# Georgia Institute of Technology
# It's a Changing World: Will Higher Education Be Prepared?
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**October 7, 2009**—Good evening. It is great to be among so many engineers and colleagues. I have been asked to talk about where I think we, as educational institutions, should be going in the next decade. This is a formidable challenge to say the least.

Throughout history of technological education in the United States there have been a number of very important events or important times, starting perhaps with the Morrell Act in 1862, which established the Land-Grant Institutions, which became the birthplace of some of the finest engineering schools in the country. This was followed by the GI Bill, which provided an opportunity for millions of Veterans to come back and be educated in technological fields and significantly strengthened the technological position of the country. Then later, beyond that Sputnik, which, I like many of you in the audience benefited from. While the current situation and status of higher education in this country may not quite rise to this level of significance, today is a very, very important time in terms of education and especially in terms of technological education.

Today, in China if you are 1 in a 1,000,000 there are 1300 that are just like you. In India that is 1100. The number of people in the top 25% in terms of I.Q. in China is greater than the number of people in North America and if you translate that into an educational perspective that means that there are more honor students in China than there are students in North America. So, our task is to determine exactly what we need to do in education today that is meaningful and can be effective and globally competitive. We have to develop educational systems and methodologies that can put us a path forward so that we can retain the technological leadership that we currently hold. I think many of you recognize that for as long as we can remember the U. S. has been blessed with the best higher education system in the world and I believe that today we still have the best higher education system in the world. But the gap in narrowing and narrowing very quickly and very significantly.

In the past we have recruited students internationally and aggressively from other countries. In fact the technological leadership position that the U. S. holds today is due in large part to the intellectual capital that we have been able to import. The students that have come here to study have been some of finest students and brightest minds from their home countries. They have studied and been educated at our finest institutions and have decided to stay. It is not happening today because the standards of living in many of the other countries have reached the point where people want to go back. They want to go back to their home country and try to improve things. It is happening because of the difficulties that we have imposed upon ourselves following 9/11 with visas, the ability for students to gain entry to the United States to study and it is happening for a whole host of other reasons. Other countries have taken advantage of this. They have improved their educational system and they have improved their efforts to keep the very best and brightest students at home in the countries of their birth. In addition to these enrollment challenges, we are facing a number of harsh realities in terms of funding. In order to survive, our research universities must attract hundreds of millions of dollars of research funding each year.

We used to think that our state universities and the land-grant institutions were as public institutions, "state funded." Then as funding decreased, they were "state supported" and now we are at a point where they are rapidly becoming "state located." We are going to have to develop new funding models, ways that we can fund higher education particularly in the technical fields. The work of our national comprehensive research universities is closely linked to the technological and economic success of the communities and states in which they exist. About 15 years ago Richard Florida, an economist and urban theorist at Carnegie Mellon University at the time, wrote a book called, "Rise of the Creative Class" and he tried to identify those things and those characteristics that distinguish communities, intellectual communities that were advancing rapidly, places like Austin, Boston, and San Francisco. He identified those characteristics and the book received a great deal of press. He later updated that concept and published an article in the *Atlantic Monthly* and he looked at the migration of intellectual capital to various places in the country. The economic well being of regions studied is entirely consistent with the education level. When you look at the economic factors and the percent change and the mean housing value as measures of economic prosperity, it is entirely consistent with the migration of the human capital. The physical proximity of talented, highly educated people has a powerful effect on innovation and economic growth.

All of us in the room I think recognize that the universities make tremendous contributions to the region, to the state, to the nation and to the development of the human capital and the research that is performed there. As Richard Florida stated in his book or in his recent article in the *Atlantic Monthly* "accommodating the snowball effect of talent attraction will be one of great political and cultural challenges of the next revolution and that will depend upon the educational opportunities that exist in those regions and how we are able to impact those educational opportunities."

Clearly the presence of research universities has a tremendous impact on the technological growth and that technological growth and economic well being is shifting rapidly throughout different regions of the country. In addition to providing a world-class education for students, Georgia Tech has more than $525 million in annual research expenditures, and that doesn't count the new stimulus money. The Institute consistently ranks among the top ten nationally among research programs without a medical school. Our annual economic impact on the state has been conservatively estimated at more than $2 billion. We are an economic engine for Georgia. We have produced more than 300 invention disclosures annually. We are one of the state's top patent producers, and spin off an average of ten new companies a year. In the past year, Georgia Tech programs for existing industries assisted more than 3,000 Georgia companies, saving or creating 20,000 jobs.

The amount of technical information is doubling about every two years. It is estimated that a week's work at the New York Times contains more information than a person in the 18th Century would encounter in their entire lifetime and the thought is that within 10 years that the rate of information doubling will occur every 72 hours. When you think about that and you try to put that in terms, what it means to us as educators is that perhaps half of what we teach freshmen this year will be obsolete by the time they are juniors and it make you or it forces us to rethink what it is that we are trying to teach students, what it is we are trying to prepare them for.

The workforce of the future is what I think we have to focus on, how to we prepare this workforce of the future and what is it that we should actually be teaching our students. What should we be preparing them for, a very, very difficult question? Former Secretary of Education, Richard Riley said that the top 10 jobs that will be in demand in 2010 did not exist in 2004. So, what it amounts to is that we are currently preparing students for jobs that do not yet exist using technologies that have not been invented in order to solve problems that we do not realize are problems. An

enormous challenge for us as educators in terms of what we want to do, what we need to do and what we think we need to do.

We know that the workforce of the future will be more mobile, that it will be more visual and that it certainly be more technologically driven. How much so, will depend upon the technological tools that we are able to develop, the classroom adaptations that will improve the way we educate students, and improve the ways in which we understand how they learn. The workforce, as I mentioned will be much more mobile. Interesting statistics from the Department of Labor estimate that students graduating today will hold between 10 and 14 jobs before they are 38. One out of four workers in today's market is in a job that they have held for less than five years and more than half of the workers today are working for a company that they have worked for less than three years. This is very different from what you and I grew up with. With these changes, just try to imagine, try to visualize what those statistics might look like 10, 20 or 30 years from now, it is really quite startling.

Clearly our ability to adapt to this changing environment will depend upon how well we can incorporate the necessary curriculum changes. Certainly our universities will have to be more agile, they will have to be more responsive, more nimble, more flexible and resourceful. They will need to review and refine their curricula and it will require that we develop structures that support the hiring and evaluation of faculty that are engaged in interdisciplinary research. Interdisciplinary as distinguished from multidisciplinary—multidisciplinary research is when you bring people from different fields together, they work on a problem and then they go back to their respective fields, their original disciplines. Interdisciplinary research is when you bring people from different fields together and they come together and they create new areas of research and new fields of study and new fields of investigation.

Investing in traditional fields is still going to be important and I think education in these traditional fields is going to be the thing that will help carry us forward, but the one thing that will not change is the necessity that student understand the fundamental concepts that we present to them.

What is particularly difficult about this and disheartening to me is that in 2004 Nintendo spent $140 million on research. That was more than the entire U. S. federal government budget for educational research. So, we are trying to find out what the future holds for us, but we are not willing to invest in it. We must strengthen our efforts to work and interact with K-12 education. This receives a lot of lip service, but it is something that is hugely important to us. University educators need to figure out how to improve the preparation of the students and it cannot be a finger pointing exercise, where we say we just have to take the best prepared students.

There have been a number of comments that have been made about the need to have a technologically educated population, not just the engineers, the scientist and the technologist, but the people that serve in the legislature, the people that vote so that they can understand the issues. The majority of the fundamental technological education occurs in K-12 and we have to improve it.

In addition to developing these new constructs for interdisciplinary teaching and research, higher education needs to look outward to the local community, the state, the nation and the world to prepare students not only for technological careers, but to better prepare students to take personal and civic responsibility in careers that will be influenced by global forces. We need to more directly influence the financial future and organizational structures of the governing bodies that control our future and the future of our families. As mentioned previously we need to identify alternative funding structures for higher education—funding that will sustain our educational system and provide a path forward for those systems.

It has not been talked about very much today, but there are also institutional responsibilities. It is equally important that we are able to attract, develop and retain the very best faculty and staff at our universities. This something that we talk about, but it is attracts, develop and retain the highest quality faculty in this global workplace, in this global marketplace.

This is going to require that we reach out. Diversity issues are hugely important. It is important, and I wish Bill Wolf were still here, because he made a statement probably eight or ten years ago that I heard that really resonated with me. He talked about why diversity was important and he said aside from the moral imperatives associated with having a diverse workforce or diverse group of people in any particular situation it is just made good sense—without a diverse workforce you have designs that are never conceptualized, ideas that are never imagined and dreams that are never realized. Diversity is important so that we have people with different perspectives and different backgrounds bringing different perspectives to the table.

Economists talk about diversity in an interesting way. They believe that if two economists with the same economic philosophy come together for an hour, the potential value of that discussion is very small. However, if you have two economists with two different perspectives, with very different backgrounds, very different life experiences and you bring them together, the potential value of that interaction is very large and potentially beneficial to both.

One thing that just amazes me today is this Google digital library project. I do not know how much you have heard about this, but as the rise of the internet has seen a flattening of the world in terms of dissemination of best practices—the remarkable growth and entrepreneurship from Bangalore to Bangkok—so too will the digitization of the collective intelligence of the human race. In December of 2004, Google undertook an effort to try to digitize all the written English works, more than 32 million volumes—and put it in a searchable data base that students who are freshmen today will have at their fingertips when they graduate. Google is investing $800 million, and they are now working on books in other languages. Our challenge will be to help students take that tremendous amount of information and turn it into knowledge, because there is a difference.

It really raises, what I think is a very important question, what is it that will differentiate our students, our graduates from the college graduates in the rest of the world? In the 1950s we lost the steel industry off shore. We said that is OK, we have got automobile manufacturing and everybody knows what happened to automobile manufacturing. We said, that is OK, we have got electronics manufacturing and then it went off shore. Well, we manufacture chips, and that too is now gone. What is it that is going to differentiate our students from the hundreds of thousands of students that are graduating around the world? That is the big challenge for us. I suspect that many of you, like me, think that is the ability to work in teams, it is the idea that we have students that have great leadership capabilities, it is the idea that we have students that are very innovative, but if that is what is going to differentiate our students then that is what we need to focus on in terms of their education. Our graduates must be prepared for an unpredictable world, because as hard as we try, we are not going to be able to understand what it is that they are going to be faced with in their lifetimes.

I think back to my youngest son, who holds a master's degree in mechanical engineering from Rensselaer Polytechnic Institute. When he went to a new elementary school, we went to "Back to School Night" for this elementary school and went into the library, no card catalog, it was all computerized and this was for kindergartners, first graders, no card catalog, all digitized. He is now 26. This was a long time ago. One of the parents said, how will they ever know how to find books if they do not learn how to use the Dewy Decimal System and the card catalog? It reminds me of a discussion among several faculty when I was an undergraduate at Kansas State, probably my junior year when the faculty were talking about whether or not they were going to allow us to use calculators on exams. One of the faculty members stood up and said "if we let them use

calculators and they do not have to use slide rules they will not know about logarithms" and today, I think—so? So, it is really difficult for us to try to predict what the future holds, what type of educational environment we are going to be working in and what kind of work environment our students are going to be exposed to in the near future.

I think that it does boil down to a couple of things and this is agility, digital age literacy, global perspectives and environmental awareness. We are in a strategic planning process at Georgia Tech, what we are calling "Designing our Future," to try to envision the characteristics of a public research university 25 years from now. Why 2035? To go out that far makes it easier. People will not say, well we cannot do that. You can do anything in 25 years. If you try to do a three or five-year plan, you tend to just rearrange the deck chairs. But one of the things that was startling to us as we tried to lay the groundwork for this process was to try to understand what the world will be like in 20 or 25 years.

As the amount of information continues to increase, perhaps one of the most important things that we can impart to our students is to ensure that we allow them to have "flights of imagination." It is tremendously important that we not stifle our students, our graduates, or diminish in any way their ability to dream. We in technical and scientific areas have a tendency to try to be very structured in the approaches that we take to education and sometimes I am concerned that we educate the creativity right out of our students. We have to be careful about this, particularly as what we feel we must teach our students increases so rapidly.

And finally, we have to make sure that all of the students, not just those in technical fields are not afraid of technology, to make sure that we as the educators do not allow technology to go the same way that math has gone. Today it is socially acceptable for people to say, "I am not good at math." And everybody says, "That's OK, I understand." We cannot allow that to happen with technology. We cannot allow our young people to graduate from high school or graduate from our universities and say, "I am no good at technology" and have people accept that at its face value.

Many people have asked me why I decided to come to Georgia Tech. My answer is that I believe that if the most pressing problems that society faces today and will face tomorrow are to be solved, including energy, healthcare, water and sustainability, they will be solved at places like Georgia Tech. We are committed to equipping students with the educational background and problem solving and leadership skills needed for our rapidly changing world.

Thank you very much for inviting me here this evening.