises were closed down more than a decade ago....

Meanwhile:

Chinese companies alone, nearly all of them state-owned, occupied 73 of the top 500 slots in Fortune’s 2012 ranking of the largest companies in the world by sales. China’s score has steadily risen on the Global Competitiveness Index; the World Economic Forum’s ranking of nations’ international economic competitiveness. And several Chinese companies, such as Huawei, have come to dominate global markets like telecommunications.<sup>56</sup>

As of this writing, China’s economic growth rate has, indeed, slowed, to between 7.4 and 7.7 percent. The United States is stuck at about 2.8 percent growth, on average, over the past few years with very little prospect of the optimists’ hope that we reach an annual three percent growth by the end of 2014.<sup>57</sup> As for their education condition, education expert Chester E. Finn, Jr., said this after seeing China’s international rankings in reading, math, and science: “Wow, I’m kind of stunned. I’ve seen how relentless the Chinese are at accomplishing goals, and if they can do this in Shanghai in 2009, they can do it in 10 cities in 2019, and in 50 cities by 2029.”<sup>58</sup> In all my travels throughout America, and having visited hundreds of schools, I have never heard an American education official look at a successful system in America and say without a doubt that we can replicate such success in fifty cities (too often, I do hear reasons why isolated examples of success are not replicable). It is not a proposal and theory, however, that we can replicate success. I certainly know we must.

With over \$600 billion a year invested in public elementary and secondary education,<sup>59</sup> Americans spend more than any other developed nation on its K-12 school students.<sup>60</sup> But we are falling behind too many of those other nations—investing money in programs that add little or no value and not appropriately educating our youth. Why do other countries, particularly Asian countries in the STEM fields, continually beat us? The reasons are myriad...but, I’m convinced the solutions are not. I have the privilege to see how rigorous programs in STEM education can transform not only student minds, but our educational landscape as well—from theory to action. We just need to take what we know works to scale.

It is in the STEM fields where that need is most urgent. That is where the growth and opportunities are. It is also where our international counterparts are most seriously beating us. But do not just talk my word for it. The Nobel Prize-winning economist Robert Solow has pointed out that half the economic growth in America since World War II has come from advances in science and

technology.<sup>61</sup> Susan Hockfield, President of the Massachusetts Institute of Technology (MIT), made two key points on this recently: Asking, “What can we do, together, to restart America’s job-creation machine?” she said,

I believe the answer lies in retooling the engine that has driven wave after wave of economic growth since the end of World War II: America’s innovation system....Our innovation system comes to life from the spark of scientific discovery and invention — but the kind of innovation that drives real economic growth goes beyond a cool idea or an incremental improvement on an old practice or product. We’re driving for innovations that produce big new ideas, based in science or technology, that can be transformed into market-ready products. Innovations that can create new markets — sometimes even new industries — and that create a future different from, and better than, the present.<sup>62</sup>

She also warned us about our ability to deliver on those innovations: “If we want to make U.S. jobs, we can’t just make ideas here — we have to make the products here. Unfortunately, no amount of innovation will be enough if we ship all of our manufacturing abroad. America remains the world’s second-largest manufacturer, but with so many nations copying our innovation model, we must stake our bets on the kind of advanced manufacturing the future demands.”<sup>63</sup> This statement, alone, haunts me as I digest all that has gone wrong with the city of Detroit, once known not only as the automobile manufacturing capital of the world but once even as the “Capital of the 20<sup>th</sup> Century.” Today it is literally, bankrupt. I believe, however, if Detroit’s bankruptcy is to be overcome, it will be overcome by innovation and growth such as what GM has done to turn itself around from bankruptcy, and not simply because of government investment.<sup>64</sup> In fact, speaking of his company’s resurgence, former GM CEO Dan Akerson responded to a congressional delegation, “no, we’re fine,” when asked why Washington should provide more help.<sup>65</sup>

Others, from industry, have weighed in on the importance of STEM as well. Fred Smith, the Founder and Chairman of FedEx has stated, “I personally think that the federal government—and you’re talking to a liberal arts major here—should restrict its funding of higher-education grants and loans to science, math, and engineering because that’s where most of the value added comes.” Rodney C. Adkins, a senior vice president at IBM has written, “When I graduated from college [circa 1978], about 40% of the world’s scientists and engineers resided in the U.S. Today that number has shrunk to about 15%.”<sup>67</sup> Antonio Perez, chairman and CEO of Eastman Kodak put it this way: “The American economy has always depended on innovation, and in a knowledge-based society, there can be no real innovation without an educational emphasis on science, technology, engineering and mathematics. This is especially important to create a workforce that can succeed in today’s rapidly changing economy.”<sup>68</sup>

I could go on and on with a list of quotes along these lines. But, there is a reason dozens of corporate leaders in America, from companies as diverse as Chevron, Lockheed Martin, DuPont Chemical, Eli Lilly, GE, and Facebook have formed Change the Equation, a “CEO-led initiative that is mobilizing the business community to improve the quality of science, technology, engineering and mathematics learning in the United States.”<sup>69</sup> This is a critically important organization helping sound the clarion call and proposing solutions to our STEM education problems in America. Change the Equation, led by Linda Rosen, recently endorsed four high quality and nationally scalable organizations: Project Lead The Way, Gilstart Summer Camp, ST Math, and Ten80 Student Racing Challenge. We ignore its work at our peril. I encourage every reader of this book to check out its website.

But, for now, to highlight as simply as possible the economic challenge and opportunity we face with STEM education, let me go to a recent report from PCAST. The report is essential reading: “Throughout the 20<sup>th</sup> century, the U.S. education system drove much of our Nation’s economic growth and prosperity,” the Council states.<sup>70</sup> Obvious enough. And if not obvious enough, it states what I have

been trying to highlight in this chapter: “Despite our historical record of achievement, the United States now lags behind other nations in STEM education at the elementary and secondary levels. Over the past several decades, a variety of indicators have made clear that we are failing to educate many of our young people to compete in an increasingly high-tech global economy and to contribute to national goals.”<sup>71</sup>

STEM is where the growth is needed and STEM is where our economic growth is. As the Chancellor of the University of Wisconsin-Madison, Rebecca Blank, posited when she was working in the Department of Commerce, “STEM workers earn a premium of 25 percent over other workers and have only a 5.5 percent unemployment rate.”<sup>72</sup> These numbers are backed up by other reports, including a recent one by the National Governors’ Association, which further pointed out that while the 5.5 percent unemployment rate applied to STEM workers, it hit ten percent at the same time for non-STEM workers.<sup>73</sup> In fact, the chances of one being unemployed in a STEM field are exceedingly rare as STEM job postings actually outnumber unemployed people.<sup>74</sup>

William Bennett and David Wilczol point out why this is; and while it may say something good about interest in some of the humanities and liberal arts fields, the basic realities of the economy tell a different tale: “Too many students gravitate toward majors in which they gain few skills or for which there is little workplace demand.”<sup>75</sup> I will later go into some of the reasons why there is a crisis in our major fields of studies, but first it is worth pointing out that while total college enrollment has risen some fifty percent since 1985, in fields such as math and statistics the numbers have hardly moved from 15,009 college graduates in those fields in 1985 to 15,496 in 2009.<sup>76</sup> And in the fields of “microbiology, chemical engineering, and computer science, we graduated more students in those fields in 1985 than we do today.”<sup>77</sup> Finally, more students graduate with college degrees in the visual and performing arts than in “computer science, math, and chemical engineering combined.”<sup>78</sup> Paying off student debt, raising a family, or just supporting oneself is a concern of college students; this statistic should close the discussion: of the top twenty majors with the highest midcareer salaries “all but one (economics) are STEM disciplines.”<sup>79</sup> And I would include economics in the STEM category.

Let me provide some starker statistics to highlight the broken pipeline to the foregone possibilities—the missed American Dream if you will: Engineering degrees constitute about 4.7 percent of bachelor’s degrees awarded each year, and that is down from seven and eight percent in those fields two and three decades ago, which was already a pretty small percentage.<sup>80</sup> Computer science degrees constitute less than three percent of bachelor’s degrees, never having risen above five percent in the last forty years. Biology? 3.7 percent.<sup>82</sup> Chemistry? Less than one percent.<sup>83</sup> Math? Just over one percent.<sup>84</sup> But the fields of psychology, art and performance, and education each routinely more than double the percentages of computer science degrees we award each year. We graduate four hundred percent more art and performance students from college each year than we do computer scientists—and five hundred percent more art and performance students than math students.

Meanwhile, a closer look at STEM readiness and preparedness in our students and workforce shows what it can mean for the country’s growth as a whole.

The National Governors’ Association report makes a point worth quoting at length:

According to the Milken Institute’s Best-Performing Cities 2010, “A rich innovation pipeline plays a pivotal role in a region’s industrial development, commercialization, competitiveness, and ability to sustain long-term growth.” The STEM workforce is a powerful component of this innovation pipeline. STEM occupations employ individuals who create ideas and applications that become commercialized and yield additional jobs. STEM fields overwhelmingly dominate other fields in generating new patents, including those that enter the marketplace. For example, during 1998–2003, scientists and engineers (S&E) applied for nearly 10 times more patents and commercialized almost eight times more patents than applicants from all other fields.

STEM workers also contribute to the creation of innovation hubs—areas that usually include technology centers and research parks—that are important sources of economic activity. STEM workers are often found in high concentrations in these areas. In addition, research universities and other postsecondary institutions typically are nearby, providing new supplies of STEM graduates and opportunities for collaboration. Innovation hubs can spawn clusters of associated businesses and suppliers in both STEM and non-STEM fields while also rapidly growing jobs.<sup>85</sup>

And, as the U.S. Department of Commerce tells us, “The greatest advancements in our society from medicine to mechanics have come from the minds of those interested in or studied in the areas of science, technology, engineering, and mathematics—STEM. Although still relatively small in number, the STEM workforce has an outsized impact on our nation’s competitiveness, economic growth, and overall standard of living.”<sup>86</sup>

What would raising our proficiency in math and science mean to the economy and growth of America? Various studies show a variety of results, but all reach the same conclusion: More growth. A lot more. According to a report by the National Governors’ Association, the Council of Chief State School Officers, and Achieve, Inc., “If the United States raised students’ math and science to global competitive levels over the next two decades, its GDP would be an additional 36 percent higher 7 years from now.”<sup>87</sup> More recently, McKinsey & Co. found that, “At the K–12 level, enhancing classroom instruction, turning around underperforming high schools, and introducing digital learning tools can boost student achievement. These initiatives could raise GDP by as much as \$265 billion by 2020—and achieve a dramatic “liftoff” effect by 2030, adding as much as \$1.7 trillion to annual GDP.” That is greater than our current national budget deficit. Add the concept of reforming our teacher workforce by just five to seven percent, and we have not only erased our budgetary concerns, we will put America back into budget surpluses.

I know the excuses – students in the United States are more creative, better problem-solvers than students from other nations who excel in rote learning and test-taking. So in 2012, PISA tested problem-solving for the first time. How did we do? We scored about average, still behind Korea, China, and other nations. Then there is the excuse that other countries are vastly different than ours culturally and in a great many other ways. So, compare Canada. As Stanford’s Eric Hanushek, Harvard’s Paul Peterson, and University of Munich’s Ludger Woessmann recently pointed out in the book *Endangering Prosperity*, while the United States falls below most industrialized countries in international comparisons of mathematics achievement and proficiency of its 15-year-olds, it is beaten handily by Canada which is ranked 10<sup>th</sup> in the world (the United States is ranked 32<sup>nd</sup>). But Canada is not that culturally different from the United States: “the two countries share a common language, a common heritage, and a common border.”<sup>88</sup> As Hanushek points out elsewhere, “Canada also has an influx of immigrants; they have strong unions; it’s a federalist system.”<sup>89</sup> But look at what it would mean for our economy if we could simply achieve what Canada achieves in its level of educational performance by 2025, giving us a little more than a decade to get there: “The average annual income of every worker in the United States over the next 80 years would be 20 percent higher...the gains from a faster-growing economy over the lifetime of somebody born today would amount to five times our current GDP [some \$77 trillion]...enough to resolve the projected U.S. debt crisis.”

Let me explain some of this from a personal standpoint. I’m often asked why science, technology, engineering and math are the only words used to create the acronym, and when Project Lead The Way (PLTW), the STEM organization I am proud to lead, will change STEM to STEAM, STREAM, or STEMM—incorporating art, reading or music into the acronym. This misses the fundamental point. Our societal, economic, and education problems are not anywhere near or about adding to acronyms, but instead adding to the relevancy of learning. Our solutions are about showing students how technical concepts relate to real-world situations and providing them with hands-on projects and problems that help them apply concepts in ever-new and changing contexts. It’s about nurturing students’ curiosity and helping them develop creativity, problem solving, critical thinking, and

collaboration skills. STEM isn't simply the subjects in the acronym. It's an engaging and exciting way of teaching and learning. Or should be. And can be.

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On a recent flight to a speaking engagement in California, I had a conversation with the person sitting next to me. She asked me what I did, and when I told her, she remarked, "Oh, you're one of those." When I asked what she did, she explained that she was the creative director for an advertising agency, and the world of STEM seems to disregard, even dismiss, the arts. Moments later, she began working on her MacBook Pro, loaded with state-of-the-art software. So my question to her was "What do you think made that laptop and developed the software for artists and creators like you?" STEM fields are at the core of everything we do. STEM connects to everything, whether it is the arts, music, sports or agriculture.

Look no further than the materials and technology artists use: computers and graphics, paint, canvas. Computer scientists develop the graphics technology, chemists work to ensure the right chemical composition to create vibrant colors, and engineers design a stronger canvas that absorbs the right amount of paint. Furthermore, the same creativity that inspires beautiful works of art is the same creativity that has led to some of the world's highest-performing, usable and visually appealing inventions. For instance, the Corvette Stingray, the 2014 North American Car of the Year, is an engineering marvel and one of the top-performing automobiles on the market. But, it's also aesthetically appealing. The same could be said for your new lightweight running shoes, your single-serving coffee maker, or the acoustically designed facilities for your community's symphony orchestra. These are all examples of engineering and the arts working together, and they all result from the same design process engineers use to build the world's most advanced fighter jets, develop new energy solutions, and create targeted therapies for chronic diseases.

STEM can be found in virtually every discipline and in every product. STEM is not exclusive to the subjects of science, technology, engineering, or math. We must continue engaging students in the STEM disciplines and encouraging them to combine technical knowledge and skills with the creativity that leads to innovative ideas—ideas that give the arts new technologies, music new instruments, farmers new machines, and our businesses a competitive advantage. Unless we continue building the STEM pipeline, each profession suffers. We end up encouraging the end product of art and performance while discouraging or neglecting science, technology, engineering, and math.

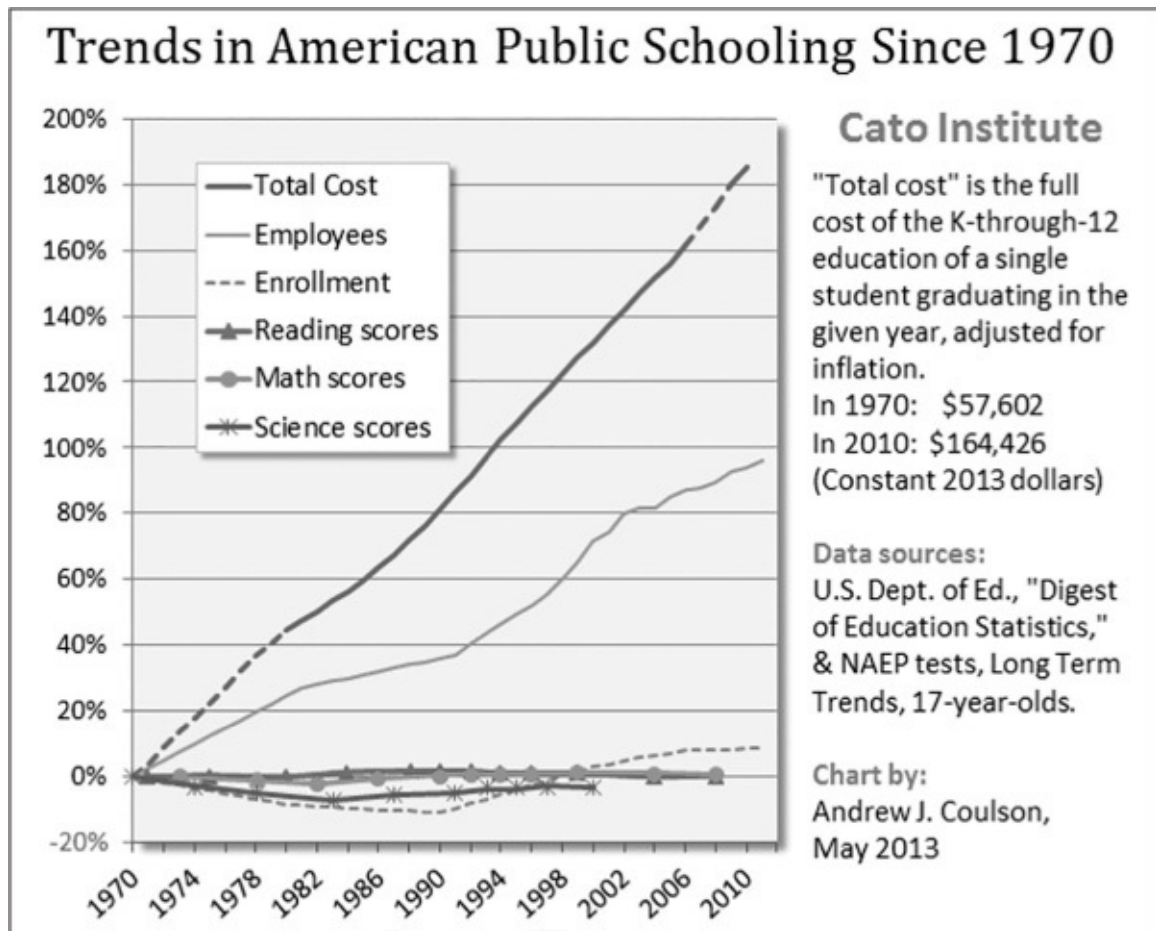
That is why education reform generally, and STEM education specifically, are the keys to our economic well-being and future.

## Why We Fail & How To Fix It

It has been a full generation—thirty years—since the landmark “Nation at Risk” report was issued by the U.S. Department of Education. That report opened with this ominous warning: “Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world.”<sup>91</sup> To add to the drama of the problem, the report’s authors continued:

If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in student achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems which helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament.<sup>92</sup>

Since then, there have been any number of citations to the Nation at Risk, there have been any number of education reform proposals, we have overhauled testing regimens, and added billions of dollars into our education system. But the results over the past thirty years have been flat at best, with no appreciable change upward in our scores. I say “at best,” because in many ways we have done worse. This chart of national expenditures and scores from 1970 to 2010 explains just about the whole story:



Spending went up, educational hires from teachers to administrators increased, and scores have flattened. The point is, we still do not get it right in American education: not in reading, not in writing

and not in the STEM fields. And, as stated earlier, we are spending more than other countries that get it right. What is the problem? And why is it so hard to see and overcome?

The answers to these questions are partly pedagogical and partly cultural. Let me start with the pedagogical. In looking at the other countries whose students continually outmatch our students in the STEM fields, there is the answer of time. Other nations, especially the ones that beat us, simply push their students through more schooling. As education reform expert Chester E. Finn, Jr. put it recently

Schoolchildren in China attend school 41 days a year more than most young Americans—and receive 30% more hours of instruction. Schools in Singapore operate 40 weeks a year. Saturday classes are the norm in Korea and other Asian countries—and Japanese authorities are having second thoughts about their 1998 decision to cease Saturday-morning instruction. This additional time spent learning is one big reason that youngsters from many Asian nations routinely outscore their American counterparts on international tests of science and math.<sup>93</sup>

Our students' "summer learning loss" is "no joke," Finn writes, as our students lose "a full month worth [over the summer], by most estimates, adding up to 1.3 school years by the end of high school."<sup>94</sup> And then there is this: "students in other postindustrial countries receive twice as much instruction in core academic areas during high school."<sup>95</sup>

Take the issue of summer recess/break and summer learning for a moment. At a time when there is so much focus on American students' global education competitiveness, students and teachers at all grade levels should find opportunities to keep their minds active and continue learning while enjoying our vaunted and nearly-sacrosanct summer breaks. I am not against them, not at all. Our teachers need them, our principals need them, our parents and children need them.

But, still, summer learning loss is real. It is also counterproductive, requiring teachers to spend considerable time at the beginning of the new school year reviewing before they introduce new material and help students develop new and advanced skills. The National Summer Learning Association reports that students lose an equivalent of two months of their grade-level mathematics and computational skills over the summer, and students from low-income families also lose the same equivalency in reading achievement. While summer is a time to relax, it is not a time to stop learning.

The key to education—especially in critical STEM fields—is activity-based learning that makes concepts relevant in real-world, meaningful ways. In Project Lead The Way classroom curriculum, for example, velocity, speed, lift, and drag—concepts often taught in a high school physics class—are applied when building an airfoil that must meet certain constraints. In third grade, students learn about forces, axels and levers, and apply these concepts to design a simple machine to rescue an animal that has fallen into a trench. Lessons like these show students the relevancy of their learning and engage and inspire them to continue learning. But learning like this doesn't have to be confined to the classroom. Nor should it all be lost over the course of two and a half to three months.

While traditional summer school is beneficial for some students, summer learning does not have to mean spending all day inside a classroom or library. Summer activities are rife with real-world learning experiences that parents and communities can help convey: A swimming pool can teach students about buoyancy. The ocean waves can be a lesson in gravitational forces. A baseball game can teach about velocity and drag. Parents and children who enjoy baking together can turn their measurements into a math lesson on fractions. There are websites and apps, sites like Kahn Academy and PBS' Design Squad, that provide engaging lessons and activities for kids. Many tools can be accessed at a community library if a computer is not available in the home. Parents can also take time to encourage their child to read, helping build not only reading comprehension and vocabulary skills but also knowledge on topics that students find interesting.

Summer camps are another great way to continue student learning. Organizations like Boy Scouts of America, Girl Scouts, Boys and Girls Clubs of America, 4H, and local zoos or museums offer exciting and

engaging opportunities for students. Project Lead The Way partners with the Society of Manufacturing Engineers Education Foundation to support Gateway Academy camps across the United States. The past summer, nearly 5,000 middle school students spent a week immersed in hands-on activities building knowledge on topics like programming, alternative energy, flight and space, fluid power, and the engineering design process.

Summer is also a terrific time for teachers to improve their craft by engaging in professional development—not the kind of professional development that teaches the latest fads in education, but rather the kind that focuses on how teachers can engage students in relevant learning. Continuous teacher training and learning is vital to student success. A number of universities offer formal summer courses. Nonprofit organizations like Project Lead The Way offer rigorous, in-depth resident training programs. And while Massive Open Online Courses (MOOCs) have their supporters and opponents, a MOOC could be a great option for continuous teacher learning over the summer months.

Learning does not have to cease for the summer when the last class bell rings. Students, teachers, and parents can have an enjoyable and relaxing summer, all while continuing the education process. The responsibility to continue learning during the summer rests with each one of us. When it comes to summer learning loss, we can change course. We can continuously improve, learn and engage, and have a great summer in the process.

We also must address the growing concern—more and more appreciated over the past few years—emphasizing teacher quality and compensation. As Michael Milken put it:

Once upon a time, U.S. college graduates near the top of their classes routinely entered the teaching profession. In fact, 90 percent of new American teachers in the early to mid-20<sup>th</sup> century came from the upper third of their classes. Today, it's just 23 percent. Meanwhile, virtually 100 percent of teachers in Singapore, South Korea and Finland come from the top third of their graduating classes.<sup>96</sup>

And we now know that teacher quality is, after parent involvement, the single greatest factor in a child's education. As Microsoft Founder Bill Gates has said, "the single most decisive factor in student achievement is excellent teaching. It is astonishing what great teachers can do for the students."<sup>97</sup> William Bennett cites two graphic studies that tell the whole tale:

[I]f you take an 8-year-old student performing at the 50th percentile and give him a low-performing teacher, he will regress to the 37th percentile in three years. Give him a high-performing teacher, and he will succeed to the 90th percentile in the same amount of time—a swing of 53 percentage points.<sup>98</sup>

And,

According to an analysis by Stanford economist Eric Hanushek, if you replaced the lowest-performing teachers in our country (roughly 5% to 10% of the teaching work force) with just average performing teachers, America's students as a whole would rise from the bottom of the performance ladder on international tests to a Top 10 ranking. What would this mean for our GDP, by the way? Tens of trillions of dollars.<sup>99</sup>

A recent McKinsey study backs up an important element of this as well: the professionalism and skills of our teacher workforce. Comparing us to countries like Finland, Singapore, and South Korea—countries that continually beat us—McKinsey has found: "The U.S. does not take a strategic or systematic approach to nurturing teaching talent. Buffeted by a chaotic mix of labor market trends, university economics, and local school district and budget dynamics, we have failed to attract, develop, reward or retain outstanding professional teaching talent on a consistent basis."<sup>100</sup> Those countries, "recruit, develop and retain... 'top third' students as one of their central educational strategies, and they've achieved extraordinary results. These systems recruit 100% of their teacher corps from the top third of the academic cohort, and then screen for other important qualities as well."



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