

## **SEI Cyber Talk (Episode 12)**

### ***STEM + Diversity = Greater Technology Innovation*** by Tom Longstaff and Grace Lewis

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**Tom Longstaff:** Welcome. I'm Tom Longstaff. I'm the CTO at the SEI at Carnegie Mellon University, and today I'm talking to a principal investigator, Grace Lewis, and we're going to be talking about STEM. So, welcome, Grace.

**Grace Lewis:** Thank you, Tom.

**Tom Longstaff:** First of all, what is STEM and STEAM and all of the other things investigated, and why is that important?

**Grace Lewis:** So STEM is an acronym. It stands for science, technology, engineering and math. STEAM adds the A at the end, in between, and the idea is these are fields that the nation has declared that are very important to make progress in research, to make innovation, and become better in everything we do. Recently I learned about STREAM. STREAM adds the R, and it refers to reading and writing. But I think in general the idea is that these are all the fields that in combination are what makes a nation progress because it leads to a lot of innovation.

**Tom Longstaff:** Great. What's the relationship between STEM and the work being done in STEM, and diversity? And especially the inclusion of girls and the inclusion of minorities.

**Grace Lewis:** STEM fields have received a lot of attention because of what I said before, but also because if you look at the statistics, girls are not interested in STEM; women are not interested in STEM, or they lose interest in STEM, underrepresented minorities, and this is a field in which it's so important, and there is so much work-- I mean, if you look at the statistics of how much work there is out there in STEM fields, in particular computing, and how many graduates are produced, there's a big imbalance. And so that is why it's very related to diversity, because imagine if you could increase diversity in this field. We would have so many more people to pull from, so many more perspectives, and that's where the relationship comes in.

**Tom Longstaff:** That's really fabulous. What does a diverse STEM force really look like? If you were embodying the middle of a really diverse STEM workforce, what's that like?

**Grace Lewis:** So in the workplace-- and this is where I think we need to extend a little bit what we mean by diversity. So if you look at all the efforts that are done in organizations related to STEM, they tend to focus on gender and race. Those are the two big areas, and I agree that they're absolutely fabulous areas to work in. We need a lot of work in that area. But I would like to see the workforce in STEM extend to diversity in backgrounds, diversity in culture, diversity in the schools that you come from, which I think is interesting, because computing is my field.

So imagine a software development project where everybody on the team comes from the same exact school and looks exactly the same. Well, if you put that team together to come up with a

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solution to a problem, everything is going to look pretty similar, right? We had the same professors, we did the same work, we had the same background. But imagine if you had a team where you not only combined people from the top schools but maybe people from not top schools, more liberal arts. Or where you combine people that not only have a major in computer science, but they have a major in music or a major in art, or any other field. When you put these people together, now you have many solutions to work with. So to me, that's what diversity means in STEM, is not only getting people from these fields, but getting diverse people from these fields, beyond gender and race.

**Tom Longstaff:** That really sounds fantastic. How do we actually motivate-- how do we get there from here? How do we motivate a workforce like that and go from where we are now internationally to that really great workplace that you're describing?

**Grace Lewis:** Right. We need to start early. We need to start as early as elementary school, getting kids interested in STEM-- gamification, making it fun, making it see that there is a lot of fun in doing math and doing science and working with technology and engineering. But where we really need to do a lot of work is in middle school. There was a study commissioned by Microsoft in Europe where the basic finding of that study is that girls, for example, start becoming interested in STEM at age 11, but they lose that interest by age 15, which is very sad, and the reasons that came out of that study were things such as stereotypes-- girls don't do STEM-- social pressures-- "That's so nerdy. Why are you doing that?"

And-- and this is one of my big, big, big pet peeves-- the lack of role models. Their STEM teachers-- they're not from underrepresented minorities. They all unfortunately look the same. So it's that lack of role models. But it's a little bit of a Catch-22, isn't it? Because we need more people in STEM but we don't have role models, but we need more people in STEM, but we don't have-- so it's a Catch-22.

But I think that if people start seeing role models, if people start seeing the people that come to schools to talk to them that look like them, or if you're at a recruiting event and the people that are there look like me, I can say, "Wow, you know what? I can do that. That person looks like me." And I think it's the lack of role models, to me, in my opinion, that is really hindering what we do. But yes, we need to start early, and after middle school, we need to work with high schools. We need to work with teachers, and we need to work with parents. Because teachers are obviously the ones that are guiding them in what careers they should pursue, but it's also the parents as well, because in the end-- I don't want to say it's a parent decision, but the parent has a lot of influence there. So teaching educators, teaching parents on what the STEM field means, and just the opportunities that are out there.

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**Tom Longstaff:** That's fantastic. Are there any sort of specific ages or critical times-- so you talked about age 11, age 15. Are there specific times in a student's career that it's really important to engage with somebody who would be a role model?

**Grace Lewis:** Oh my, yes. So definitely middle school. Let me just give you an example. I have two children. I have a 15-year-old boy and I have a 13-year-old girl. They both went to the same middle school, and they had a teacher, Mrs. Datilo, who just retired, but Mrs. Datilo had an event that she had in her class, in her science class, called LOST. It was the Life of a Scientist Talk. And every two weeks she would invite someone, a scientist-- and she used the very broad word of that-- a broad concept of "scientist"-- but just to talk to the students, and purposefully every single person that she picked was from either from a minority group or from an underrepresented group, or maybe somebody that broke the stereotype, and I think that was great, because I talked to my kids and they're like, "Oh, this person came to talk to me. A dentist came and talked to us. It's great. He's from Brazil and he came in to talk to us." And I was the computer scientist, so I'm the female computer scientist coming to talk to the students.

So that age is important because they start seeing, "Hmm, maybe I can do this." Oh, and the morning I talked to my daughter's group, the next day there was the very first meeting of Girls Who Code. After that talk, a lot of girls came up to me and said, "Hey, so is this something I could do?" So it's that. So to me, it's middle school. It really is middle school. That age 11 to 15 to me is absolutely critical, and that sort of matches up to middle school.

**Tom Longstaff:** Wow. I love the passion that even I hear in your voice, coming and talking to these kids. It's just so crazy. Are there other examples of programs that we think are effective or that actually work? That sounds like a great one. LOST is just fantastic. Are there other kinds of programs and things that we think might be effective?

**Grace Lewis:** Right. So back when I was a graduate student at Carnegie Mellon, 1999, I was one of the founding members of a group called Women at SCS. This was the very first year that they had a larger group of women in their undergraduate freshman class, and the group was formed to create-- not to create a special environment for women, but basically to give women the same opportunities that men have at networking and socializing. It was just trying just to level the field, right? And especially because even though it was a larger group, it wasn't 50/50 like it is today, and that's why it's I'm sure. But it was more like, back then, 19 percent was a huge number, and it's kept growing. So to me, that is a very successful group and I invite people to take a look at Women at SCS, because, like I said, it's about just creating a level-- a balanced field of giving people the same opportunities.

And one thing that has been crucial at Carnegie Mellon University, and that's why they got this increasing number of women at first, is that they did not relax the admission requirements; they did not make it easier for women to join STEM. They didn't do anything different. The only

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thing that they did was that they removed the programming requirement, and that made a huge, a huge difference, because not only did that increase the number of women applying, but that increased the number of different people applying. It wasn't just your usual-- there are stereotypes-- it wasn't just your usual person that you imagine being a computer scientist, but it was all kinds of people, and that made a huge difference because it started changing the culture.

So now CMU in their undergraduate class has a 50/50 class, and I believe it's the third year in a row. And it's great because now you have an environment where you see that balance, where diversity is not an exception, it's the norm, and it's almost like normal. I mean, a 50/50 class-- yeah, that sounds right.

**Tom Longstaff:** So it sounds like Carnegie Mellon is all over this. I mean, just great. Is there anything that the Software Engineering Institute or an FFRDC can do to help with this? Is there anything or any programs within the SEI that can really help to multiply even the success that CMU is having?

**Grace Lewis:** Right, so at the SEI we have a group called the STEM Forum. It is a fully volunteer-based group. We rotate leadership between divisions every year. I am leading it this year. And the goal of the STEM Forum is to-- because we're a software engineering FFRDS, the role of the STEM Forum is to create awareness and provide resources for people that are interested in software engineering and computer science as a field.

Our two big activities every year-- one is that we run the Take Our Sons and Daughters to Work Day, and we usually do two different activities, one focusing on software engineering and computer science, and the other one focusing on just being creative at problem-solving, like a maker activity, and that has been a big success. The other big activity is that we organize about three or four talks every year where we invite people that are making a difference in STEM, and we invite them to give a talk at the SEI, invite all the SEI of CMU, but we also invite local schools, but they are the ones that need to see this.

But we want to do more, and we do have a role and we do have an obligation to do more. We are working on becoming a resource for anybody that's interested in software engineering as a career. So if you're a teacher and you want to learn more about software engineering because your students are asking about it, it should have all the resources that you need to grab and just talk to your students about it.

Because we're the Software Engineering Institute, we get a lot of emails from students. "I'm interested in a software engineering career. Can I talk to you about what it means to be a software engineer?" And we're always very open to helping out and doing what we can.

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**Tom Longstaff:** This is really great. So of course artificial intelligence is the big thing that's going on--

**Grace Lewis:** It is, mm-hmm.

**Tom Longstaff:** --And at the SEI, we have a very strong push into AI engineering and really engineering software for AI and using AI in doing software engineering. Is there anything within that world that is going to be beneficial to sort of the whole STEM program? Is there a way that we can link that in with STEM to sort of get that diverse workforce that we need to AI engineering?

**Grace Lewis:** Actually I think that's a very good question, and I think there is, because one of the things when I talk to students about computer science, my main thing-- in software engineering-- my main thing is to break stereotypes. I start out by saying, "What do you think a computer scientist looks like?", and they'll say, "It's probably a person with glasses sitting in front of a"-- they always say that, I don't know why. "It's a person with glasses. They sit in front of the computer all day and all they do is write code." Immediately I say, "Wrong. I am a computer scientist. Look at me right now. And that is wrong."

For us, the computer is a tool. It's a tool. We're really about solving problems, about solving important problems, about solving difficult problems, and you know what? It so happens that yeah, sure, we can write some code to solve that problem, but it's about problem-solving, and to me the big thing with AI and machine learning and everything is that that is what it does. It's really targeted at problem-solving. So imagine bringing people together to solve a lot of these problems. So AI being used to solve problems in health. AI being used to solve problems in education. I mean, you can think of any combination, but the fact is that if we're looking at data and trying to analyze data and trying to produce insights on that data, there are so many-- I mean, where do we start? There are so many problems, and I think this is really what is--

**Tom Longstaff:** The puzzles are intense. They're great, yes.

**Grace Lewis:** Right. What is going to bring people together.

**Tom Longstaff:** Oh, that's going to be great fun.

**Grace Lewis:** I agree.

**Tom Longstaff:** So what can our listeners do to help in this whole area? What's your best advice to our listeners on how can we support STEM, support diversity, support the area of making this work environment a reality?

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**Grace Lewis:** Right. So the first thing is volunteer. I mean, if you have the time, volunteer. Work with your schools, work with your teachers. Volunteer at work. Volunteer to go to recruitment events. But it's volunteer, and educate. Educate people on the stereotypes, on breaking the stereotypes, on the fascinating world of STEM not as-- just as a set of problems that we can work on and a set of problems that we can solve, and not just the computer-- the stethoscope-- that it's about solving problems. But it's really that. It's go out, volunteer, educate, and break the stereotypes.

**Tom Longstaff:** Excellent. Well, thank you. Thank you very much, Grace. This has been just terrific.

**Grace Lewis:** Thank you.

**Tom Longstaff:** So for more information on the work that we do, please check out the link in the description. This has been Tom Longstaff and Grace Lewis. Thank you very much for watching.

## **Related Resources**

Women@SCS: <https://www.women.cs.cmu.edu>

[Girls in STEM: the importance of role models](#) (Microsoft study)

[SEI Science-Technology-Engineering-Math \(STEM\) Initiative](#)

[AI at the SEI](#)

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