Innovation and Education

DR. CURTIS R. CARLSON

Founder and CEO, Practice of Innovation

Former President and CEO, SRI International

The President's Distinguished Lecture Series • Stevens Institute of Technology

October 5, 2016

Well, thank you for that generous introduction. I must say, what an honor to be here at this great university — and particularly on a day like this. Is there a university in the world that has a better view in a more unique spot in the world? I don't think so. This is spectacular. We spent the day talking to many of the professors and staff here who are transforming this university to make it an even more valuable place for students and for society. It's inspiring to be around people like this, who are dedicating their lives to both understanding the world, and also creating the kind of students and graduates that we need so they can thrive throughout their careers, not just for a few years after they graduate. A lifetime of learning, a lifetime experience, the right kind of skills. So my congratulations to all of you who are involved in that — it's just been a terrific day.

I want to talk to you today about innovation and education, both of those, but also how they come together — and I hope I can communicate a few basic ideas to you. I come from SRI. I dare say, every day you use something from SRI, whether it's the computer mouse, Windows, hypertext, high-definition television. My teams have won two Emmys. Siri on the iPhone, Nuance if you talk to a computer almost every day, and the ideas I'm going to describe today are how we did it. It's not magic; it's a series of fundamental ideas that we applied rigorously and that made all the

A video of Dr. Curtis R. Carlson's lecture, which includes his slide presentation, is available at **stevens.edu/lecture.**

difference. So I'm going to talk to you about, today, how I think this is the best time in the history of the world to do what we're doing. But performance is not so good. Success requires a rigorous adherence to some fundamentals I'm going to tell you about, and why students need the kind of education they're getting here at Stevens — skills and value creation — and both are mastered through project-based or team-based education. It's one thing to learn the fundamentals, but you also have to learn how to apply them, if you're going to be effective in today's world.

So what's the critical importance of innovation? Well, it's the only path to prosperity, jobs, environmental sustainability, social responsibility and national security. It's the only path. It's responsible for about 80 percent of that. So what's going on here is really fundamental to the future of the nation. There are many bad ideas. Here's one that people often say in Silicon Valley: Fail fast to succeed early. Fail fast. Who here wants to fail fast? Anybody want to fail fast? I don't think so, right? That's a really terrible idea. The goal of innovation is to learn fast. Innovation is about learning fast — not failing fast — and as soon as you say learning, it changes how you think about the education, innovation and the kind of skills you need in today's world to be successful. There are a number of what I call learning amplifiers if you want people to learn fast and be effective. The first is doing — you have to do it. The second is real-time feedback. A third is multiple representations, because we all learn in different ways. A fourth is doing this in teams to get the genius of your colleagues. Another is mentors — not just a teacher, a mentor. A mentor is a different kind of support and learning teacher. Great human values: Working in teams means you must have respect and integrity, or else people won't work with you.

> "Innovation is about learning fast — not failing fast — and as soon as you say learning, it changes how you think about the education, innovation and the kind of skills you need in today's world to be successful."

You have to have the right incentives, so it's positive, it's a win-win for everybody. You need to have certain tools and concepts and frameworks, so you can think about what direction to go in. You need to focus on the big ideas — don't get lost in the little cul-de-sacs that people often do. And you need a way to assess performance in real time. What we've learned is if you pull these ingredients together into a complete system, the results can be really remarkable, and I'm going to give you some examples of that. And again, that requires an experiential, or a team-based, project-based education. What would I call the global innovation economy? That's a picture of Moore's law for computers. Right now, the fastest computers go at about the rate of a mouse, so we're kind of in the mouse age right now, but in 20 or 30 years, we'll have computers that go faster than the human brain.

So we're about to enter a really profoundly different era, and it's already begun. There's exponential progress, not only in computers, but in just about every major IT technology. There's intense competition, there are new business models, and there are endless opportunities. You know, in

the old days, you attacked companies either from the top or the bottom. So Tesla's attacking the automobile business from the top, with expensive cars, toys for rich people, right? But now they're producing lower-cost cars so they can go after the main automobile industry. That's kind of the traditional approach. But you also know what's going on with Uber attacking the taxi industry from the side. And what can the taxi industry do? Could they have invented Uber? I don't think so, and this is happening in just about every area. It's happening in financial services, it's going to happen in education, it's going to happen everywhere, where all of a sudden, these IT technologies come together that allow unprecedented changes in how we do things.

I mentioned that it's the best time ever. I'm not going to go through this chart, but if you take any major area of technology, whether it be next-generation internet, nano, satellite technology, digital education — every major field is now in transition. Every field. How many billion-dollar opportunities do you think there are in the next 10 or 20 years? Do you think it's one? Ten? Hundreds? It's probably thousands around the world. This, if you're involved in technology and you have the skills we're going to talk about, this is the best time ever. The best time ever, but it's also a challenging time. This chart shows the formation of new companies and how quickly they go away. The formation of new companies used to be the advantage of America, but for the first time, more companies are now going away than being born. We're not doing a good enough job. This shows what's happening to middle-class incomes. They've been going down for 25 years. We're not doing a good enough job. We have things like the sharing economy, that's like Uber with the taxicab folks. There's less job security for those people, and if you think it's going to slow down, I don't think so.

Just imagine: In China, a million people a week move from the countryside into the cities. So every year, three or four cities the size of New York City are being born in China, and they're going to be competing with us and everybody else in the world. The competition has just begun, and, of course, automation is everywhere. You all know about driverless cars, robotic manufacturing, service robots and personal assistants. So we did Siri — that was the first big personal assistant — but now, there are going to be personal assistants in all kinds of things, financial services and other areas that are going to transform, bit by bit, the service industry as well as the other industries that we're familiar with.

What's happening to big companies — well, big companies are dying faster than ever. This is an interesting curve. It shows the lifetime of the top 500 companies in the world. And two things I want you to notice. First are these big ups and downs where companies either last longer or go away faster. Those are the business cycles, and it's amazing how periodic they are. But at the turn of the century, 100 to 120 years ago, big companies would last for 100 years before they went away. Today, it's down to 15 years or less. I just read a report the other day, on the average it's 10 years now. Those big companies are basically like dinosaurs — they can't adapt fast enough to the ecosystem to survive. Think of Kodak, they went from number one to out of business in 10 years. Motorola pioneered some of the earliest smart phones. They sold that company to Google, and then that was sold to China. And Nokia's kind of the poster child for what not to do. They

went from number one to out of business in seven years. Imagine that. They had brilliant people, all the technology in the world, great partnerships, name brand, they had everything except for one thing: They couldn't innovate fast enough to keep up, in this case, with Steve Jobs. He knew how to innovate, and they had a very limited understanding of innovation. In fact, innovation is a mystery to most people. Every leader at least gives lip service to the idea that the world is moving faster and we need to do a better job in innovation, but if you go into an enterprise and ask them to describe their innovation system, you get blank looks — they have none.

That's the test. When any of you go into a company, ask a middle-level manager to describe the innovation system. If they can't describe it, they don't have one, because those are the people who are supposed to make it happen, and I've been in hundreds and hundreds of companies, and the number who can actually answer this question is on one hand. It's amazing. Everybody knows it, but very few people do it. One of the things I've been working on is programs for the National Science Foundation, and the NRF is the equivalent in Singapore, and these large government programs need to be significantly improved. They were great 50 years ago and during the industrial era; they're not keeping up today. They don't use what I call best practices. They really don't fully address the big opportunities that they're given. They don't have what I call a value creation playbook — think of it as a syllabus of what to do if you're in the education world — and they don't collaborate. They say they collaborate, but the truth is they really don't collaborate with the kind of passionate intensity that's required today.

If you're not meeting almost every day or every week, you're not collaborating today — you're playing around, and very few of these programs build in that kind of intense collaborative process. I've done workshops with centers both here and Singapore, so I've seen this firsthand. They say they collaborate intensely, but the truth is, they really don't. And what I'd like to say is that in the global innovation economy that moves so fast and is so competitive, this is no longer acceptable. We have to do a profoundly better job if we're going to create the jobs and the prosperity we need. I wrote a book about this called The Five Disciplines of Innovation. I'm not going to spend a lot of time on this. I'm going to tell you a few things that are important customer market needs. If you're not working on important things, you can't expect to get important results. I'm going to tell you a little bit about what value creation means. At SRI, we celebrate champions — those are people who have these skills, who are passionate and committed. It'll make sure that they're successful. How do you put together the best teams? Not just good teams, the best teams? If you don't put together the best team and there's a team in China that does have the best people, who's going to win?

It's a flat world, as Tom Friedman said: Everybody knows what's going on, and we're now competing with everybody. And organizational alignment: How do you create an organization that amplifies the ability to innovate and doesn't attenuate it? This is a big issue in universities. There are barriers to some of the things that we'd like to do, and the people here at Stevens and other places are working to remove those barriers so we can be more successful. We've learned the hard way that if we violate these principles, we don't have success.

So what is innovation? You probably have all heard this expression, 'Build a better mouse trap and the world will beat a path to your door.' Well, there've been 6,000 mouse trap patents and really, only two have had success. It's amazing. It's probably been more wasted effort placed on building new ideas for mouse traps. So they were good enough to get a patent, but nobody wanted it, so they're not innovation. They might be clever, they might be creative, they got a patent, but nobody wants it. So what is innovation?

Creativity is something original and imaginative — your child brings home a pretty picture. Invention is something novel reduced to patent. You could patent those umbrellas, but you're probably not going to sell very many. Innovation is when we deliver new, sustainable value to society. Remember the first time you saw a ketchup bottle upside down? Did you go, 'Oh, what's this?' And then you said, 'Oh my gosh, this makes perfect sense. I don't have to pound on the ketchup bottle and spill it all over the table.' So it was surprising. Now, if you see a ketchup bottle and it's not turned upside down, you're also surprised, but now in a negative way. You're thinking, 'Oh my gosh, I have to pound on this thing — it's going to go all over the table.' So that tells you a lot about what innovations are like. First, they're always surprising. If they're not surprising, it's probably not important. Then you adapt to it and then it becomes expected. So whatever educational program Stevens puts together today, they have to create new ones for the future. Today's not good enough. You have to be preparing for the next, because people will be looking for those.

> **"How do you create an organization that amplifies the ability to innovate and doesn't attenuate it? This is a big issue in universities. There are barriers to some of the things that we'd like to do, and the people here at Stevens and other places are working to remove those barriers so we can be more successful."**

I mentioned that value creation is about learning. So this is called the product development curve, where you build value. So at the bottom of it, you do research, you try and identify important societal needs, you hope to get that out into the marketplace so people will use those ideas, and then you have to start over. And connecting important needs with new knowledge is a process. It's not an event. You don't wake up one day and create a Siri or an HDTV — it's a series of creative events and learning events to be able to solve that problem. So anything you can do to speed that up is good news; anything you can do to slow that down is bad news. Very clear, and we call that first process value creation, and as I just said, once it gets into the marketplace, that's an innovation.

So I mentioned this idea, playbook for innovation — what is a playbook? Well, it's the core concepts. I'm going to give you some. It's how you effectively collaborate. It's value creation best practices. One of the problems we have when we put multidisciplinary teams together is they have a kind of tower of babble — what does that mean? So imagine you're solving a medical

problem and you put together information technologies, a biochemist, chemist. All these different disciplines think about the world in a different way. They have different language, different concepts, and you want them to collaborate, but what's the common language? There is no common language; you have to create a common language.

So a best practice, which we're now working with the NSF and others about, is you hold a workshop on the kind of things I'm going to talk about. Get everybody in the room, working on their project together, teach them some ideas and form that common language, and the common language is for the stakeholder. So the customer or society or whoever it is — the only common language that makes sense is addressing the needs of that end group. The only common language [is the one] that makes sense for all of them. For all of them. So one of the questions is, well, what is stakeholder or customer value? It's customer benefits over customer cost, so stakeholder benefits over customer costs. Here's a trivial example: Some of you probably would prefer an apple for lunch and some a pear. In fact, some of you might pay a little bit more for an apple than a pear, or some of you would want to pay less for a pear, and the principle is this: Only you determine the value of an idea. The person who produces the apple or the pear doesn't. They have no control over that — it's what you think that matters. Benefits and costs are all perceptual. They're all perceptual. And the goal is to figure out what you need as stakeholders and find ways that are compelling to address societies' or customers' or stakeholders' needs.

> **"What we found is that most failures start at the start. At the beginning of the project. It just doesn't make any sense."**

There's a progression of value. What does that mean? Well, people work on commodities like wheat, and then there are products and there are services and experiences and emotions, and the higher up the chute you can work, the more value you have here. So at Stevens, it's not just a product, it's a great product, but there are also other services that are provided here, and they're the experiences of being in a beautiful place with great colleagues who share common values, right? And there's also higher meaning of working together to do things that are important for society. You want to be at the top of this, right? Nokia made really good, solid phones. You could drop them, you could flush it down the toilet and it would probably come out the other end and you could use it, but Steve Jobs came along and made superior products with iTunes as services, Siri as experiences, and he branded Apple as being a special place. If you bought Apple products, you were smart and you were clever, you were distinguished, and Steve Jobs created the best, most valuable company in the world when he was CEO — and Nokia went away during the same period.

He understood this. He understood the dimensions of value, and that's a challenge for universities, too, to understand the different dimensions of value that they need to present to their students and society in this world. What we found is that most failures start at the start. At the beginning of the project. It just doesn't make any sense. In fact, I've done workshops all over the world and typically, no matter what it is, a university or a company, less than 20 percent of the things they

say that have importance for their enterprise have any value at all. Eighty percent of what they're doing, nobody cares about. It wouldn't impact anybody, it would never make a difference. What are they missing? Well, they have no value proposition. Okay, well, what does that mean? What's a value proposition?

So here's the definition we used at SRI. What's the important need, the stakeholder need? What's your approach for addressing that need? The solution? And if it's a commercial thing, it's got to have a business model, some way for it to be sustainable. What are the benefits per cost, which are now recognized as the value of the idea, and how does that compare to the competition or the alternatives? NABC [Need, Approach, Benefits, Competition]? Now, you can make a value proposition as big as you want, but I would argue you can't make it smaller than this. Take one of these ingredients away and what have you got? There's no customer need, you don't know what you're doing. You don't have a solution, obviously. If you can't do something of significance, the benefits per cost when compared to the competition, nobody's going to care. Nobody's going to care. NABC. It's the simplest, most complete definition of a value proposition I believe you can use, and it's really, really powerful.

Here's the problem. Most presentations look like this. They call them big As — they're about the person's idea or their approach. So, typically, people will come in to people like me or the president and say, 'I got this idea, it's a beautiful idea. It's the most stunning idea you've ever seen in your life. I want you to take the next four hours and listen to me describe my idea,' and you're sitting there thinking, 'Okay, well, what's the need?' 'Oh, the need's obvious, don't worry. Don't worry about that. Everybody knows that there's a need for this widget.' 'Okay, what's the quantitative benefit?' 'It's going to be great. It's going to be perfect, you'll love it.' 'How about the competition?' 'There is no competition; this is unique — nobody's ever done this before.'

Now if some of you in the audience listen to presentations like I do all over the world from people who are starting new companies or academics or people in research labs, they all look like this. We call these big As — they have no value. This is why most of the waste that we see happens, because they haven't done their homework, they don't have a framework to think about the questions that have to be answered. If you take one thing away from this presentation, this is it. Everything you do in life must at least answer these four questions. At SRI we had a guy propose to his wife with an NABC value proposition. I thought that was kind of interesting, because I wanted to know what he proposed as the competition, but nevertheless, he was successful.

We use a way to speed up these processes — what we call value creation forms. These are recurring meetings that happen every two to four weeks. They're multidisciplinary. The teams get together; there are three to five teams. We only give them a short period of time, two to 10 minutes to give their value proposition. When they're done, they have to listen, they can't talk back for two reasons. One of which is if they talk back, they stop listening. This has never happened in a faculty meeting, I'm sure. Never, right? The second reason is the meeting goes on too long, and getting feedback usually is a 10 percent improvement in someone's presentation, when, typically, they

need to improve by tens of thousands of percent. So 10 percent doesn't get you there, it doesn't scale. The reason these meetings are so effective is when the person sits down, if you give them an NABC framework, for example, they can see that the questions aren't being answered. It's easy to see. So you avoid the negative stuff. On the positive side, because we hang around with over-competitive, over-stimulated, over-everything people, when they see somebody who does something really well, they want to do better than that. So their natural competitive juices kind of boot-strap them up to doing amazing things without those of us in executive positions really demanding it. They demand it of themselves.

And we teach people other things in these sessions. Here's an example that I love. That young girl has MS and today, the mobility aids that she has are really very limited. That's not a solution. If you go to various places — this often happens, if you can — they're doing a lot of robotics work. So they thought, 'Let's take a robot and let's strap it onto the person's body and that will aid their mobility.' Do you think a 25-pound system like that is something you want to put on that young child? How about an 80-year-old who has some kind of mobility problem? That's not a solution, that's a big A. That's a technical person who knows how to build robots and says, 'Oh, let's strap that onto this poor young girl.' That's not a solution. So our team said, 'Well, we have to attach it to the body somehow, how are we going to do that?' And we had a series of meetings where people were trying out different value propositions and finally, somebody said, 'What about a Chinese puzzle?' You stick your finger in and it grabs, and if you push it in just a little bit, it'll come out. Why can't we put a Chinese puzzle on each one of the person's legs, and when we sense the leg moving forward, it will tighten up, grab onto the body, and then when that leg stops moving forward, you start moving the other leg — that one then grabs. So it grabs, lets go, grabs, lets go, grabs, lets go, and that turned into this. That's a prototype of our company we just spun out and basically, it's like putting on a pair of pants, and unlike the robot, which only lasts for two hours, the power that lasts for 10 hours and you can wear it all day long.

It was an example of getting the value proposition right before you started building something. It's an example of answering those four questions before you went and built something. So with that, I have some fundamental ideas. I said our world is changing, that we need to better understand these ideas. You know, in the agrarian economy, we taught animal husbandry. In the industrial economy, we taught drafting. In the knowledge economy, programming. And these things don't go away, they just get morphed into different kinds of programs, but we're in the innovation economy, so we should be teaching people value creation. That's the skill that's needed for today. After all, what's the purpose of an engineering education? It's innovation, right? Why would you become an engineer if you don't want to do innovation? How about math, biology, chemistry and physics? Well yeah, of course, right? How about economics and business? Of course, why else would you do that? What would be the purpose? How about art, media and architecture? Of course. An architect designs new buildings to satisfy needs and hopefully does that in a really comforting, positive, new, novel way. What about social sciences and psychology? Absolutely, and what about political science? It ought to be, but how many political science professors think they're in the business of creating real value for society?

Imagine just if all the departments of the university realized this is your job. Imagine what a transformation that would make. And today, unfortunately, very few universities around the world have come to that realization. Stevens is working to do that, but we're still not there. So I want to go back to these learning amplifiers and give you a couple quick examples. These are the things that we found if we can do these things, these 10 things, we have success. These are the 10 same principles that we use in our innovation process, exactly the same ones. And the more we know we can do these 10 things, the more success we're going to have. And again, it has to be integrated into a complete solution.

"... we're in the innovation economy, so we should be teaching people value creation. That's the skill that's needed for today. After all, what's the purpose of an engineering education? It's innovation, right? Why would you become an engineer if you don't want to do innovation?"

So in many schools, we still have classes that look like this. Are they doing? No. Are they getting real-time feedback? No. Are they getting multiple representations? Maybe a couple, if the professor's really good. Are they working in teams? No. Is the teacher acting like a mentor? No. Are human values being emphasized here? No. What's the positive incentive for being there? Probably most people were trying to find a date for the weekend, right? Why else would you want to sit there? Tools and frameworks? Yes, if the teacher's really good. Focus on the big ideas? Yes, if the teacher's really good. And is there a real-time assessment system? No.

That's going to go away. That's going to go away. That is not the future of education. Because it violates the fundamental learning principles that we need for innovation, as well as for education.

Here's an example of something we've worked on at SRI. It's called Cornerstone Math. Right now, algebra, STEM technologies are one of the limiting factors in America. If you go to parts of Detroit or LA, the graduation rates in parts of those cities can be 25 to 35 percent. If an enemy did this to us, we'd go to war with them. We would never accept this, that 65 or 75 percent of our kids have no skills to participate in the world that we're in. Can you imagine what a nightmare this means long term for America? Is there a bigger problem in the world in America today? I don't think so, because we can't have half of our population left out of the abundance that's potentially in front of us. So we've been developing a curriculum to teach children algebra. That's where we typically lose these kids. They get angry, they drop out, they don't graduate. So we developed a blended learning approach.

It's called blended learning, because it uses computers in the classroom, and here's a picture of the screenshot. It's very simple, and it teaches algebra multiple different ways. It teaches with stories, with equations, numerics. Those are calculations, with graphs and little motion examples.

So you might have an example where Sally and Judy are running down a soccer field with different slopes and the question for the students will be, 'Well, who wins the race?' So the students would go through the exercises, and then a little soccer field would show up, and you see the kids running down, and they get the feedback and that's how it works. It works in teams. It focuses on the big ideas of algebra. It doesn't try and take over the curriculum for the students, because that would be impossible. No teacher's going to let you come in and completely take over the curriculum.

Our key idea was focused on the big ideas of algebra, slope, proportionality, similarity. And if they get the big ideas, then the teacher can teach normally in between — but if they don't get the big ideas, they're gone. We have to get them to understand the big ideas. So that was our approach, a very simple technology that scales. It's now being used in, I think, the biggest trial in U.S. history in Florida — 100,000 kids — and here are the results we've gotten in various experiments we've done. This looks like a busy chart — it's actually very simple. The vertical axis shows the number of questions the children get right after a lesson. It's a 30-question test, so out of 30 questions at the top of this curve, they get 11 more correct than when they started. The horizontal axis are individual classrooms, so there's 25 or 30 kids in each one of those bars. So you see there's maybe 1,000 kids on this graph, and I want you to pay attention to the control group. That's the gray line.

This is fairly typical of the places we're working. You'll see that most of the gray bars are on the left-hand side of the graph. Most of the children — 50 percent of them — are not learning algebra, 40 percent are learning some algebra, 10 percent are learning a lot of algebra. That's America today, and you can see, with our curriculum, we still have some children, maybe 10 percent, who are not learning algebra, 40 percent are learning some algebra to get through, and more than 50 percent are up there with the top 10 percent. I, frankly, have never seen these kind of results before in education at this level, and the reason we believe it works is because it satisfies all those criteria I mentioned, those 10 principles. We've evaluated all kinds of other educational programs — almost all of them fail or they don't scale. You can always have exceptional people who can do anything, but they don't scale. We need a program that is actually implementable to millions of children. So as I mentioned, this is now being used in Florida, in Broward County. The sixth-biggest educational district has just adopted this — it's still a prototype — because if you're a teacher or a superintendent in one of their districts, you're desperate to save these children's lives.

Now, we're not the only one. Obviously, here at Stevens, there's a new venture center, there's an innovation expo going on. We had a great discussion today about a new program for teaching calculus that's having remarkable results here. It's called a flipped classroom. So the kids use a computer program, and then they go to a lecture and the teacher asks them questions, and they have clickers so they can answer the questions, and then they go into team workshops, where they work, again, to learn more algebra. So it's an example of a program that's including all the elements I mentioned, and it's using a computer assistant to help with the learning that gives real-time feedback and all the kinds of things that I just mentioned. And that computer assistant, if you think about Siri as kind of the first version of computer assistants, imagine what they're going

to be like in 10 to 20 years. Imagine what you can do in a program like this in 10 years or so, in terms of being able to be responsive, understand how the kids learn, provide them new kinds of content, all the things, and even collaborate in new ways. That's the world we're going into.

Aalto University is the first innovation university that I know of in the world. They said, 'we're going to create an innovation university.' It formed about 10 years ago; it's in Finland and it's a project-based curriculum. The students do projects all four years. When you meet these students, they're tremendous, and this little sign here — 'To educate the world's best product designers' — I love that. Not to be good, to be the best. The goal is to be the best. Now, is there any other standard in today's world where everybody knows what everybody else is doing? You can't be best at everything, right? But they're aspiring to be the best at that one thing.

> **"... if you think about Siri as kind of the first version of computer assistants, imagine what they're going to be like in 10 to 20 years."**

The d.school, it's called the Design School at Stanford. It's another experiential program. You don't get credit for it, it's all voluntary, it's not part of the faculty or anything, it's just a voluntary program. And 15 years ago when it got started, that was kind of a crazy idea: 'Why would you want to teach this?' This year, it's up to about 600 students taking the course and if you look on their website, this little napkin talks about what they're doing. So you see big projects, radical collaboration and design thinking, future innovators — all the things we just talked about — and I love this. Create the best design school. They're also aspiring to be the best in the world at what they do, and they're really, really good. They're really, really good. If you go to Stanford and you see this program, those kids are tremendous.

My undergraduate school, WPI, has a four-year project-based curriculum and they send kids off to do projects, not in a bistro in Paris, but into the middle of Cape Town, South Africa, or China or some other place where they have to work with the community to solve a real project … an incredibly exciting, life-transforming kind of program. And here's one I'd love to show you, that it's not just universities like Stevens and WPI and Stanford and Aalto who are doing this — it's now filtering down to younger children. In Australia, they have an innovation program that they're trying to make part of the national curriculum in elementary school. Can you imagine?

The Girls' Middle School is a program, it's an all-girls school in Silicon Valley down the street from us — sixth-, seventh- and eighth-grade girls. It's a serious school. Serious math, science, and in the seventh grade, they have what they call their entrepreneurial program where these girls have to go through a boot camp, and they have to learn about what innovation is and how to form a company, and then they have to write a business plan, and then they have to go over to Google and the big auditorium and pitch their business plan to a panel of Silicon Valley venture capitalists to get funded a few hundred dollars. And then they have people like us as their board of directors, really more mentors, and they go off and they have to build their products and they have to then sell them.

A while back I went to visit these young girls, because I wanted to see what it was like for them, and I had the following conversation: 'Judy, what did you learn from this program?' 'Oh, Dr. Carlson, this was really hard work. Have you ever noticed how much hard work this is?' I go, 'Yeah, as a matter of fact, I have.' 'Oh, well, Dr. Carlson, I don't know if you've ever noticed this, but putting a team together is also very difficult. Very difficult getting everyone aligned.' I said, 'Yeah, I understand. Well, how'd you do that?' She said, 'Well, what we discovered is that everybody wanted to do something different. So I was good at sales, I became the vice president of sales, and Sally was really good at art, so she became the marketing and product designer, and we all ended up with something we wanted to do and we all had a role to play. And, Dr. Carlson, I don't know if you've ever noticed this, but even though this was an enormous amount of work, it was also a lot of fun. Have you ever experienced that?' And I went, 'Boy, yes I have, but I wish I'd had that experience in the seventh grade.'

What a gift to give to those young girls. What a gift. So that's what I wanted to tell you today. It's the best time. We're not doing a good enough job. We need to get better at innovation, and students, graduates today, need these skills if they're going to thrive, not for just the next 10 years, but for the next 50 years. And the way to do that is basically what's happening at Stevens and those other schools I mentioned. It's the move to not only a really first-class technical education, but also learning the disciplines of innovation.

Thank you very much.

A video of Dr. Carlson's lecture is available at:
stevens.edu/lecture.