

Education for Today's Innovation Economy Getting Past the Barriers

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There are few issues that have received as much attention in the U.S. as school reform. Ever since the study *A Nation At Risk* was released in 1983, policy leaders, business leaders, parents, and more have expressed concerns that our public schools are falling seriously behind competitor nations and not serving society's needs. A lot is being done in response. Since 1983 per pupil spending on public education has more than doubled in constant dollars, to an average of over \$12,000. The United States spends more on K12 education per student than all but four countries: Norway, Switzerland, Luxembourg, and Austria. All kinds of policy and curricular changes and "reforms" have also been tried. Technologies we could hardly imagine in 1983 are now common within classrooms today. Teachers are better paid. Honors and advanced placement courses are more available. High school graduation rates are the highest the country has ever achieved, and many more graduates go on to college. Targeted financing programs help almost any student get the resources to cover tuition. Government mandates insist that children with special needs get extra attention. More schools particularly in urban settings offer extensive "wrap around" services including medical care and counseling for life challenges. Charter schools in almost every state provide choice for parents and allow innovators to try different approaches.

There certainly have been local benefits from these changes. One regularly hears about a creative activity or program in the local schools that is well received by students and makes us feel good about what is happening. Nevertheless, all the changes to date have not even come close to addressing the needs, which is why concerns are still being expressed. The most credible measure of student achievement is the National Assessment of Educational Progress (NAEP). Since its origin in 1969, the results from periodic national samplings show students have done about the same or marginally better in reading and math than they did 40 years ago. Other countries are seeing significant improvements. Beyond that, large disparities for poor and minority students are still common. Further, more and more studies and interviews with business leaders report that graduates lack important skills needed for the jobs of today. And recent events such as the 2015 Baltimore riots remind us that public education in the U.S. is failing many students.

In the midst of all this concern, many parents say good things about their local schools—most likely because of personal relationships with dedicated teachers. Increasingly, however, parents are worried as their sons and daughters graduate from college but still cannot find a good job. More than 50% of college graduates today cannot find a job or at least a job that uses their degree.

It is difficult not to conclude that public education in the U.S. is in crisis. To me, the biggest question is one that is rarely even being asked: why aren't we learning from the pioneering schools that have been so successful? The fact is that a few pioneering schools have successfully implemented radically different approaches to education with unheard of success even measured

against the new challenges of today. Manor New Tech High in Texas, for example, where about 65% of students live in poverty, has an official graduation rate of 100%. More than 90% of their students score proficient on the Texas standardized exams, which is 20 points or more greater than peers in the other local high school. The MET School in Providence, a Big Picture Learning school, has taken literally hundreds of kids who were thrown out of regular schools for disciplinary issues and not only graduated them but helped them prepare for careers where they shine as leaders. High Tech High in San Diego is another school that has turned education upside down, and turns out graduates from all socio-economic levels who are skilled and confident problem solvers and innovators. If a business was achieving that kind of dramatically greater success over others in its industry, the rest of the industry would be all over that leader to figure out and adopt whatever it is doing. Yet, very few educators, business leaders, and parents are even aware of those successful education pioneers, much less learning from them. And most of the educators trying to mimic their successes are falling woefully short.

I have tried to understand why education is not learning from the pioneers and innovators, but it is difficult to pin down. Obviously, public education is made up of bureaucratic institutions that are resistant to change. I run into that constantly. Education in the U.S. is also very local, so we have literally thousands of local bureaucracies that are fiercely independent. Further, everyone has an opinion about what education looks like based on his or her own education experience, and parents are understandably afraid to put their children into something different from the education they had. Education has become big business, and there are many constituents with a stake in the current system. All those factors undoubtedly have an impact. More fundamentally, however, I sense a broad lack of understanding and consensus in this country about the real challenges, where education fits, and the role of education in the 21st Century innovation economy. Today's economy, as well as today's society, are dramatically different than when our schools were designed, and we as a society have not faced the need to reinvent public education for the new times.

I am going to take a stab at advancing the cause in this document by highlighting what I have discovered in my personal experiences with students and my visits and conversations with a number of education pioneers. I will start with a brief history of public education in the U.S. to set the context, talk about how education needs have changed, and finally share lessons the pioneers have learned about what it takes for education to meet today's needs.

Brief Historical Background

Many assume that education has always been similar to what we have today because we all were educated in this way. However, for most of civilization, formal education was limited to a few elites, and it took place largely through one-on-one interactions with scholars (back to Plato). The majority of people received no formal education. In the early days of the U.S., most learned from their parents just enough to play a productive role in their family farm or business. Or perhaps they learned a trade directly from a mentor in the local community through apprenticeships. As society and ways of life advanced, communities began to set up one room schoolhouses and similar programs to teach very basic literacy and numeracy to more citizens. Such basic literacy facilitated more public communication and increasing commerce among different trades and specialties. This largely ad hoc way of educating was pretty variable in what

it produced, but most people did fine as long as they had some family members or associates who could help them when needed. "Academic" learning was not important for most people in those times anyway.

This changed in the U.S. with the growth of the industrial economy. The massive factories of the late 19th Century needed large workforces who all had a common base of literacy and math skills so they could efficiently execute the work processes. Our country faced a need to educate large numbers of immigrants and unskilled farm hands for those industrial jobs. In 1892 a group of mostly college presidents called *The Committee of Ten* was commissioned to design a new education system meeting those industrial needs, and they based their design on a model imported from Prussia. The resulting education model resembles an assembly line for education. In it groups of students pass through different stages in batches (grades). At each stage experts in a range of subjects provide pre-determined skills and content to students subject by subject before passing them to the next stage. More advanced skills and content are layered on as students step through later stages until graduation. All students are taught the same material in the same order and schedule, and assessed in the same way.

Note that almost everything we associate with modern schools was designed at this time, and, for the most part, it has not changed. This includes the basic list of academic subjects with which we are all familiar, the core content in each subject, the division of the school day into fixed periods separated by bells, and the role of the teacher and textbooks to drag students through predetermined topics and skills some outside authority (scholar) deemed important and make sure students know the "right" answers. Few of us remember even 5% of what we "learned" in this school environment, even if we made good grades. Nevertheless, this system was a dramatic step up from the former ad hoc education system. It provided enough academic exposure and basic literacy and numeracy skills to prepare masses of future workers for those mass production factory and office jobs. For most of the population that meant they could access the American dream in the form of solid, middle-class jobs in mass production and related office and service professions for the majority of the 20th Century.

That commitment to public education for the broad masses was unprecedented, as was the robust middle class empowered by it. It is a major reason for the booming prosperity of the U.S. at that time. As a result, the notion that education is the ticket to the American dream remains deeply embedded in our society. Further, most of us are confident about our traditional education system because that is how we were educated—and we turned out OK. What is easy to miss within that thinking, however, is how much of what makes us successful we learned *outside* the education system, from parents, mentors, youth programs, and other enrichment activities of all kinds.

The problem today is that the world looks nothing like it did in 1892 or even in 1990. It should not surprise us that a system designed for the mass production age is having problems meeting the needs of today's innovation age. However, in my experience few people seem to really understand the full nature of what has changed and how it impacts what is needed from education. For that reason, let me now review three of the major changes that have significant implications for education.

Changes in Today's World

Changes in Job Opportunities and Related Skills

Perhaps the most impactful change is the fundamental shift in the nature of job opportunities and the skills required for them. As already noted, our current education system was designed in 1892 to prepare people for jobs in the industrial factories that needed literally thousands of people to implement a given line of products and/or services. The jobs were well defined and relatively routine, pretty much do as you are told. Those with basic skills qualified for stable jobs that provided good careers with a family sustaining wage, which led to the rise of a robust middle class. The high school graduate could easily qualify for a wide range of production and office jobs, and anyone who graduated from college was pretty much guaranteed a higher level but still largely routine job. Life was good for a wide segment of the U.S. population.

Today, those routine, well defined jobs are being taken over by automation or outsourced to lower cost countries. First, computers and robots took away the difficult and dirty jobs, which was good for the people because they moved into safer work that leveraged the brawn of the machines. Later, computers became proficient at tasks requiring high precision and consistency from data processing to production to logistics. This raised the level of skills required by the people who operate and maintain the automation tools and those who took on new tasks enabled by those tools. However, for a long time the growing pool of college graduates was able to keep up with those jobs. We have now reached the point where computers can do complex tasks including driving a car and writing a news story that many thought would never be accomplished by a machine. This leaves even fewer opportunities for new graduates prepared only for well-defined, routine jobs. Further, the relentless march of automation and global sourcing has led to thousands of people being laid off from traditional routine jobs who lack the skills for the good jobs that are available.

There have been many articles in the last few years questioning whether there will be *any* jobs left for human beings. In reality, however, the issue is not a lack of opportunity. One only has to look at the dramatic phenomena of Silicon Valley and the INC 5000 to see that there are many new opportunities available today. However, today's opportunities require a very different type of graduate. Rather than do only what they are told, graduates today must help create new value by improving existing products and services, developing new ones, and finding creative new solutions to problems that arise. In today's chaotic, fast moving business environment people must be able to think on their own, take initiative, tackle ambiguous problems, collaborate with others, communicate effectively, identify opportunities, and develop innovative new approaches. Knowing facts is of little value in a world where almost any information is instantly available on the Internet. It is what graduates can *do* that counts, and particularly how they can forge through ambiguity to learn and innovate. We still tell our students they will be successful if they make good grades, but base those grades on regurgitating facts on multiple choice tests. We effectively tell students there is one right answer for every question, when the interesting and valuable problems today are open-ended and changing all the time. The education that served us well in the mass production economy is completely disconnected from what is needed in today's innovation economy. That is why, today, more than 50% of college graduates cannot get a job or a job using their degree. A 2013 Oxford University study concludes that 47% of U.S.

employment in 2010 is at risk of computerization, and that number will only grow as technology advances.

The dynamic nature of today's economy is also driving major changes in the structure of employment and how and where to find opportunities. A recent report by the U.S. Government Accountability Office says that 40% of the 2010 U.S. workforce was made up of contingent workers. In 2005 only 30% were contingent, so the proportion is growing fast. Many of these are part-time and on-call workers in low end service jobs, but a growing number are independent professionals including marketers and computer programmers. The skills and attitudes needed to thrive in this environment are clearly very different from those in the days most people worked for one employer their whole career.

Changes in Society

A second major change is the loss of the stable, mutually reliant, nuclear family and closely knit supportive community with the time and experience to nurture kids in practical life skills. At one time rich and poor alike largely co-existed within communities where families and neighbors supported each other. Much of the support was organized by trusted institutions such as churches rather than government programs, and even the mass media contributed with family-centered programming such as *The Waltons* that reinforced a self reliant, helping culture. While schools were important, most of the "life" skills critical for future success (persistence, negotiation, project management, collaboration, growth mindset, etc.) were learned from social connections, programs, and opportunities. Today rich and poor are not only separated by income but increasingly live in segregated communities where they go to different schools, programs, and activities so they rarely come in contact. Institutions including churches are no longer trusted by many. Multigenerational poverty propagates poor parenting and limited possibilities where poor kids experience only poverty, violence, and the dog-eat-dog social structure of the "hood." The increasing separation draws out racial and cultural biases, which often mix with economic inequities and are expressed in attitudes and relationships toward others that are not easily addressed by formal laws. Those biases are accentuated as poverty and lack of opportunity spread into the formerly middle class and people fear for the future of themselves and their families.

The resulting breakdown in social capital, relationships, community, and mutual support leaves too many kids unprepared to take advantage of traditional schooling. Children from less advantaged neighborhoods often have low self esteem and perceive limited possibilities for themselves. Further, they may be traumatized by their living situation. Medical experts have documented symptoms of PTSD in poor kids, the same problem faced by soldiers traumatized on the battlefield. Dysfunctionality of varying degrees is also common today in wealthier families, as is reflected in the high rates of depression, addiction, and suicide. As a result, schools today need to create a safe environment that helps students deal with living and relationship issues, opens up possibilities, and develops understanding of self, confidence, and a growth mindset. Frankly, this is a new burden for public schools, but we can no longer count on students getting such critical nurturing and support anywhere else.

Further, schools today need to adapt to different learning styles and backgrounds and draw out the best in every student. At one time graduates with average skills had many opportunities, but

preparing kids to be just average at anything is a recipe for failure in today's dynamic and demanding environment. All graduates need to understand and develop their unique strengths and passions so they can find a career where they are very effective and also fulfilled. Unfortunately, our assembly-line model of education leaves little room to really understand each student and deal with him or her individually.

Changes in Technology

Finally, the notion of where and when learning occurs is changing. At one time we went to school to learn everything needed for future success. Today, that is an oxymoron because things are constantly changing and advancing. Google Chairman Eric Schmidt has said "every two days, we now create as much information as we did from the dawn of civilization up until 2003." Fortunately, where we used to need a teacher and school to learn, today the motivated person can learn just about anything from the Internet and other readily accessible sources, through a combination of online information, tutorials, and social connections. In the future, the vast majority of learning will occur outside of any formal education environment and usually in real time as new knowledge and skills are needed for a given problem. This fundamentally changes the role of schools. They really are not needed to teach many facts, but they are the only universal institution we have to nurture and shape students into confident, motivated performers. Schools today need to evaluate graduates less by what they memorize from recorded understanding and more by how well they learn how to learn and respond to any new situation.

Further, the same technologies that have changed the nature of learning also make students much more aware of the world around them. Many students will no longer accept a teacher's advice that a given topic is important to learn, for example. They have many ways to make their own evaluation of that. As a result it is much more challenging to engage students, and many who do the work their teachers ask are just playing the game to make their grade.

Schools today must adapt to this always connected environment. For example, teachers will no longer be content experts who have every answer but rather facilitators of a learning environment or journey, who are often learning with their students. This is fortunate because teachers will never have enough time to play their traditional role in addition to the new roles demanded by today's world. Today schools must leverage the new technologies to take over most of the direct instruction role traditionally played by teachers, which gives our teachers time to get to know students individually and facilitate learning journeys for each. Further, to engage students we must help them learn in authentic ways, by applying the same skills, approaches, and technologies they will use in their future careers and life to problems and challenges that interest them. They also should learn by working on authentic problems at least partly chosen by the students so they experience the same kinds of challenges and decision processes they will face later in life. Truly authentic problems will be interdisciplinary (not by subject), open ended (no right answers), and collaborative.

Challenge

In many ways, our education system is doing pretty much what it was designed to do. Perhaps that is one reason why many parents are happy with their local school, and why some educators question if there really is a problem. As outlined in the previous discussion, however, the world has changed dramatically since our education system was designed, but education has remained

essentially the same. By analogy, we have a great buggy whip, adapted with the latest design and material improvements to optimally spur on our horse-drawn carriages, but that has little value in the age of the auto. It should not be too hard to grasp the need for a very different education: one that nurtures lifelong learners who are innovative problem solvers, one that connects with students from every social, cultural, and economic situation to help each become the best he or she can be, and one that leverages new technologies to transform how education is done (rather than automate the traditional approach).

The challenge is that we need to fundamentally rethink our view of education. Frankly, education has largely become a credentialing vehicle. As noted earlier, most of what we learned in school is forgotten. However, students traditionally benefited from good grades because the grades provided the credential to be considered for better opportunities. One big reason why educators are afraid to attempt big changes is a fear that their students will suffer in the credential game. While one cannot deny that credentialing is still prevalent, it is beginning to diminish. Google, for example, determined after extensive studies that employees with real relevant skills and experience perform better than those with fancy grades and degrees from big name schools. Google now hires many new employees without college degrees, and many more from schools most people would not recognize. Today's dynamic economy is unforgiving, so those who truly have valuable skills will succeed over those with artificial credentials. For the same reason, many colleges are rethinking their admission criteria, with some no longer even accepting SAT or ACT scores but depending on essays, interviews, and extensive reviews of past student work and experience.

As a society, we must stop thinking of education as a place to learn facts about different subjects and to prove our academic prowess, and instead think of education as a process that helps every student discover his or her individual strengths and passions, hones the ability to address novel situations and challenges, and develops each student holistically to become the best he or she can be. Only then will education once again become the great equalizer or gateway to the American dream. It will be challenging for schools to change as long as parents and the community expect education to look as it did when they went to school.

Defining a New Direction for Education

It should not be difficult to see from the prior discussion that deep changes in the economy and society put dramatic new demands on education. If we expect education to continue to provide opportunity for all citizens, we must move beyond efforts to improve education and begin to reinvent a new approach to education for the new times. Different groups have been looking at that challenge for a least a decade, and they have done much good work. Let's begin by looking at the most widely accepted efforts.

Perhaps the longest running effort to define new skills for the new age goes back to 2002 with the founding of the Partnership for 21st Century Learning (then called the Partnership for 21st Century Skills). This industry-led consortium developed a framework for learning that included traditional academics along with four 21st Century skills it called the 4 C's: communication, collaboration, critical thinking, and creativity. The meaning of these 4 C's was later expanded to better deal with evolving trends by including problem solving with critical thinking and

innovation with creativity. More recently the Hewlett Foundation assembled a network of pioneering schools identified as on the leading edge of 21st Century learning. They started using the term "Deeper Learning" to reflect learning that goes well beyond the 4 C's. This network expanded upon the 4 C's by adding two very important additional skills: self-directed learning and an academic mindset. I have summarized the list below. This list of Deeper Learning Skills is probably the best widely recognized overview of the types of skills and learning that are important for success in today's innovation economy. .

Deeper Learning Skills (21st Century Skills)

1. Core academic content

From the Partnership for 21st Century Learning

2. Collaboration
3. Communications
4. Critical thinking and problem solving
5. Creativity and innovation

Added by the Deeper Learning Network

6. Self-directed learning
7. Academic mindset

As an overview of requirements, this list has withstood a lot of scrutiny. However, the terms are sufficiently broad that they can be interpreted in ways that miss important dimensions. As an example, there is broad consensus that a grounding in traditional academic skills and content including English, math, history, etc., is still required. Nevertheless, more and more people, particularly those who hire graduates, are acknowledging that the full measure of detail from those academic subjects included in traditional state standards and standardized exams is not important in today's information-rich environment. It was recently reported that a school board member in Florida, the successful leader of a \$1 billion+ organization, took the standard Florida high school exams, and failed all of them. This reflects that our current exams, and the standards on which they are based, are not very indicative of what it takes to be successful in today's world. Some suggest that elements of the traditional subjects with wide practical value be emphasized, such as financial literacy and civic government. Others suggest that major concepts within each subject are important, but the detail that we all learned and quickly forgot in school is not because it can be readily accessed when needed. It would be valuable to have a suitable team review traditional academic standards to identify a subset or re-thinking of the material that is truly important for all students today. The Common Core Standards are a step in that direction insofar as they emphasize mastery of math and literacy as tools over specific formulas and vocabulary. However, they have gotten caught up in a political firestorm related more to issues of local control. I am not aware of any effort to delineate a new "academic core" that is widely accepted. However, many of the Deeper Learning schools have had great success providing students more in depth engagement with representative topics they select, even though it means they cover less of the traditional academic breadth.

The 4 C's represent the first attempt to capture what is involved with the higher levels of improvement, adaptation, and collaboration common in business today. In terms of just identifying skills, these 4 C's have withstood the test of time. The vast majority of schools with 21st Century skills efforts appear to be basing their thinking on the 4 C's, probably because of their maturity and supporting infrastructure. However, schools incorporating them within education have tended to define or frame these skills and approach them in classrooms similar to traditional academic skills. Thus, for example, collaboration might include assignments where a group of students each do part of the work and combine their efforts, and critical thinking might include any kind of straightforward decision. The reality is that the importance of the 4 C's in today's economy rests in how they integrate within a creative, open-ended problem-solving process involving much higher level thinking. Mastery in that context includes specific patterns of thinking, intuitive judgments, mindsets, understanding of self, and manners of trusted interactions that have been missing from most school implementations.

Deeper learning is the term now being used for learning approaches that more fully address the level of initiative and innovative problem solving that is important today. As noted, the Deeper Learning Network tried to fill those gaps by adding two additional skills. Self-directed learning is critical to solve novel, ambiguous problems, where complex decisions and emotions are involved. That can only be learned through authentic experience, where students are determining the next steps, where they are going, and learning from mistakes. The final skill, academic mindset, incorporates the associated habits of mind such as belief in self, persistence, and a growth mindset that are recognized as critical for successful innovation and problem solving.

Progress in Implementation (Or Lack Thereof)

Any school implementing the full measure of the Deeper Learning Skills will be well on its way to preparing graduates for today's innovation economy and being more of an equalizer for all students. Fortunately, the pioneering schools and organizations within the Deeper Learning Network are already demonstrating how it is done. Network members including Big Picture Learning, High Tech High, Manor New Tech High, and more have very robust implementations of the fuller Deeper Learning skills operating at the scale of a school or network of schools. The excitement, engagement, and mature learning of their students stands out when one visits those schools. While those schools mostly reject teaching to the test, their students generally do much better than peers on the required standardized exams. While they refuse to play the credentialing game, well over 90% of graduates of most of the schools go on to college. Moreover, the graduates have poise, confidence, and problem solving skills that today's employers need, and that also serve them well in college. Further, all of the schools are very generous about sharing their approach and operating details and accommodating visitors.

Another big effort toward transforming schools is coordinated by EdLeader21. This is a consortium of school districts working together to incorporate 21st Century skills. It was started by the founders of the Partnership for 21st Century Learning. Its 175+ members have serious efforts underway. Many members have developed new visions and goals for their districts that are relevant and responsive to the demands of the new age. I want to recognize them for their

bold efforts. At the same time, when I look at what changes even the leaders within EdLeader21 have made in the day-to-day learning experiences of students, it is clear they have a long way to go. Even those with powerful guiding statements that are fully attuned to the innovation economy still look a lot like traditional schools in their classrooms. The fact that almost all still have individual teachers teaching a given subject in their own classroom and giving traditional grades is one clear indicator of how little has changed.

I read almost every day about another school that is doing something bold and creative toward education transformation. Frankly, there is much to celebrate. Nevertheless, when I start to discern the details of what has been done, the progress still comes up way short when measured against the new demands of today's economy and society. When the gap is so large, there is a tendency to celebrate even modest steps forward—and then rest there, hoping it will be enough. Change is hard. Unfortunately, the world keeps changing, and at this rate education keeps falling further behind. Our country is losing the competitive edge we held for so long and becoming a second class power. If we want to prevent that, we must ramp up the transformation of education in dramatic fashion. Let's look at some commonly seen changes and talk about why they fall short.

One improvement commonly advocated by educators and policy leaders is making honors and advanced placement courses available to more students, and encouraging enrollment of disadvantaged students. This action was actually featured at a recent White House Conference on Next Generation High Schools. Unfortunately, it is a good example of doubling down on an inadequate approach to make it "better." Such courses most often involve more memorization of more material that will be quickly forgotten. While it might improve the credentials of more students, it is not better preparing them for today's world.

A similar change that involves pushing what we have to do better is the higher discipline environment of many schools, including some of the best known charter school networks. The idea is to create more rules and a more disciplined environment to minimize the disruption and get students to focus more on learning in the traditional manner. This clearly can work to get students performing better as measured by traditional grades and graduation rates. Some schools include changes such as "looping," where teachers follow students as they advance to higher grades. Such techniques can drive stronger relationships between teachers and students, and that is a very valuable change. However, in the end, the students are really only doing better based on measures that are disconnected with what is needed to be successful in the innovation economy. There is some value gained by those students who change their attitudes about schools and learning and their own future as a result of the strong mentoring relationships. In a sense, this is helping students who are disconnected gain the same value as the motivated students. But those students are still not being prepared for the innovation economy.

New or add-on curricula are another common improvement. The use of curricula as a detailed framework to guide what teachers teach in what order is an integral part of traditional education. If one curriculum is not working, there are generally vendors who promise that their new curriculum is just the ticket needed for success. Today, for example, a new curriculum might be "common core ready." This is enticing because, by adopting it, one will know that all teachers are implementing the change in the same way and time. Needless to say the promises rarely

come true because the problems are often more complex than a change of curriculum can solve. A related change is adding a new curriculum to a school environment to address a new need. A very common example is adding a social-emotional learning curriculum to address non-academic issues faced by many students in today's society. Besides the general limitation of a fixed curriculum, such add-ons put more pressure on already overburdened teachers, so the outcomes could be worse than before. Many schools seem to believe that the best way to address the new needs of today is to add a curriculum to the agenda designed for each new need. This has no chance of working because the radical new demands described earlier quickly overwhelm. Besides, most of the new 21st Century skills can only be mastered through authentic practice of an integrated way of thinking and doing.

Another change that educators view with unjustified promise, and on which they are ready to spend substantial sums, is technology. The big technology strategy today is called "one-to-one" because it involves providing a dedicated computing device to each student. This has enabled more use of dynamic, online textbooks and blended learning. Both can be improvements. However, in the vast majority of cases the traditional pedagogy remains the same in that teachers still determine what is learned and lead students through the process of how it is learned. Learning enhanced by technology may be a little bit more interesting and convenient, but it is still not addressing the new needs. This reflects what is commonly the first implementation of technology or automation improvements, which is the automation of the current process. The real value comes when technology is used to enable a more powerful learning approach that would not be possible without the technology.

Many schools are introducing more projects that may even involve field or lab activities, which they most often call project-based learning (PBL). In the majority of cases this consists of students completing a teacher-assigned project right after a given lesson to apply what they have just learned. Again, this is valuable as an improvement. Hands-on activities help to make learning more real and interesting. Nevertheless, because the project has a well-defined solution that ties to a current lesson, students are not learning anything about solving open-ended, ambiguous challenges that are so much a part of the innovation economy. In many cases completing the project is more important than what is learned. As I will discuss later, the project-based learning discussed so favorably within education research is a very different activity that is commonly part of Deeper Learning.

One more radical approach to change education that has become popular with many policy leaders is school choice made possible by alternative schools such as charter schools. Frankly, I believe this is mostly a result of frustrations among policy makers that regular schools cannot seem to get it right so we need to create incentives or solutions outside the school establishment. Ironically, the vast majority of charters, even those known for strong success, are based on a more intense application of traditional teaching practices: longer days, more discipline, and building student self-worth, for example. Certainly, as I have already noted, many of them show clear improvements in their graduation rates and test scores. However, if we evaluate their graduates in terms of the Deeper Learning Skills, for example, very few alternative schools measure up. So the choice strategy does not seem to be getting us where we need to be, except that charter schools did provide a vehicle for many of the pioneering Deeper Learning schools to form.

Let me reiterate that all of the changes mentioned above can be valuable improvements, if improvement is the goal. They may also be valuable tools to augment a more fundamental change effort. I cite the shortfalls *only* in the context of transforming education to address the new needs of today's economy and society as summarized earlier. The previously listed improvements do not change the fundamental design elements of traditional education that have been made obsolete by changes in the world. These include the relationship between the teacher as expert and the student as mostly passive receiver, the mass production approach of giving all students the same experience at the same time, and the assessment of only basic achievements related to memorization over higher cognitive performance. I have observed that even well-led schools with a strong commitment to their students seem to be limited to the kinds of improvements I just cited that fall way short of the new needs. This is despite the fact that the few Deeper Learning schools are demonstrating much more radical changes with success that is off the charts. I conclude that educators don't really understand what the Deeper Learning schools and others like them are doing, and they don't seem to care enough to understand. Also, educators are not aware enough or comfortable enough about the critical needs driven by the economic and societal changes to overcome the fear that accompanies radical change. Finally, the systems of education we have created in this country seem to be designed to resist change and discourage the initiative required for transformation.

As an example, the role of teachers within Deeper Learning is to facilitate an environment where students learn largely on their own direction. However, teachers have been taught to *teach*. They believe they are doing their job only when they are providing answers and leading students through the material they need to know. It is very difficult for the teacher who has believed this for a career to abandon it. They will think of all the reasons why they cannot turn students loose to take more initiative and direction. They cannot imagine it will ever work. Some may just be resisting change. However, I have observed many situations where teachers are taught a truly new approach such as project-based learning. But when they implement they revert to adding projects to traditional learning, which is completely different and without the same effectiveness. Of course our minds filter everything we learn through prior experience. Those teachers have screened what they are learning through a filter of what their experience says "good teaching" looks like and come up with a very different version. They often don't even realize this has happened. I know because I have talked to many teachers in this situation. This explains why so many schools believe they have tried project-based learning, for example, without getting the promised results. In reality, they never tried the technique demonstrated through research to be so effective, or its implementation was so isolated as to be lost within the dominant education culture.

It is instructive to note that the exemplars from the Deeper Learning Network all started fresh as new schools. Further, they tend to be run by visionary leaders who are education rebels that strongly believe in the ability of students to direct their own learning. It seems that most educators have a very difficult time transforming existing districts and schools even with successful models from which to observe and learn. This is the dilemma.

I encountered those constraints of tradition when I visited three Deeper Learning exemplar schools with other educators. All of us could tell immediately that we had stepped into a

different education world. Students confidently taking charge of their learning is truly a sight to behold and experience. As one who has quite a bit of experience with Deeper Learning in various program settings, I was encouraged and supported to see the same transformative benefits I have experienced now implemented for the complete education experience in a school. However, other educators were more disoriented. What they were seeing violated their basic understanding of what education involves and how kids respond. A few were instant converts, but most seemed to be questioning skeptics—which is only natural. Further, and probably more important, they missed many crucial education approaches that made aspects of the learning environment work until I pointed them out. It is scary how our minds tune out new information that does not fit our expectations from previous experience.

By now, some may be thinking my arguments here go too far. Surely one can apply selected improvement tools from those mentioned above effectively to create a satisfactory 21st Century education system. Let me refer you to comments from Professor Richard Elmore of Harvard University Graduate School of Education. Elmore has done pioneering work in instructional development, written the most studied books, and is generally viewed as the guru of high performance instruction. At a program on the future of education, Elmore recently lamented that he now realizes the work he has been doing is "palliative care for a dying institution." Even the most effective improvements he has been advocating cannot take education where it needs to go; we must fundamentally redesign the learning approach and associated culture within our schools so it engages kids in a different, much deeper manner.

Getting to Deeper Learning

What would it look like if we reinvented education for today's economy and society? There are no easy answers, but in my experience the solution follows when we fully understand what is needed from education today. I saw a quote recently, attributed to Seymour Papert, that is very relevant:

"Success in the slowly changing worlds of past centuries came from being able to *do well what you were taught to do*. Success in the rapidly changing world of the future depends on being able to *do well what you were not taught to do*."

Education has been a compliant environment where the educators were expected to have all the answers and the students were to dutifully learn the answers presented to them. Now no one could possibly know all the answers, and we must prepare students to be independent thinkers and original problem solvers who can tackle any new situation. That will never happen as long as educators control what is learned in what order and what time frame. Students must be groomed to take charge of their own learning, to come up with their own questions, to find their own answers, to try and fail and regroup until they achieve a satisfactory outcome. Wrapped up in this is mastery of the creative problem solving process, or how to attack an ambiguous problem and work toward a novel solution. In essence, all graduates need to think and act like entrepreneurs if they want to achieve success and fulfillment. That statement is not as radical as it seems. I don't mean every graduate must start a business. Rather, all must be prepared to contribute *in an entrepreneurial team environment*. In my experience, that is very realistic with the right preparation.

The previous discussion also laid out the need to nurture the whole person to make up for things that might have previously come from parents or other community support. In particular education must incorporate "softer skills" including understanding oneself, developing confidence, managing interactions, identifying strengths and passions, and finding how each student can best contribute to business and society. Further, our new education must help many students deal with challenges and traumas in their lives and to recognize possibilities beyond their current perspective. As noted earlier, we can no longer count on students developing these critical skills and possibilities outside of formal education. It represents a new task or goal for today's education.

The disruptive nature of these changing needs requires us to rethink almost everything about education. Teachers must assume a completely different role. Curriculum is no longer central to learning or even needed in many cases. Fixed schedules must give way to more flexible time management, and even different physical layouts are needed to reinforce learning most effectively. In short, we must be ready to change essentially everything about the learning environment at the same time. For the most part, the different changes will integrate and reinforce each other to create a very different education, so they cannot be ramped up one at a time. This kind of radical change will be unfamiliar and most likely even scary to most educators, for good reason. It is tough work. It would not make sense to go this way unless we were already so far behind. We can also expect the goals and needs to continue evolving. Thus, the new education system itself must be designed to learn, grow, and adapt.

Fortunately, the Deeper Learning schools provide working examples of all the tools that are needed. However, there is wide variation even among those schools, and there will always be more to learn. The answer will not be a copy of any school, but a mixture of changes carefully integrated to work for each situation and location. As I thought about how to provide principles or guidelines for the reinvention, I settled on three things. First, the creative problem solving process itself is unfamiliar to most educators accustomed to a rigid, compliant environment. I will try to illuminate that process by sharing a kind of summarized scenario of creative problem solving at work. The topic of the example will be designing a school for today's economy and society. That way, the reader will have a scenario of a school, as well as a portrayal of the creative design process that developed the school. After that, I will highlight a number of specific elements of Deeper Learning that I have observed are often missed by educators. Finally, I will outline a strategy that can be used to transform an existing school district.

Scenario: Designing an Innovative Education for Today

In this scenario, a team of educators and community members has been asked to design a new education approach and school that will prepare graduates who thrive in the world of today. The dialog and decision path will be simplified for clarity. In a real situation, the team would spend a lot more time and conduct more research evaluating paths and alternatives at the different stages. There would be much more questioning and back and forth within a healthy process. Nevertheless, I hope that one gets a more realistic feel for the creative design process and the related skills in action, as well as a model of what a transformed school could look like.

As we meet for the first time, our team is very excited about the opportunity to design a whole new school that will address all the questions and challenges with which the educators have been struggling. The district has provided an experienced facilitator, who starts with some fairly extensive exercises to help us get to know and trust each other. We notice that most of us don't really know where we are going, and we all view education somewhat differently based on our own experiences. The facilitator helps us understand the importance of evaluating and deciding where we are going or what we want to come out of this process before we start to consider specific steps for a solution.

To stimulate our thinking about goals, we all watch a new movie *Most Likely to Succeed* together. The movie makes it shockingly clear how the world is changing, and how far that change has already come. The business leaders among us reinforce that the dynamic, constantly changing, unpredictable business climate highlighted in the film is their day-to-day reality, and they lament that they cannot find prospective employees with even the most basic preparation for this kind of challenge. This leads us to a lengthy, multi-session discussion about the role of education. Many views are shared. The businesses share a number of skills they need in graduates, but educators wonder if it is even possible for schools to include all that they cite. A common theme that keeps coming up is that education should provide a path for all to the American dream. Another notion is that education should prepare citizens to contribute their best to a healthy and successful future for community and country. For a while, we wonder if the whole notion of the American dream is obsolete. However, several entrepreneurs on the team talk about the dynamic opportunities available today. We begin to see that the American dream is very much alive, but it takes very different skills to achieve it. Preparing graduates for today's American dream is a very challenging task. At the same time, it is apparent that the entrepreneurs and their employees who are doing well in today's environment have much more interesting and rewarding jobs than most of us ever even imagined. It would be nice to believe that our graduates have such rewarding career options. It seems like our task is really to bring out the very best of the uniquely human qualities and talents in each graduate, which will provide a successful and fulfilling future even as automation and competition advance.

We continue this discussion of the new world. Several members bring in research they have done that stimulates our thoughts. We also invite others from the community to share their perspectives, including two panels of students. This leads us to home in on three broad goals:

1. Prepare all graduates to be independent, lifelong learners and collaborative problem solvers,
2. Build mutually respectful relationships with each student that honor differences and support personal development and a growth mindset, and
3. Adapt the learning as needed to bring out the best in each and every student.

While there is excitement about these goals, the educators are concerned. They are not sure how to accomplish them, and they are certain they could not do all this on top of everything they have to teach now. The facilitator explains that such concerns are common in this kind of creative problem solving process. Our goal is to find a creative solution to this overconstrained and ambiguous problem. By definition, a creative solution will likely involve changes we are not even imagining now, and we should not expect to see everything at this point. We agree to

suspend the concerns about the overload for now, and look at what we could do differently to accomplish those goals.

We start examining how kids can become creative problem solvers. This leads us to a deeper discussion about the open-ended student projects and exhibition we saw in the *Most Likely to Succeed* movie. Many of us have done projects before, but the movie presented a version where the students really took charge and decided on the end result. We all talk about our own learning experiences. A few team members actually had experiences a little like this when they were young, but all of them happened outside the regular school environment with help from very influential mentors.

We decide we should do more research on project-based learning (PBL). One member finds an archived webinar series on Deeper Learning led by representatives from several schools including High Tech High, the school in the movie. We take time to watch those webinars together as a team, reflecting on each as we go. The comments from the educators and especially the students in the webinar are inspiring. Many of us have done projects before, but we always taught the lesson first and then led the students through the steps of the project to apply what they had learned. We wonder if students can really do this largely on their own. The webinar showed how students took ownership when they had a role in selecting the specific problem and presentation mode within an open-ended assignment. That is where we would like to be. We learn that a few of the Deeper Learning schools use PBL for all learning. We decide 100% PBL has the greatest promise, so we tentatively decide to pursue that in our design—at least while we try to work out what it would involve.

Thinking further, we start to talk about what kinds of problems we could give students. The business leaders on the team keep reminding us that textbook problems that are obviously artificial don't help kids learn much of value. Additionally, they stress that real problems are multidimensional, requiring a variety of content and skills to address. The educators start to get nervous again. However, after talking through several potential problems, the educators agree that breaking the day and effort into a fixed time for each subject is one of the biggest factors making learning unauthentic. This is another big jump. However, we decide to consider eliminating formal subject classes and making all projects interdisciplinary—touching whatever subjects, content, and skills naturally are involved with each authentic project. We realize that projects will likely take different times to solve, and different students might even require different times for the same project. This leads us to make another leap where we provide a flexible school day without fixed periods or bells where students (with teacher guidance) can work on different projects for extended periods as needed for the current item.

During the project discussion, we recognize that many students might be challenged to figure out the next steps. Our business members reflect that is common in business, and it is why almost everything of substance is done by teams today. The idea of teams gives us a lot of opportunity to adapt to student needs. Students will be more comfortable having others on a team to help work through ambiguous issues. We can mix the membership of teams for different projects so students begin to appreciate that different people have different strengths, and the best solutions come by integrating diverse perspectives and skills. We can also mix the membership of teams to provide some extra help for a given student by assigning him or her to a team with other

students who are strong where that student is weak. It seems like the logistics of teams could become a problem, but we decide to proceed by assuming that we will have students work in teams of 3-4 for most or all of their learning.

We come back to the question of what problems will our students solve? Certainly, our traditional curriculum standards are full of content that drove most of our instruction in the past. However, projects will likely take more time than just drilling answers and filling out work sheets. Fortunately, we now understand that knowing a lot of content does not mean much in today's connected world, as long as students have enough familiarity with important topics to know where to begin and to find answers they need. This understanding leads us to review our standards to look for essential or representative content and skills that, if students understood well, will give them enough background to tackle a whole range of issues including entirely novel challenges. When we look at math, for example, we need students to be skilled in the operations required for personal and organizational budgeting as well as building or repairing things. For history, we want students to understand how people interact and form governments and societies and get into wars, without needing to recall the details of every war or civilization.

As we work through the content we want to cover, we realize that each teacher tends to promote more depth in his or her own specialty. For example, the math teachers feel calculus is critical, while others can't think of any situations where a normal person would use it. We learn that we can do a better job working together, where other team members moderate our own personal biases and help us think in new directions. Together, we arrive at a set of core content we all support as vital for all students.

We talk through what students are likely to experience when they work through one example problem that involves making fresh vegetables available year-round in our urban community. We realize that within this project students would gain tremendous understanding of the social dynamics of high poverty communities, building a profitable business model serving poor neighborhoods, the biology of plant growth, and extensive algebra, geometry, trigonometry, and science in designing and constructing some kind of green house for year-round growth scaled for an urban environment. Our educators especially now begin to understand how effective PBL helps students acquire more knowledge and skills about academic topics than any traditional classes. They are just not used to thinking in terms of problems or challenges rather than subjects. This will be an adjustment. Fortunately, we can expect students to remember what they learn because everything is hands on and authentic. We begin to feel comfortable that, with a carefully chosen series of projects, students will learn everything they need to know to be successful, and really understand and retain it for a change.

Several educators point out that coming up with a range of such broad, open-ended projects that lead students to master important core content and skills, and still are interesting to the students, is a challenge. Our educators are accustomed to a curriculum that spells out everything to cover in what order. For this new vision, however, the projects will need to be chosen or at least adapted at the time of use based on the learning needs and interests of that particular group of students. This notion that the "curriculum" must essentially be developed on the fly for the particular students seems like a huge burden on educators. Someone points out that we already talked about having students work in teams to make them more comfortable tackling difficult

problems. We should design our new school so educators collaborate in teams as a normal part of their job.

Several educators share how being isolated in a classroom has made their job so much more difficult and emotionally challenging, and they would love to work with other educators on a regular basis within teams. We decide that collaboration among teachers similar to that in this design activity should be an integral part of our new learning environment. Someone reminds us that, in this emerging model, the teachers must know their students very well. After some discussion, we home in on grouping students into cohorts and assigning a team of teachers to each cohort of students. All teachers in a team will share responsibility for all student learning. Each teacher brings his or her specialty and may contribute more in that arena, but by sharing we get the combined thinking of our teacher team to come up with the best student projects and mentoring. Several educators mention they would love to work in such a collaborative environment, and they believe they would be much more effective with students in that environment.

As we check back with our goals once again, we realize students need to work as independently as possible so they learn to initiate solutions and make decisions. We can help by encouraging students to help each other within their teams and to leverage available resources before running to the teacher for explanation. Nevertheless, once students take on a project, they will need to learn a range of supporting information and skills that used to be taught in "lessons." This is where the connected world comes in. With all the tutorials and content available on the Internet today, we decide we will forgo textbooks, preplanned daily lessons, and as much explicit instruction as feasible. Instead, we will help students learn to find answers and skills on their own using modern information tools and other resources, including original sources wherever possible. This is very important so they learn how to learn and how to research a new problem or opportunity in the future when no teacher is around. Since the Internet is central to learning in this evolving model, we decide we must provide a computer for each student. They are directing their own work and will need access whenever they feel the need. We should be able to find the money for computer purchases from former textbook budgets. We will also need to provide different levels of scaffolding to assist students until they become proficient. This will include model documents and presentations, links to helpful web sites, rubrics, process frameworks, and structured forms for different skills, and perhaps a list of community experts willing to answer questions. We can develop an ongoing library of scaffolding collaboratively among our teachers, and over time also add contributions from the students and student teams.

Our educators start to get nervous again. How will they, even working in teams, ever be able to have all the answers for students in this flexible project environment. One of the community members points out that, in this environment, they don't need or expect teachers to have all the answers. In today's world, no one can have all the answers. We can anticipate students delving into a topic following their passions and learning things their teachers never knew. At this point, we really begin to understand the radically different role of teachers in this new education environment. They are there to create an environment where every student learns what he or she needs largely on his or her own. Teachers will learn along with students. This fundamentally changes the relationship between teacher and student. However, that kind of relationship can

build trust and respect between student and teacher that helps us engage each student and draw out the best in him or her.

Someone suggests we try to walk through what it might actually look like for a student working on another project. Frankly, while the educators can see how different topics are brought to bear, they don't have a good feel for the steps and decisions involved along the way. However, the business members, particularly the entrepreneurs, share stories and perspectives that are very helpful. This helps the educators understand how a team can move forward and find a workable solution even when they don't currently understand how to solve the problem. The educators also follow up to see what research exists. We learn that the people involved in team processes that achieve high levels of innovation are so engaged that they enter a state called "creative flow." Participants become so immersed that they focus completely on this activity, tuning out everything else around them. We want our students to achieve creative flow so they can experience and master the most effective form of innovative problem solving. So observing creative flow at work becomes another benchmark of how we are doing.

By this point, we are all overwhelmed but also excited about what we are developing. We know that there will be many more details to address in a successful implementation. Nevertheless, there is growing confidence the educators we know can do it. Most of our teachers are excited about working in teams and mastering the art of student-directed PBL. They can see how, collectively, it should be possible to come up with the projects needed to cover the core content and skills. They also relish the idea that, since educators are no longer lecturing and providing answers, and since they stay with a cohort of students, they will have lots of time to get to know and keep up with each student and provide effective mentoring. We are no longer worried about covering the content that we suspended at the start. However, we still have a major goal of bringing out the best in each student that we have not really addressed.

At this point we focus on investigating and discussing the lives of our students, issues that are barriers to learning, and important relationships and life skills they might not get from their living situation. Being in an urban environment, our educators have many stories of students dealing with problems that would overwhelm any adult, but also stories of student triumphs over their circumstances. Members doing research turn up that urban students often demonstrate symptoms of PTSD, the same disease that afflicts soldiers on the battlefield. We talk about providing a range of counseling services and finding mentors for students. This is what many schools do today with help from services such as Communities in Schools. However, this problem is becoming complex very fast because of the diversity of possible issues. Someone changes the direction of the conversation by suggesting that, instead of providing a service targeted to each individual issue, could we incorporate features within education that insure each student develops the mindset and life skills to overcome any challenge?

Several recall how a mentor came into their life when they had a challenge and helped them work through it. We start investigating how some of the Deeper Learning schools address this issue. We learn of a practice called Advisory. An Advisory is a group of about 12-15 students who meet regularly with an advisor who stays with the students for their whole time in a given school. Time in Advisory is normally reserved to develop deep relationships and talk about life issues in a trusting environment. This is essentially a group mentoring/counseling function

designed into education. We decide to include Advisory in our model, and to try to provide 30-45 minutes each day for it.

Our talk about student life issues brings up that many students don't really understand themselves, their strengths, weaknesses, and passions. Many also see limited possibilities for their future, and often believe nothing they do can change that (fixed mindset). We realize that our project-based learning environment gives us an edge in that regard. We just need to make sure our projects address challenges that are doable but require effort from the particular student team at the given time, that are interesting enough to engender engagement, and also to constantly reinforce what students have accomplished at each stage of their solution. Once a student sees that he or she has actually accomplished something thought to be beyond his or her capabilities, we will have a permanently transformed individual ready to take on much more.

Further, organizing learning around flexible projects rather than subjects and class periods will give us the opportunity to expose students to a wide range of topics and experience so students can see where their strengths and passions lie. We can have a range of projects, some longer than others, that involve different kinds of challenges. With open-ended projects, students can choose what direction they go and how they present their results, giving different team members with different skills a chance to try different roles. We can even have different teams working on different projects. We must make sure that our design expects projects to be developed and adapted so they bring out the strengths and passions of each student. We can vary the nature of the projects so it exposes students to a variety of challenges, opportunities, and tasks and allows students to shape their solutions and gravitate to tasks and outputs that really engage each student.

We are really starting to see the power of this new learning environment. It provides a very robust platform to facilitate students learning on many levels and developing their own strengths and passions. This gives us the ability to adapt to just about any learning need we can imagine. We can even accommodate differences in student styles and mastery by creating the right mix of students on each team. Further, we can reserve a portion of the day for students to work independently on any topic for which each wants or needs more study.

Someone notes that schools have traditionally left many of the learning issues we have been discussing to extracurricular activities. It is common, in fact, to hope that student enjoyment of extracurricular activities such as sports or art will carry them through the boredom of the traditional curriculum. Since we are reinventing the learning environment, we have incorporated much of what was learned in extracurricular activities and more into the core learning environment. We expect many projects to provide experiences for students to get out into the community. Further, our whole learning environment will be highly motivating and engaging. Thus, there may be no need for extracurricular programs. We will have to see how this develops.

One thing we have not discussed is assessment. Tests just don't seem to fit within this environment. Some of the entrepreneurs point out that, to be authentic, the environment should encourage iterative work and adaptation until the desired result is obtained. Students should get comfortable trying things and learning from failures. On the contrary, tests encourage playing a

game to make the grade for someone else to review. We want to always encourage the best learning effort from students. If students are really taking charge of their learning, the students will want to evaluate their progress at regular intervals. Some educators point out that a competency based assessment model, used in many vocational programs, is a better fit. Students know what is expected, and how to evaluate their progress, through vehicles such as rubrics. They can improve and resubmit work. It is expected that different students might take longer on different challenges.

The entrepreneurs share how their work environment encourages inquiry and discovery and supports employees to keep working until they achieve their best. It is clear to us that this will be an important part of the culture of our school. We decide to assess on competencies, to lay out the full range of competencies expected of students (including skills such as leadership) and share it with them, and provide a computer data base where students and teachers can track progress at any time on all competencies. We can reinforce the student ownership by having students regularly assess themselves and reflect on where they need to do more work. While we may be required to take certain standardized tests, we can make them simply a routine thing that doesn't cause angst or require special preparation.

Now, as we step back, we realize we have a new learning model that really does promise to address all the challenging goals we set at the beginning. However, some teachers worry about how our students will do on the standardized tests we still face. Fortunately, we can ask some of the existing Deeper Learning schools about their experience. They tell us students do fine on the exams, even exemplary in many cases. Even though the breadth of material covered is less than conventional education, the students learn what they study so well, and recall it because they really understand it, that they tend to do fine on tests. If standardized test scores are particularly important to educators, they just need to carefully incorporate a range of projects that touch on all the core content that is measured by the tests. One school says they lay out all the key standards for their grade level on a large white board at the beginning of the year, and they use that tool to guide the creation of projects throughout the year, checking off when each standard is addressed. Other schools tell us they give teachers more freedom on what is covered in their projects. However, they have found that teachers will gravitate to topics they know are important anyway. Thus, it seems we can prepare students for today's dynamic economy and improve our traditional measures at the same time.

In our final review, the educators acknowledge they will need to master a lot of new skills, and give up much of what they previously thought made them good teachers. That will not be easy. It cannot be expected to work unless they have leadership that fully supports the model and gives them the flexibility and professional development they need. Frankly, the prospect of students so engaged that they take full ownership of their learning excites everyone and gives our educators the drive to work through their own challenges. We cannot forget the enthusiasm of the teachers we saw in the *Most Likely to Succeed* movie and heard from teachers at the Deeper Learning schools to which we talked. We are much more comfortable taking on the work now that we have agreed to continue this collaboration experience by working within teacher teams. We will no longer be isolated in classrooms, and we will have the opportunity to utilize the full measure of our professional skills. We understand the needs of business much better from this experience, and we are ready to help students prepare for today's demanding jobs. Finally, we

realize that, through this process of designing a next generation learning environment, we have learned things about our colleagues that never came up before. We have seen talents they normally don't bring to school but can contribute in this collaborative environment. Part of the time we have even experienced that mysterious "creative flow" that we learned about earlier. It really is addicting. We realize that we are becoming creative problem solvers ourselves. And that is good because we won't be able to teach students to be creative problem solvers unless we model that behavior. Further, the world will keep changing, so we need to design an education system that continues to change and adapt along with the world.

Implementation Challenges

I hope that the scenario provides at least a flavor of the creative problem solving process. It is *very different* from traditional strategy development or problem solving because it cannot be carefully planned and staged. By nature much will be discovered along the way. Knowing too much can even get in the way when it prevents you from asking good questions and exploring at the edges. One cannot predict the outcome in advance except that it will provide a creative solution to the driving problem. Nevertheless, this is what our students need to learn to be successful and fulfilled in today's world. This process actually taps the highest level thinking and reasoning abilities of humans, the kinds of things that machines cannot do and may never do. Steve Jobs has called it "connecting the dots." Mastery requires knowing yourself as much as having the necessary skills and background understanding. The mind will not engage in creative problem solving unless the people are intrinsically motivated. It is just too taxing otherwise. This is important because it means kids will never do this to earn a grade. They will do only what is necessary to earn the grade. Fortunately, the engagement and "creative flow" connected with creative problem solving is tremendously nourishing and rewarding in a deep sort of way, fulfilling a human desire to be part of something bigger than ourselves. For that reason participation can help students over many hurdles and challenges.

For more on the creative problem solving process, look for articles on entrepreneurship, particularly what is called *lean entrepreneurship*. Entrepreneurs are the role model. It used to be that we thought entrepreneurs came up with their novel innovations through creative genius. We now understand that they follow a creative problem solving process similar to the scenario. It is also closely tied to the design process as famously advocated by the company IDEO, whose founders have released several books and other resource materials.

Note how a very innovative new education environment emerges logically from this process, even when no participant knew anything like it to start. It is not a process that can be memorized and followed step by step by rote. It can only be learned with authentic practice, which gradually sharpens the thinking patterns and mental states that are needed. Thus, the new education model ends up being built around 100% project-based learning as the best known way to include the authentic practice. A cohort of students stays with a dedicated team of teachers to reinforce deep relationships. Students work in teams facilitated by the teacher team so that collaboration or teaming helps both the teachers and the students combine diverse perspectives and skills to come up with novel directions and answers. Assessment is built in as an ongoing (formative) evaluation or reflection process largely managed by the students, so it contributes to the learning. Some schools make this work fairly well by sharing projects across different

subject classes. However, the more authentic environment ditches traditional subjects and scheduled class periods. Students utilize whatever skills are necessary for each project, and help to manage time within an open schedule depending on the project. The teachers develop open-ended challenges that frame the projects only after getting to know the students, their interests, and their education progress, so the projects are specifically chosen to meet students where they are, fit their interests, and lead them to learn new skills and understanding through practice. Teachers make sure that, on balance, the range of projects exposes students to the full body of topics and skills they need to know. Projects are also chosen so students experience different activities, talents, tasks, preferences, and strengths associated with a variety of careers so they can recognize their own passions and strengths in what resonates with them.

One can see why it is challenging for traditional educators to develop or even live within an environment so foreign to everything they know about education. Teachers are taught that *controlling the learning* in their classroom is what makes them a good teacher, but now we ask them to let students help determine what they learn and how, let students and the work largely determine the schedule (both order of topics and time spent), work in teams with other teachers, take joint responsibility for everything a student learns versus a given subject, build nurturing relationships with each student, abandon a fixed curriculum and adapt the project work dynamically depending upon the interests and current needs of the students, and respond to student needs dynamically versus controlling the steps. Further, all those changes and more integrate to create the effective new education environment. Trying to change one at a time can make things worse. This represents a complete paradigm shift in education.

Many educators will be thinking this is beyond their abilities. Experience at the Deeper Learning schools and elsewhere, however, suggests that the *transition* is very challenging for educators, but they do very well once they make it over the hump and see how students respond. It is extremely reinforcing, even addictive, when teachers experience the impact they have on kids. Teachers are using the full value of their professional skills, perhaps for the first time. Nevertheless, the degree of change can be overwhelming. Except at pioneering schools with extraordinary leadership, the educators I see and read about almost always fall short in some significant dimensions, which limits the outcomes. They generally see some improvement, and perhaps are happy with their efforts. But they don't get close to the transformation that is required.

I hope to help more educators get past the tipping point to full Deeper Learning by highlighting some of the of key things I have observed that smart, well meaning educators seem to miss when trying to transform. It has been frustrating for me to see dedicated teachers putting in great effort and turning their regular practices upside down—yet missing the critical changes in learning approach needed to address today's education needs and achieve that highly motivating and effective new learning environment. I hope the pointers that follow are clear enough to enlighten and empower more educators to advance into Deeper Learning.

Common Barriers to Effective Transformation

Missing or Loosely Defined Goals

Probably the biggest barrier that catches people who are not used to innovative environments is trying new approaches without clearly defining what they want to accomplish. It is easy to get caught up in an exercise to make education "better." However, what does "better" mean. Without further examination, it probably defaults to improving test scores or graduation rates, which are the measures that are universally tracked now. But I have talked about how dramatically the world has changed, creating entirely new needs for public education. If we want to bring education forward to meet today's needs, we must talk about and agree on where we want to be. For an innovative solution, of course, we cannot define exactly what the answer should look like. However, we need to clearly understand the objectives, goals, and/or targets that caused us to seek an innovative solution. In this case, that includes what skills and experiences we want all graduates to master and how performance will be measured.

By the way, we are not talking about the typical vision or mission process that creates flowery language to put in brochures and on wall plaques and makes people feel good but has no day-to-day role. We are talking about goals which are defined in enough detail and presented in readily interpreted form that educators can constantly evaluate whether and how their initiatives, ideas, and even daily activities support those goals. When done effectively, the goals and related commitment to measure everything against the goals will help educators and educator teams move away from traditional practices and try new approaches that are responsive to those goals. Most educators today realize that test scores are a poor measure of their success, but they don't really have any alternatives. Once educators start to work toward the new goals, they will become the norm. This is also how innovative organizations can insure that everyone is pulling in the same direction while allowing the flexibility to adapt to individual student concerns and the shifting needs imposed by the constantly changing world.

I have already mentioned, for example, that most of the well respected charter schools demonstrate improved graduation rates and test scores. However, there is little evidence they are preparing graduates for the very different requirements of today's world. One cannot blame them. They are just responding to the common public demand to "fix" our schools. While they may have satisfied that narrow (obsolete) goal, it is not clear how much value has been created if graduates are not fully prepared for today's economy and society. If more of those schools made the effort to determine what is important for today's graduates, and derived a clear mission and goals from that analysis, they would see the shortcomings and likely make more dramatic changes to address them. As this example shows, determining goals can have a dramatic impact on outcomes, and it should not be left to chance or individual interpretation.

Incremental Improvement vs. Transformational Change

Another situation that more or less follows traditional mass production approaches is incrementalism or dealing with issues one at a time, assuming each can be tackled independent of any other. For example, if students in a given grade are doing poorly in English, a district typically will set up a team to review practices and perhaps end up purchasing a new curriculum that promises improved English scores. At the same time, another team is given the task of better recognizing and assisting students who are dealing with traumas from their lives outside of

school. They will likely decide to purchase a social-emotional skills program and instruct teachers at designated places to add this to their curriculum.

There are several problems with this incremental approach in terms of transformation. First, teachers today are already overloaded by what they are expected to teach, and there are many new issues to be addressed. Trying to solve the range of new issues by finding a separate solution for each, and adding each to what teachers already have, just compounds the problem. We end up with overstressed teachers and students, and perhaps less learning as a result.

Second, beyond the issue of curriculum overload, the assumption that the solution to every problem is a new program that everyone follows in lock step is another assembly line principle that is obsolete today. As we get beyond teaching independent facts and begin to engage students to think and reason, we cannot be effective unless teachers adapt the learning activities to the individual students at least to some degree. Our minds learn by associating new information with past experience. Every student will react somewhat differently because he or she has different experiences, and different students will also think in different patterns. We need to give our teachers more flexibility (and training) to adapt and mentor to each student while following broad guidelines on what is to be accomplished.

Third, the higher level skills and inquiry that are important today require a more authentic learning environment. Real world problems do not get separated into individual subjects or components, and students cannot effectively master real world problem solving unless they engage authentically across all aspects of a given problem. That is what students will face in their future careers, and they develop the right skills only through practice in solving the kind of problems they will face. Of course, mashing subjects together is a serious disruption of the traditional education environment. Fortunately, once we start looking at learning environments in a more holistic fashion, we begin to identify new approaches to learning that deal with multiple issues at the same time. It turns out that a multidisciplinary approach is integral to the innovative problem solving process students need to master.

Certainly, people are much more comfortable looking at an incremental change rather than totally reexamining how they are doing something. It used to be that organizations avoided more comprehensive change efforts because of the perceived risk involved. With the advent of the Total Quality movement (TQM) and related changes in the 1980's, however, businesses found that they could not compete with others without retooling their processes. Incremental changes might improve performance by 5%, which used to be good. But when competitors were doing 20% better by using TQM, others had to make the adjustment or go out of business. For whatever reason, schools seem to have never gotten to that point. The unmet needs for education today are too extreme to be satisfied in any way other than a major reinvention. Educators must be prepared for wholesale change in response.

What might a more transformational problem solving approach look like with the example above of students failing in English? A broader examination could show that students are not doing well on English tests and lessons because they are bored and distracted. Thus, we could try changing the reading or writing topics to make them more interesting to students, and give students more voice in what is read, how it is interpreted, and advocating their own conclusions.

If done effectively, this could address both the poor English performance and the social-emotional issues simultaneously, and also give our teachers more time for individual attention and relationships. It is the difference between responding simplistically to every symptom and trying to match each one with a given solution versus really understanding the problem and redesigning the learning environment to overcome all the problems and issues together.

Teacher-Directed vs. Student-Directed

As has been noted, one of the most challenging aspects of education to change is the teacher directing all aspects of the learning. Let's face it. Schools are very compliant environments. Teachers are taught that managing their classroom is the mark of a good teacher. Further, since teachers are often most focused on covering a given curriculum, they feel they must control the agenda and what is learned very tightly in order to get through it all. Many students figure this out pretty quickly, and they play the game to do what is necessary to earn the grade they want. One can even observe a learned dependence, where students automatically look to the teacher for answers rather than make any effort to figure it out on their own. What they are really learning is how to give the teacher (or manager) what he or she wants.

This teacher-directed approach has been acceptable as long as the goal is to memorize a bunch of material long enough to regurgitate it on a test and earn a credential. The problem for our purposes is that students will never master the nuances of critical thinking, decision making, and problem solving if teachers make all the decisions for them. They won't know where to begin until told what to do. They won't be comfortable trying things that might fail. They won't know how to do anything that is not exactly like something they studied or found in a book. These are serious limitations in the innovation economy. Shifting to student-directed learning is another serious disruption of traditional education that is absolutely essential if we want our graduates to thrive in today's world. In my observation of many schools supposedly working on 21st Century education, this emerged as the tipping point toward effective school transformation. I never observed the sustained benefits of Deeper Learning unless the school had changed its learning environment enough that students were truly taking ownership for their learning.

I was reminded of how easy this is for traditional educators to miss not long ago. I was with a group of excited educators embarking on a significant new school effort touting the use of project-based learning (PBL) and student choice as core to a 21st Century education. In opening remarks, the leader said something like "I am so excited our students will have the benefit of PBL where they will apply what they learn to real situations." These educators have rightly chosen an approach (PBL) proven to drive Deeper Learning. Unfortunately, what they are actually implementing, teaching a given lesson and then having students apply what they just learned to a real problem, is completely contrary to effective PBL practice. This is such a common misperception of PBL that good PBL training materials highlight it as something to be avoided very early in their presentation. I was experiencing another group of skilled, dedicated educators supposedly working on a transformational education model but missing a fundamental change. In talking to them later I could see they had no idea anything was missing. I spent much of my career working with entrepreneurs. The best entrepreneurs told me their greatest fear is when "I don't know what I don't know." Too many educators seem to be oblivious to what they don't know. That is something to which we should all pay close attention.

PBL is an important component of our future education system. However, the essence of PBL is the inquiry process where students are given open-ended problems and they learn what is needed *while working on the problem*, doing their own research, setting their own direction, trying options and regrouping when that fails, etc. The primary role of the teacher is configuring good open-ended problems for the students that will interest and engage them and help them master important skills and content. Once that is done, the teacher needs to let go and give the students space to do their own thing, as messy as that is, providing only strong support and carefully targeted but limited guidance. The teacher is now responding to the students, and students will likely take things in a somewhat different direction than the teacher expected. That is the essence of student-directed learning. If the project is designed well, the students will still need to work through the broad topics and skills intended to be covered by the project. Yes, the younger the student, the more scaffolding will be needed to lead students through the process, but even the youngest students should be encouraged to ask their own questions and pursue their own interests as much as possible rather than follow the teacher step by step.

Many teachers cannot imagine they should give up their traditional role to show students how to find the answer before letting them practice the application. But in doing that, they take away the most critical part of the learning for students—mastering the process of solving complex, ambiguous problems that have no known answers or at least are unknown to the students. When I talk to teachers in the exemplar Deeper Learning schools, most say the emotional stress involved with letting go of their directive role has been the biggest hurdle they had to overcome. Once they get past it, however, and see how students react, they all say they will never go back.

Many hear this description of PBL, and they wonder when and how students will learn something if a teacher does not present the lesson. Teachers will always need to provide some direction on the steps. It is common, for example, to start a new project by having students determine what they know about the problem or project and what they need to learn to address it (knows and don't knows). The goal is to then have students figure out where to get that missing knowledge and understanding on their own. In today's world, this can often be found in examples and tutorials on the Internet or other materials readily available in a school. Khan Academy, for example, has become famous for its web-based short tutorials on math skills and beyond. Students can also help each other. Or students might interview experts in the school or community to get more detailed knowledge. The school or teacher might have created a kind of curated index of resources to help the students. There are a number of efforts today to index "open education resources (OER)" and describe how each is best used. Teachers need to stay in close touch to see how students are progressing, and provide helpful hints when students get too far off. At times, it may be necessary to stop everything and provide a more traditional lesson on a topic with which students are really struggling. The goal is to keep that to a minimum.

I acknowledge that many progressive schools, including some of the Deeper Learning schools, do not follow that guideline completely. They create an overall project that touches many different subjects and skills, and then their teachers provide the lessons needed to address the project more or less in traditional fashion within subject classes but also connecting with the project. When done well this is much better than traditional education. At least the students are working on real problems, and they receive the lessons right when they need them so there is no longer "why do we need this." Nevertheless, remember that we need students to become

independent learners. We are preparing them to solve new problems they will encounter beyond school, when there is no teacher or school around to help. Students won't really master independent problem solving unless they are required but guided to figure most things out on their own as presented above. I have learned to never underestimate students' ability to address pretty complex challenges mostly on their own in today's information rich environment as long as they work in teams to help each other and they are sufficiently interested and engaged.

That independent problem solving ability that is so important in today's careers is the ultimate self-directed experience. Mastering it involves a complex interaction of skills, habits of mind, understanding of self, confidence, experience, persistence, and leveraging intuition. The only way to learn it is through repeated authentic practice where students figure things out mostly on their own in teams. In this way each student learns the process in his or her own way. That is why the Deeper Learning Network made self-directed learning a core skill.

Assessment for Ranking vs. Learning

Another important change that is easy to miss is an over dependence on summative assessment in the form of tests. While many teachers have ways of trying to keep up with where their students are, formal assessment in traditional education is really a ranking or labeling exercise. Students are given assignments with instructions on what is expected and when it is due, and they are graded on what they complete by that time using arbitrary criteria determined by the teacher. This labels them as good or bad students, and such labels create a culture that discourages learning. It is all about the grade instead. We develop students who are good at figuring out what the teacher wants and giving it to him or her. School becomes a game to earn a particular credential that is assumed to be helpful for another stage in life, such as getting into college or getting a job. In today's economy, however, those who play that game will likely find a less than desirable outcome since the memorization that earns the traditional credential is not valued very much anymore.

While this traditional assessment approach might have been acceptable in the black and white days of memorization, complex thinking skills are inherently mastered through a learning journey involving encounter, trial, and reflection over some extended time. We need to create a culture that reinforces the value and adventure of learning and persisting until one achieves the goal. To do that we must guide students through the journey, helping them assess where they are at any time and what they should do to improve, as well as reinforcing their efforts to continue to the solution. For the most part, we don't care how long it takes or what path a given student takes, as long as he or she masters the learning we are targeting.

Regular and timely formative assessment in the form of actionable feedback and suggestions for improvement meets that need by reinforcing progress and encouraging further effort. The resulting culture supports a growth mindset and a focus on learning, e.g. one can always make it better the next time. That culture is essential for Deeper Learning. For this reason Deeper Learning environments incorporate on-going formative assessment as an integral part of learning, and most assess in a competency-based manner based on where students stand relative to mastery. Many schools provide opportunities for constant self assessment using rubrics or related tools to reinforce students taking responsibility for their progress. This assessment approach is one that effectively eliminates the game and helps to create a true learning culture.

So how do we assess and report student progress? The most common answer is to have a way for students to record and track their status in mastering whatever competencies the school feels are important, and to save examples of work that reflect their progress in a type of portfolio. It is common to create rubrics, for example, that describe what below basic, basic, or advanced progress or mastery looks like for each competency. Teachers and students use the rubrics regularly to evaluate progress on different competencies, and those results are tracked in a database or manual process that reflects overall progress at any given time. This is very effective to assist learning, giving students a way to reflect back on where they have come. The key is maintaining the culture for learning. Schools that feel they must have grades should have the grades reflect only competency and be subject to improvement, e.g. students can keep working to improve and raise their grade. Schools also should assess and report progress in the full range of skills important for success today, which includes collaboration, initiative, persistence, problem solving, and self direction.

This form of assessment integrated into learning is very helpful for students. The challenge, of course, is how to deal with external parties who have traditionally used summative grades to rank graduates for different purposes, e.g. the traditional education credential. Fortunately, more and more of those external parties are starting to recognize the folly of grades and welcome evidence of actual mastery. Every day additional colleges are dropping their requirement to submit SAT or ACT scores or even transcripts. They are looking for students with unusual drive and interests, and they have found traditional grades are poor indicators of those qualities anyway. Hampshire College in Massachusetts no longer even accepts SAT or ACT scores, believing them to be counterproductive for the college and the students. They instead review each applicant's whole academic and living experience. They report that it takes longer. However, they only get serious applicants, and the extra effort is helping them choose students who are a good fit for the college. Another prestigious group of colleges is creating a new online portal that allows applicants to create and submit portfolios of selected student work as part of the admission procedure. One college recruiter said to me "look at how many home schooled kids get into Ivy League schools." It shows that institutions and organizations are already willing to consider alternative measures or indicators of real learning, and the frustration with standardized tests and grades will accelerate that trend.

Businesses are also moving in the same direction, with Google being the poster child for the way the company interviews and evaluates new employees with almost total disregard for grades and prestigious degrees. Google reports that good grades are often indicators of employees who do not work well on innovative teams. As more businesses struggle to find the truly outstanding employees who can help them be successful in today's dynamic, hypercompetitive innovation age, they will have to make these kinds of changes, also, despite the disruption in traditional policies it causes.

Finally, to deal with those who insist on a more traditional credential, some schools have been known to track and assess competencies, but allow students to determine or strongly influence their own grade. In the right learning environment, students will almost always be fair or even harsher on themselves than the teacher would be. As a more authentic approach, schools that track progress on mastery can easily create synthetic transcripts based on what students have

mastered mapped into what traditional courses would have covered each given topic. The bottom line is this. Several of the Deeper Learning exemplar schools told me even the best colleges and most demanding businesses welcome their students because of their easily identified confidence, problem solving abilities, and effective communication skills, despite a lack of traditional grades or ones that can be compared to any traditional school. Beyond that, Big Picture Learning, for example, now creates synthetic transcripts for any students who request them (with an explanation), and they have never had a college or employer question those transcripts.

Racial and Cultural Biases

Other, more subtle barriers to effective education transformation that are frequently missed fall under racial and cultural biases. One of the changes within society tied to the rich/poor gap is the increasing geographical and social separation between different income and ethnic groups. In particular, poor families today tend to live in separate enclaves, often urban ghettos, with very high concentrations of families living in poverty. Urban schools, then, tend to have large concentrations of students living in poverty. While largely based on economic situation, there are frequently racial overtones as the vast majority of poor families in urban areas are minority. Obviously, the reasons for people being poor and concentrated in poor areas are complex. However, anyone who gets to know poor urban people will come to understand that they are not treated the same by many people who are more privileged, and many if not most privileged people have no recognition of that status. Poor and minority families and students are much more likely to be disrespected and steered toward less desirable options with an assumption that they cannot do the same quality work as the other kids. Stereotypes also come into play as racial minorities are often treated this way regardless of their education and income. I must say that, as one who grew up relatively privileged, I have been appalled by what I have observed and heard about how people of color are treated in what I thought was a more progressive U.S. society. I believe this treatment is actually getting worse, as formerly middle class families lose or downskill jobs and sink closer into poverty. The fear about their future seems to encourage many to take out their frustrations on someone they perceive of lower status.

I have noted one particularly hard to discern problem. Privileged people, many of whom grew up in relatively poor circumstances, tend to reflect on how they worked hard to overcome their poverty and rose above it, and they wonder why poor families today cannot do the same. There is a tendency to question the effort and drive of today's poor. However, the challenges faced by today's urban poor are much greater than those from earlier times. Poor people used to interact more with the rich and see them as role models, and society used to provide a palpable path upward if one worked hard and made good choices. But many of today's poor have no similar role models or expectations, and neither they nor anyone around them can even imagine a path upward. This obviously affects how poor students respond to teachers and schools.

For purposes of education reform, these barriers show up as differing expectations for disadvantaged kids that are not based on true abilities. Kids from poor, urban neighborhoods, for example, may act in a manner that seems improper to their privileged white teachers. However, for the kids, such behavior is the only thing they know and how they have learned to survive in their neighborhoods. Those kids may avoid several violent criminals on their way to school every day. They may also suffer from deep emotional trauma from living in homes where there

is violence and dysfunction of all kinds or at least no place where they can feel unconditionally supported and nurtured. The teenager may be the primary care giver for younger kids. They may be distant toward teachers because they have been abused or at least taken advantage of in other adult relationships. Teachers often react by disciplining the kids to act in a "proper manner," rather than trying to understand them, which breaks down trust and makes the situation worse. Very frequently, teachers in urban schools develop stereotypes that these kids are not capable of doing what more privileged kids can do. The stereotypes seem so real that teachers might not be conscious of them. However, lowering of expectations always shapes the education experience in unhealthy ways.

The most important step forward is for educators to recognize and acknowledge their own biases. We all have biases or stereotypes based on our experience. We are more comfortable with people who think, look, and act like we do. That is just human nature. In particular, people of the dominant white race often don't realize the privilege they have experienced. However, education needs to be the place where all segments of society come together with *mutual respect* to support and improve *each other*. It is not one helping the other, but all learning from each other. Educators must work to develop relationships with the kids from different circumstances before drawing any conclusions about them. In many cases the educator needs to do much more than meet the kid halfway because the kid is too traumatized to openly respond until he or she can feel safe with that educator. Further, educators must never underestimate what kids can do, no matter the history. I have experienced when kids who seemed to be failures with little prospect blossomed to do amazing things once they realized the possibility. Kids can actually be conditioned to not believe in themselves or set their own expectations low, and be acting that out when teachers encounter them.

There is no substitute for training and supporting teachers to face their own biases and to work toward bringing out the best within each student. Fortunately, however, a student-directed learning environment creates friendly conditions for that to happen. Students have the freedom to try new things and make choices, even make mistakes, and get better. Different learning styles are naturally accommodated by the hands-on approach. When all students are engaged in their learning, they will generally support each other rather than bully or demean. With the variety of authentic tools used and problems addressed, every student gets a chance to shine at something and often discover something about themselves in the process. There is nothing more powerful to develop confidence and a growth mindset in a student than realizing he or she just did something believed beyond his or her capabilities. Nevertheless, educators must remain diligent especially when working with kids from different cultural, racial, or income backgrounds to be open to knowing and learning from each student.

21st Century Skills

Let me make some brief comments about the role and meaning of the so-called 21st Century skills or the 4 C's. I find that educators often miss the value of these skills when expressed within the creative problem solving process. Let's take collaboration, for example. Having students work in teams is fairly common even in traditional schools. However, in these instances collaboration frequently means that students divide up a work assignment into different tasks, each completed by a different student. One can clearly learn things about working together and project planning this way. However, the collaboration that is valuable in today's world involves

diverse teams of people who share ideas and build off each other so they collectively create outcomes none of them could have done on their own. This is a much more sophisticated skill than share-the-work teaming. Such collaboration, which we might better label as co-creation, requires high levels of trust, which in turn requires empathy and tolerance and healthy self confidence. It is more effective with diverse teams, even though diversity makes it more difficult to trust. The way co-creating teams work together is dramatically different than share-the-work teams. Obviously, it is co-creation that we want our students to master. We need to create challenges and a learning environment that reinforce co-creation among teams and settle for nothing less.

Communication is another skill that has new meaning in today's world. Certainly, lessons on reading and writing have always been a core feature of education. Today, however, the ability to first locate and then understand material including writings, videos, and more is very important in our information rich age. This involves not just language but use of technology and sorting or distinguishing the needed information from the vast store of the Internet. It also means comfort learning about topics outside one's own experience. Further, persuasive communication is critical today. That includes writing from formal papers to informal blogs. It may include persuasion through effective use of social media. It clearly includes understanding and selecting the most effective media for a given situation, whether formal or informal writing, presentations, video, or full multimedia. Our ability and means to communicate are changing rapidly with new technologies and related social changes, so quickly that educators may not be familiar with the latest tools. Nevertheless, it is incumbent on educators to follow such changes and incorporate them as needed for their students to master.

The value of critical thinking and creativity in the context of today's economy should already be evident from all the prior discussion about the creative problem solving process. Many educators, for example, equate "creativity" with art. Certainly, there are similarities. Nevertheless, creativity within art is often about creative expression, e.g. this is creative because it is different in an interesting way. It is a form of personal expression. Creativity in problem solving, however, is about novel ways of achieving a goal. It is creative only when the novelty provides practical value toward a better solution. The thinking processes for the two kinds of creativity are often very different, even though both are uniquely human in many ways. There is room for both within education. However, it is important to always keep in mind that the importance of the 4 C's in today's economy connects to how they enhance the creative problem solving process.

Business and Community Partnerships

The ultimate way for students to prepare for future careers is to work on real company projects for real community leaders. It is common for schools today to seek business partners who will take student interns, offer site visits, etc. However, fundamental disconnects between business and education seem to get in the way of effective partnerships.

Businesses want to help by creating meaningful experiences for students. However, when students lack basic work skills, project skills, communication skills, or numeracy skills, there likely will not be anything the students can do for the business. The business is left with making some kind of artificial work or experience for the students, which becomes a burden for the

business and provides little value for the students. Some educators expect that businesses will teach generic work skills to their students since that has traditionally not been covered in schools. However, businesses don't have the expertise, time, or resources to do that—especially in today's hyper competitive environment where resources are stretched just to keep the business successful. I learned from a recent college graduate that every job he had seen posted asks for at least 3 years of experience. This reflects that businesses are finding recent graduates don't have the basic skills to become productive employees, and the businesses cannot afford to provide that basic level of education for potential employees.

Effective partnerships should leverage the strengths of each partner and provide benefit to each partner. Preparing students to be problem solvers is a very sophisticated education task that needs to be performed by the school. Once students have that preparation, businesses are able to give them meaningful opportunities to apply what they have learned to real tasks, and to learn about how business and careers really operate. Fortunately, students in a Deeper Learning environment get ample experience at school with their student-directed project activities. They are often ready to contribute usefully to a real, on-going project activity at a company partner, much as any other entry level employee. Students might even bring outside perspectives or unique strengths to the project that are recognized by the company. This kind of high value, mutually beneficial partnership between business and education will be welcomed by all, and both partners will want to continue.

A suggestion is to plan for a broad array of business interactions, all designed to leverage the strengths of each party. At one end of the spectrum would be light touch activities where business leaders talk at schools and give plant or site visits. These are relatively easy for business to do. However, with such brief exposure students may not have the context to understand what they are hearing and seeing and connect it to their own future. Thus, they may get very little out of such activities unless schools follow up in some manner. Having business and community leaders serve as expert resources for students to interview for student projects is a more intense partnership that is also fairly easy for both school and business. A next stage would be to have students work at school on projects suggested by business or community parties. In this situation the business or community organization would provide advice and mentoring, perhaps host students on site from time to time gathering information or evaluating alternatives, and would evaluate the success of the effort. Students might also take internships where they work on an internal company project part-time or over the summer. The final level of partnership would be where students take primary charge of a project for a company at the company site.

It remains the role of the teachers to guide and connect students with the right experiences and challenges for their stage of development and future needs. However, the rich range of outside partner experiences suggested above can be one of the most valuable learning tools to prepare students for the innovation economy.

Practical Transformation Approach

The previous discussion shows there are many things to consider when planning a transformation for an established school district. There are steps that individual teachers can take within their

own classrooms, especially with appropriate leadership support. Examples include more work in teams and getting students to ask more questions. This will create a "better" education experience. However, those changes will inevitably fall short of preparing graduates for today's world as long as the traditional compliant, teacher-focused culture persists. Students who are conditioned to look to the teacher for all answers and direction will simply not engage their thinking capacity for independent problem solving, and teachers who continue to believe they must direct how, when, and what is learned will not give students sufficient room to practice independent thinking.

My own experience demonstrates both the enormous power and the overwhelming challenges of implementing this new paradigm of education. My first experience was with a one week summer entrepreneurship program for high school students. This program was established by a successful entrepreneur, and taught at a beautiful corporate retreat setting he owned. His approach was to forgo traditional academic tools such as business plans and instead get kids thinking about what they love and how that might solve a problem for someone. Of course, kids were initially very uncomfortable. They wanted to be told what to do, and we responded by asking them what they wanted to do. Some of the best students wanted to quit. With some thinking exercises and particularly support to explore the fringes of their thinking and experience, the kids started to trust us and themselves. Within a few days they were evaluating and planning very ambitious initiatives from their own interests and experience. Students from wildly different backgrounds discovered common interests and began working together. We brought in successful business leaders, particularly entrepreneurs, but not to talk about their accomplishments. The entrepreneurs sat down with individual student teams, listened to what the teams were thinking, and asked good questions. These leaders found it stimulating to engage in some very creative development ideas, and they were charmed by the enthusiasm of the students and impressed by the students' work. The students could not believe such successful people would spend time "helping me with my company." By the end of the week, each team made a formal presentation of their business or community initiative. While one could generally find weaknesses, the quality of the work was off the charts, especially for high school students with no relevant background. The students engaged essentially as peers with the distinguished review panel on sophisticated challenges and issues regarding their proposals. I have judged a fair number of high school entrepreneurship classes, but I had never seen this kind of work. I still recall when one of the most respected and successful business leaders in the region challenged one student team on the viability of their business model, and they respectfully replied with extensive data and insight on the particular industry that strongly supported their position. We learned to never underestimate what students can do.

Wanting to carry our experience into a more traditional school environment, after a lot of effort I found a charter school founder willing to give it a try. The school carved out one period three days a week in the high school for student-directed project experiences leading to a capstone project. I prepped the regular teachers, and then I co-led the special classes. I followed practices I had honed very successfully in the summer program and other activities to drive student ownership for this learning. The students selected and researched their own ideas for projects, formed their own teams, and worked through the task and scope of their initiatives. I and the regular teachers provided support and encouragement, but no answers—in true student-directed PBL form. Over time, the students learned valuable skills in basic teaming and project

management, for example. Many of the students eventually experienced that blossoming where they start to believe in themselves in ways they had not before. All of the students felt the experience was very helpful in the end, and the school was very impressed with what their students accomplished. The reviewers from the community noted that these student projects were much more impressive than the capstone projects at other local schools.

Despite what others said and the clear benefits to the students, I noticed that this experience fell way short of that in the summer program. Changes in student confidence and engagement I had regularly seen after 2-3 days in my summer program took more than a year to emerge in this school environment. Further, many students never took full ownership. In fact, many backed off of complex issues as they continued work in the following year when I was much less involved. For example, instead of finding a unique solution to the homeless problem, their original idea, one team instead settled for a project that raised money for a local homeless organization. I could easily discern that students kept being pulled back into the compliant, follow-the-teacher culture that still dominated the school everywhere outside the special project periods. "How will this affect my grade?" was still commonly heard. Seeing students struggle with complex issues, the regular teachers could not resist suggesting simplified solutions (such as fundraising), and the students readily accepted the suggestions. After all, those same teachers were pressing the students very hard in their other classes to make the grade to graduate and do well on their SAT exams.

This capstone project activity continues at that school. The students gain experiences they would not get in any other local school, including teaming and project management. They get out of the classroom and engage with adults in the community. They give formal presentations to community leaders, and this helps to develop their confidence. Nevertheless, they are not being fully prepared for today's economy because the deeper thinking and problem solving experiences are missing. Further, I rarely see the full power of engagement and drive that comes with students owning all of their learning, as we regularly observed in the summer program. Instead, students scramble to get an acceptable product at the last minute, as with everything else they do in school. This experience reinforces the importance of the proper learning culture and assessments and educator reinforcement for Deeper Learning to take hold. I now realize we were trying to pull the students in two directions at once, both toward self direction in their projects but compliance in everything else. The dominant culture clearly won.

I think this experiment could have been much more effective if it were clearly perceived as the first step in a full transformation for the school. While beginning as a capstone project outside the regular classes, the rest of the learning would shift to this approach over time. Staff not directly involved would need to be regularly informed and know that they will be making a similar transformation in the future. The other teachers at the school would need to acknowledge that they are still "teaching answers" and begin to make small changes toward Deeper Learning. In my case, this experiment was helped by recognition as a strongly backed initiative of the school founder and leader. However, it was undermined when everyone and everything else around it continued with the compliant, teacher-directed approach. This retained the old culture and led the students to also resist the deeper changes. Fortunately, the culture in this school is very supportive of students being successful learners, but not of students owning their learning.

This experience strongly reinforced for me the need to execute sufficient change to instill the paradigm shift in thinking and culture toward student direction discussed earlier. As I mentioned above, that seems to be the tipping point between schools that remain traditional in feel and outcomes and those that reap the engagement and transformation of students associated with Deeper Learning. However, I saw how hard it is for an existing school to make those kinds of changes, even with strong, devoted leadership. For that reason, I believe the best approach for an existing district is to begin with a three-part effort that (1) focuses on getting clear agreement around a mission and goals, (2) supports interested educators and schools to make even modest changes in the new direction, and (3) implements a focused pilot that drives a fully formed Deeper Learning environment within a controlled group of students. The first part creates the agreement that everyone can use to guide both individual classroom efforts and a growing number of focused pilots leading to a full transformation and a new culture of learning. It provides new ways to assess progress that are critical to shift efforts in the new direction. The second part reinforces the commitment to eventual transformation of the entire district by supporting interested educators to take preliminary steps matching the new goals. The third part provides an internal test case and model for what is required and what it looks like to implement the full paradigm shift within the specific district with its own history and past practices. The later is important because districts that attempt only incremental changes never seem to get close to the full transformation. Once you have a well understood set of common goals and a model that has successfully worked through all the internal barriers even on a small scale, a phased plan can be developed to spread that model at a realistic pace throughout the entire district.

(1) Mission/Goals Development

The first transformation step derives from the importance of knowing where we want to go. As discussed earlier, people are very unlikely to make any kind of disruptive change unless they have a goal or target that is inspirational and clearly understood. The action is to create a special task force with representation from school administration, school teachers, business leaders, students, and any other important local constituencies. The task force should meet for an extended time period to discuss and agree on where you want to go. That likely starts by looking at what has changed in the community and the world, where are future opportunities, and what skills, content, habits of mind, perspectives, etc. are needed to access those opportunities. You will want to then talk about the role of education in meeting the needs, and set broad goals for education and perhaps other entities. You will also want to address equity issues and include goals such as bringing out the best in every student. In the past, communities looked to schools only for academics, and other community and extracurricular organizations and programs addressed related needs. However, if you are going to make the effort to reinvent schools, it makes sense to try to integrate any and all needs that really apply to all students within the new education design. Remember, you are not looking to simply delineate problems. Rather, focus on what the community really needs from education to fulfill its role, assuming there are no constraints. You want a bold vision that will drive deep change.

Most will want to work through a mission, key goals, and even specific skills and other competencies desired in all graduates. You want these criteria to be broadly enough defined to last for years and flexible enough for teachers to adapt them for individual students as needed, while concrete and specific enough to guide individual day-to-day actions. Ideally, you want

educators to feel comfortable trying things they know are consistent with the goals without needing to get approval first. The skills will likely include the Deeper Learning Skills noted earlier, but also expand on them and what they mean to you. The goals and skills should be discussed in sufficient detail for all task force members to grasp what is really meant and arrive at a common understanding. The results should be shared with a wide range of community leaders and institutions for their endorsement, and formerly adopted by the school board or other governing body. Often, the task force will present the results in some kind of graphic format or other presentation document that is easy to communicate to these broader constituencies.

This exercise is not as easy as it may seem because most people have only limited awareness of the breadth and depth of changes in the world, how they impact job opportunities and skills, and what can be learned in today's environment. This is why it is best done with a diverse task force that takes time to hear each other and investigate what leading schools are doing. Business leaders will have a good feel for their current needs, but may take some effort to expand those needs more broadly and define them in terms that are easily shared and understood by educators. Educators speak a different language, and they are largely isolated from what is happening in business. They may not fully realize that basic academic skills are no longer adequate for career success, and much of what has traditionally been taught will rarely come up in a future career. Educators may have difficulty thinking beyond their subject. Nevertheless, when asked, most will identify modern attributes and skills important for their students based on what they hear and perceive about what is happening in the community.

Today's business world is in the midst of a serious transformation impacting jobs, skills, expectations, etc. in significant ways. While few feel comfortable with where those changes are taking us, they are generally aware of the impacts. For this effort, then, you want to focus not on specific job openings in current demand, as policy makers have traditionally done, but best projections of what kind of education is needed to prepare graduates for the broad range of jobs expected when they graduate and beyond. Remember, we are preparing graduates for jobs that do not exist today. Don't discount input from students, whose perspective on whether and how education connects with their own interests adds an important dimension.

There are several tools that can help the task force work through the complex, multidimensional issues. The recent movie *Most Likely to Succeed* (mltsfilm.org), for example, does a great job of laying out how the world has changed, and it includes extensive scenes from Deeper Learning school High Tech High as one example of how education can change to address today's education needs. It even points out the concerns of parents about a radically different education for their kids. There is also a book of the same name by the same team of Tony Wagner and Ted Dintersmith. EdLeader21 (edleader21.org), the learning network mentioned earlier, helps school districts with this kind of visioning activity, and has a book and other materials that provide further guidance. In particular, there is value in reviewing missions and goals some of the EdLeader21 schools have already developed to help frame your process.

This mission and goal-setting action gives the school district and the whole community a benchmark or target that can be used to develop specific solutions and measure progress. Educators may not appreciate that role because they are accustomed to having detailed curricula and pacing guides that spell out what is taught in detail. However, the transformed school needs

to be more of an innovative organization. Innovative organizations must adapt over time to changing needs as well as adjust to individual student needs on a day-to-day basis. They do this by having a high level framework that keeps the organization aligned but provides great flexibility for teachers to constantly adapt as required within that broad framework. This mission/goals process provides that high level framework. If you choose to set goals to achieve a certain transformation in 5 years, for example, it will be easy to track progress and also to adjust efforts that are not making adequate progress.

(2) Individual Classroom Initiatives

Once the mission/goals are completed and adopted, teachers can start to make changes consistent with the goals in their own classrooms. However, it will likely be challenging to initiate broad scale change actions. In the beginning only a few pioneer teachers might be willing to engage. If the district supports those educators, more will be drawn in as the pioneers achieve success. For that reason, there is value in offering professional development more widely across the district. This can be offered on a voluntary basis to start, with plans to expand across the entire staff over time.

This action serves to reinforce where the district is going. Different initiatives can be tracked and publicized. In fact, there is value in having the school board, for example, regularly review progress in a very public manner, and perhaps having a newsletter that shares successes. Management attention reinforces that this is where the district is going. You want to empower your leaders as much as possible. You also want all staff to get on board and prepare for a full transformation within a reasonable number of years. Clear goals keep all that activity aligned with what the district wants to accomplish without the need for bureaucratic committees that study issues to death and impose solutions from on high. As much as possible create opportunities for individual principals and teachers to take actions aligned with the goals without bureaucratic interference and permissions. Many will resist the change, including those with a big stake in the traditional system. You want to disempower their resistance as much as possible, and empower the supporters and pioneers.

Full culture change takes a long time. This action step begins that change early before it affects too many people's job roles and responsibilities too much, making time for the adjustment.

(3) Pilot to Demonstrate Full Transformation

The third practical transformation step derives from the need for a complete shift in the learning environment to achieve the value of Deeper Learning. The great majority of schools I have seen are missing this step, and they never seem to get to the tipping point. The nature of school districts, as government agencies easily swayed by politics and with influential players including teacher unions, makes them very resistant to change. Even parents provide obstacles because they tend to expect today's education to look like the education they received. These factors make it almost impossible to shift an entire district at the same time. For that reason, it takes more than just empowering a few pioneering teachers to drive the depth of change required. Even with inspirational goals and strong leadership support, there will still be a large combination of active resistance and just inertia.

The need for a complete paradigm shift really exaggerates the challenge. Educators will have a hard time understanding how radical changes will affect their role, so they will naturally be afraid of change they do not understand and control. Incremental advances tend to be modified or watered down upon implementation to not disrupt the environment where people are already comfortable, so the paradigm shift with multiple self-reinforcing components is never achieved.

I have studied a number of districts that have tried to roll out individual improvements one at a time across the district. While this usually makes education "better," I have not seen a single example that has even come close to the threshold of Deeper Learning with this approach. The best way to overcome the fear and resistance is to demonstrate success with the full paradigm even on a small scale within the existing school environment accomplished by teachers already there who are known within the district. The results and impacts on students will be overwhelmingly positive, and the teachers involved will feel better about their role than ever before. This undermines the naysayers and provides an understanding of what other teachers can expect when they make a similar transformation—both the good and challenges. As already mentioned, the positive transformation in students achieved by this new education approach, as demonstrated by the pioneering Deeper Learning schools and others, is powerfully rewarding to teachers. They truly see a big difference in their students' lives. Such successes should therefore provide strong incentives for other educators to get on board so they can achieve the same benefits. Just clarifying questions about what this will all look like and how it will change education and the role of teachers can make more educators willing to try it.

A few districts have chosen to create an alternative school within the district that is designed from the ground up to incorporate key Deeper Learning elements. I have thought that would be a good approach since you have freedom to create the model school without legacy barriers and with its own culture while planting a working model within the district for all to observe. One such school I visited, Manor New Tech High near Austin, Texas, is very successful as a model within its district. In this case, however, despite the model school's success, Manor has not been able to drive transformation across the rest of their district. It seems too easy for other district educators to believe that Manor succeeds because of special circumstances that will not work in the traditional schools. It may also be that the district leadership is not adequate to propagate the changes. For those reasons, while a model school might be a good option for some districts, I now believe a better approach is to initiate a small pilot within an existing district school if such an initiative can be given sufficient isolation to achieve the cultural and related changes.

The pilot can incorporate perhaps one grade in a medium-sized school or a team or academy grouping of about 100 students in a large school. You want enough students to justify a dedicated team of 4-5 teachers who collaborate within the pilot following the principles of Deeper Learning. Even with this small group it is probably best to introduce Deeper Learning in parallel with continued traditional approaches for a time. Perhaps the students begin by doing one multidisciplinary project while continuing most of their traditional learning. Following that, more of the curriculum is gradually shifted to a full Deeper Learning approach in stages as rapidly as the teachers and students are ready. A robust implementation should be reached in a semester or a year at the most. The teacher team, along with their principal, will need to work through all kinds of barriers as they arise. Thus, it is critical to select participants who are

enthusiastic and comfortable in a dynamic entrepreneurial environment. Most important, they should believe that students can take charge of their learning and be ready to try, fail, and adapt along the way. Leadership from the principal is very important, as is full support from higher administration. Once the path to success is realized, it can become the model for future groups.

Strong professional development for all pilot participants is critical. Beware of training from the local university or similar source whose instructors may have studied 21st Century approaches or project-based learning but lack serious Deeper Learning experience. There is too much to understand about not just the theoretical principles but also the on-the-ground experience and culture. Because of the major paradigm shift, I believe in addition you should have a lead teacher or mentor on the pilot team who has some serious experience with Deeper Learning. The teachers in the pilot will constantly run into situations new to them which can undermine their confidence in continuing. Having someone with experience readily available to reinforce their actions and help them understand new challenges and experiences can make a big difference. This could be someone with the appropriate experience brought in to play that role, although you again must be careful because, for example, there are many educators who believe they are practicing PBL when they are really just doing projects. This could also be accomplished by registering one of the teacher team to take an intern-like experience at one of the existing Deeper Learning schools, and then return to assist his or her home district.

Finally, it is very important that the pilot be seen not as an isolated experiment but as the first step in a full district transformation. That is a key reason for the other two steps of mission/goals development and individual initiatives. District personnel will assume an isolated experiment reflects hesitation or lack of support by top leadership, which will empower them to ignore it and even try to undermine it. However, if it represents the first stage of a larger transformation effort to come, the other school personnel will follow it closely for guidance and understanding. Further, teachers with a strong commitment to students will likely try some smaller changes they discern from the pilot, which helps prepare more people to participate in the transformation at a later time. Incorporating regular sharing of progress and professional development for other faculty will begin to shift the culture and thinking toward a Deeper Learning paradigm.

A successful pilot achieved within a district school lays the groundwork for a larger rollout. Next steps will be to expand the pilot perhaps to more students in the same school and/or small groups in additional schools. Each district will need to evaluate what is learned from the early pilots and the challenges encountered to determine what kind of rollout fits the needs and readiness of that district.

Final Thoughts

Given all the controversy, concern, and lack of progress within public education for such a long time, it is easy to conclude that the challenges of bringing education into the innovation age defy any solution we could afford. I have concluded, however, that the big issue is that we have been focused on the wrong problem or task. The issue is not that education is broken, but that the world has changed and we need a new education system for the new times. No amount of effort to fix or improve the traditional system developed more than 120 years ago for a mass production economy will ever bring it to satisfy the needs of today's innovation economy.

However, a different model for learning that fully addresses today's needs is pretty well known, has been backed up by research, and has even been demonstrated successfully among a few pioneering schools and networks of schools. Our challenge is to transform the deeply entrenched system we have today using the proven Deeper Learning model.

Of course, the new model is less a specific recipe than a set of principles to guide implementations tailored to each district. Schools must change radically, with educators learning to be mentors of learning rather than teachers and credentialers. The whole interaction between education and society will also need to change since the game of education to credential students by grades rather than true learning and ability is obsolete. This will require strong leadership and a lot of effort from educators. Fortunately, those few who have made the transformation unconditionally believe it is well worth the effort. Experiencing a school where students are fully engaged and direct their own learning is truly awe inspiring. Seeing what they accomplish and how they blossom as they learn about themselves and hone their strengths and skills is rewarding. When all students achieve this our country will be a long way toward providing equity of opportunity for all. A country where essentially all students are prepared to access the new American dream will once again become the undisputed global leader.

I welcome comments and questions from anyone related to what I believe needs to be our highest priority agenda item. We must get this right.