

Immersed in the Future: Randy Pausch on the Future of Education

"Enrollments are down 23 percent in the computer science discipline. And at the top echelon, people aren't too bothered by it, because we will be the last to be impacted, right? But this is a huge, huge problem. And it's a huge problem for the country."

[Randy Pausch is Professor, Human Computer Interaction, Computer Science, at Carnegie Mellon University, and Design Director of CMU's Entertainment Technology Center (ETC), a joint initiative of the School of Computer Science and the College of Fine Arts.]

UBIQUITY: What's most important to you?

PAUSCH: My sons Dylan and Logan and my wife Jai are the most important things to me; after that, if you ask what really drives me, I like secrets. And the reason I became a researcher is that the best way to know a secret is to figure it out yourself before anybody else knows it. The essence of a being a researcher is knowing the answer to a question that nobody else has even asked yet. It's really a kind of illusion, and I love the creation of illusion, which is why as a kid I was fascinated by theme parks, particularly the stuff that Imagineering has built, because they they're so much better at creating an illusion than almost anybody else. And I come from a long line of people who believe that child-like wonder is not optional, right. My dad is 82 and still approaches life as if it is something to be experienced fully. My dad has just been diagnosed with terminal leukemia, which is very sad and very unfortunate, and there have been a lot of tears over it, but one thing a lot of people and their families go through that's just not operational for us is whether there places that he wants to visit before he dies? My dad says no. He says if there were places he wanted to visit, he had 82 years, right? I mean, this is a guy who lived every day as if it might be his last day. And he's had a very strong sense that you should never be afraid to let somebody else think you look silly, you should just go do things.

UBIQUITY: And that's influenced you?

PAUSCH: Very much so. I'm constantly finding myself in situations where people are saying, well, it's never been done that way before, and I say, well, that's fine, and I guess that's an instructive piece of knowledge to share with me, but why are you saying that as if it's some sort of design constraint? You know, you said you wanted to accomplish something. And I suggested, well, why don't you do thus-and-such. And then you said, but it's never been done that way before! But I say that's not relevant to whether or not this is a good solution. Of course if you told me it had been done and it *failed*, that would be really useful data, all right.

UBIQUITY: What drives you most?

PAUSCH: I'm constantly driven by the notion of, what are we really trying to accomplish? And, OK, how about if we tried the following? So, I guess I'm driven by experimentation and novelty. I guess that, other than deeply personal things that involve my family, some of my most special life experiences have been things like,

for example, the time I had the chance to be in zero gravity. Since then I've learned that the world bifurcates when you tell people that. It splits cleanly in two. Half the people go, why would you want to do that? And the other half of the people go, how can I do it? Frankly, I find the people in the latter camp much more interesting to be around.

UBIQUITY: We'll choose our own answer carefully.

PAUSCH: That's quite all right.

UBIQUITY: What do you take them to mean?

PAUSCH: Different things. Now if somebody says, oh, I understand about zero gravity, and they are afraid of physical discomfort, the way some people don't want to ride roller coasters, that's fair enough. But if that is a metaphor for a larger example of things -- Hey, there's a thing you've never seen before! -- that's a different problem. If I had a zoo of animals from another galaxy, I could not fathom someone who wouldn't pay a substantial fraction of their annual salary, if they had it as disposable income, to go to that zoo for a day. And if you think about it, children are completely driven by seeing new experiences. And so am I. There's an old bumper sticker, "He who dies with the most toys wins." To me, I really believe the right bumper sticker is, "He who dies with the most really cool, unusual experiences wins." So, you know, I got a briefing once from the first special ops guy into Afghanistan.

UBIQUITY: Really.

PAUSCH: Oh, my God! Oh, my God! Right? The stories this guy had to tell, many of which I cannot repeat, just amazing. So, I'm really driven by stuff like that. One of the things I like about being an academic is that being an academic, particularly at a place like Carnegie Mellon gives me a backstage pass to life.

I can get into a lot of places that most people working for for-profit companies can't, and that's very cool.

UBIQUITY: As the head of an entertainment technology center, do you have to defend the seriousness of what you do?

PAUSCH: Yes and no. The first thing is that, I don't focus as much on entertainment as you might think. So, for example, we run an entertainment technology center here. And I would say that almost a quarter of the students in our student body want to go out and use their powers for good and not evil, meaning that they want to work for non-profits. They want to do museum exhibits. They want to do educational software over the Web. The longest-running research project I have is called Alice, and it is using some of the underlying technology from 3-D graphics (driven of course by video games) and some of the inspiration of storytelling as a powerful human motivator (everybody wants to tell stories) -- and using that to devise a system that is able to provide a better, first exposure to computer programming, in much the same way that Logo used to. But this is much more advanced than Logo was, to the point where it can be used for a full semester course at the college level.

UBIQUITY: And it's been used successfully?

PAUSCH: Yes. We've demonstrated that with at-risk students we can both improve retention and grade point average. And so, when people say, well, how do you feel having a career doing all this frivolity, I hasten to point out that the number of computer science majors in America last year declined by 23 percent. The direct implications to American productivity, quality of life and educated citizenry and national defense could not be more stark. Not producing enough computer scientists is a mission-critical way to fail for a modern society, and I'm the only guy in town that I know of with a potential solution to that problem. Yet I'm the one being called frivolous?

UBIQUITY: What are some examples of projects you're developing?

PAUSCH: The biggest project we have going on at the Entertainment Technology Center is called Hazmat, and is for training firefighters and other first responders to respond to chemical attacks -- whether they're poison gas attacks or just industrial chemical hazards. We're working with the fire department in New York on this, and it's literally training people for life and death. If al Qaeda decides to go after the subway system with poison gas, they might be foiled by firefighters who have been trained on our simulator. So, again, most of the people who take potshots at our "frivolous" work are people who are doing something fairly insignificant, but not frivolous, while we're doing stuff around here that has the potential to be fairly significant and that's informed and educated by the huge fraction of human energy that's gone into understanding people and how to entertain them. And that strikes me as too big a lever to ignore.

UBIQUITY: So you're saying that entertainment can be deadly serious.

PAUSCH: Absolutely. I mean, Fred Brooks was here visiting this morning, looking over our program; Fred and I go way, way back, and he's been a true mentor to me. He's just one of the finest human beings I've ever met, in addition to being probably the single wisest computer scientist there is. He doesn't do this kind of stuff; he does the serious, hardcore science, but the reason we love to get together is that he's in the business right now as a researcher of trying to figure out what about a synthetic, immersive environment really makes it effective or not effective? And he absolutely knows that the people who understand that very well work at places like Imagineering, yet don't articulate it or measure it the way a scientist does; and so, you see this collaboration of results all the time, where the scientist will carefully measure something and come up with the phenomenon, saying you should be doing X, and then you go into the theme park industry and find, yes, and they've been doing it that way for 10 years, because the designers just instinctively knew this worked.

UBIQUITY: A moment ago you mentioned that you were the only game in town. What did you mean by that?

PAUSCH: I was referring specifically to the Alice Project, and what I was saying there was that if you ask, "Who here has any kind of a potential solution to the fact that enrollments are dropping like a stone?" you don't get many answers from people. Do you know anybody in the computer science community who says, "Oh, here is something that could change the fact that young people are not going into our discipline"? When I say I'm the only game in town, I'm saying that we have an entirely novel way to introduce people to programming, where we have huge amounts of evidence that we have a teaching strategy that works even at the middle

school level. Typically, a kid's first exposure to programming frankly sucks, right? It's not an accident that the highest rates of academic dishonesty occur in introductory programming courses, and that's not just because it's mechanically easy to copy code; the reason is that we put people into the most frustrating situation in the world.

UBIQUITY: More so than other test-taking situations?

PAUSCH: Absolutely. I imagine, if you wanted people to cheat the most in freshman composition, you would say, you have to write a five-page paper, and you can't use any tools other than some very crude editing system that doesn't do spelling correction or anything else. You submit your five-page paper, and if there's any spelling or grammatical errors in it, you get told there's a problem in your paper somewhere on page two. And if you can beat your way all the way through that, then you get to submit your five-page paper, and the professor will read it and grade it on its merits. Oh, and by the way, this course will be taught in Sanskrit. I mean, literally, that's what we do to people in intro programming. And then we have a community of people who, I think it's a fair assessment, that if you measured the social skills across the disciplines, computer scientists, shall I be generous and say, won't end up in the top half. And we wonder why a lot of people never take their first programming course. And if they do, we don't get a lot of them to go on to a second one.

UBIQUITY: You sound like you're just getting started.

PAUSCH: I am. And by the way, why is it that programming is the gateway to computer science? I mean, I realize that it's a valuable skill, and computer scientists should be able to program. But other disciplines have figured out that the first course should be a survey of all the cool things in the discipline, you know, mixed in with some laboratory sessions about doing the stuff. To us, it's all laboratory sessions. I used to teach in a lecture format, which is kind of a stupid way to teach people a lot of this stuff. But with the Alice system, you drag words around, you can't make a syntax error. You're authoring an interactive, 3-D -- you're authoring a 3-D movie or an interactive 3-D game, and this is highly motivating for students. But we had to wrap a textbook around it, because one of the things I learned painfully is that you can have the best software in the world, but if there isn't the educational infrastructure called the textbook, no one will start using the software. Once the textbook was in beta we were in 25 schools.

UBIQUITY: The story has a happy ending then?

PAUSCH: Yes, but Alice is not a panacea. A lot of people were saying, wow, this is different, I've got to teach differently, because now the kids are all highly motivated. What everyone wants to do is just go off and just write programs and tell their stories -- everybody wants to direct! And here I am trying to get them to sit here and calm down and print out the twelfth Fibonacci number. Now, we could have a long discussion about how perhaps we should be excited about the fact that the kids are willing to write multiple hundred-line programs in their first semester, and that they will willingly do that and stay into the night, because they're having fun. I might actually as an instructor just run with that and let them do that for the first semester and put off worrying about Fibonacci numbers until the second semester: that might be one strategy. Instead, the reaction we tend to get is more one of, "This is really

great and the kids seem to enjoy it, which is kind of weird, but, by the way, what's your transition path? Because what I really need to do is have them learn how to type Java." And then I say, but aren't you the one who was just telling me that it's all about the concepts in computer science, and the language doesn't matter? Their reply: "Absolutely. This course is all about concepts. But if they can't type Java by the end of the 14 weeks, this is not an acceptable solution." And so now there's a Java syntax mode in there and all that. But what I find fascinating is that, if you were a company and profits were down 23 percent, everybody in the company would be talking about that to the exclusion of everything else, wouldn't they?

UBIQUITY: At least one would hope so.

PAUSCH: Enrollments are down 23 percent in the computer science discipline. And at the top echelon, people aren't too bothered by it, because we will be the last to be impacted, right? But this is a huge, huge problem. And it's a huge problem for the country.

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