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The Future of STEM Depends on Diversity

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(TEDx intro music)

(Nicole) Now, I won't make you close your eyes, but I want you to imagine a famous scientist in your head. Now, there's a study that shows that the majority of us will have imagined a male scientist. So whether you thought about Stephen Hawking or Albert Einstein, the fact is that most of us simply think of a scientist as being a man.

So now that you know that, I want you to try this again, except this time I want you to imagine a normal, everyday scientist. So now that I made you aware of this male bias thing, maybe some of you made sure to imagine a woman this time, right? Well, the same study that I mentioned before also showed that even if we can imagine a scientist as being female, we are most likely to envision someone white. Now if you're like any guy I've ever met at a bar, you would be shocked to discover that I'm a scientist, but it's true.

I'm getting my PhD here at Georgia State in astronomy, and I got my bachelor's degree in physics just down the street at Georgia Tech. I also happen to be a minority, and even though you probably can't tell just from my accent, I'm an immigrant from Chile. When I was young, we moved to Miami, which is one of the largest Hispanic enclaves in the U.S. 93% of my high school was Hispanic, and not because we were in the inner city. In Miami, this was the norm, where white Americans had to assimilate to our culture, learning Spanish and how to kiss on the cheek hello and goodbye. It's true.

Now I became a feminist at the age of 11, because in this macho culture, it was very apparent to me the social injustices toward women, but it took me another 10 years to become aware of racial prejudices, because living in Miami protected me from feeling like a minority. But then at the age of 20, I moved to Georgia, and I started getting questions like, no, where are you really from? And jokes about how we Mexicans are all the same. At the bank where I first opened my student checking account, I hesitated for just a moment at the teller's question, and seeing my name on the application, she angrily asked me if I even spoke English.

Now until this moment, I had always felt like an American. I mean, I grew up speaking English, and I fully embraced the culture, but here for the first time, I felt like I did not belong here. And this feeling that you don't belong is a common theme for minorities in STEM. Now maybe you're wondering, why is everybody talking about STEM, which by the way, stands for science, technology, engineering, and mathematics. Now you've probably seen a lot of articles on your Facebook lately about STEM, and even President Obama is concerned about it. Well, it turns out that science and technology are major drivers of our economy. And that's because the money that we invest in research and development, it doesn't just disappear into thin air like people like to think. It actually gets multiplied and injected right back into the economy because innovation fosters job creation. And to give you just one example, for every dollar that we spend on NASA, we get about $8 right back.

Now if you've never invested in the stock market before, please don't expect to get that kind of return on your investment. It's just not going to happen, right? Well the problem in STEM is that white men, who make up only about 30% of the US population, make up over 50% of the STEM workforce. And that means that a large fraction of the population that is made up of minorities is being left out.

Now by minorities, of course I mean people of color, but I also mean women, people with disabilities, and sex and gender minorities. Now personally, I think that diversifying STEM is a social justice issue. I think it's only fair that we give proper representation to every kind of person in STEM because it's the right thing to do. But the great thing is, it's also the smart thing to do.

Research in the business world reveals that being in a diverse work environment forces us to think harder and make fewer assumptions. For example, a study at the University of Illinois showed that when we're in a group of similar looking people, we tend to assume that we're all similar thinking people too. We don't bring all of our ideas and opinions to the table because we think that everybody already agrees. Another study at Stanford showed that when we're presenting a dissenting argument to a group of socially diverse people, we try harder to convince them than if everybody's the same. So socially diverse groups, they're better at solving problems because they have deeper discussions. They share more information, they have a wider variety of ideas, and they can look at a problem from different perspectives. So we know why diversity is good for STEM, but what's the incentive for minorities?

Well, how about this? STEM workers make about $30,000 more per year than the average U.S. income. So tell that to minorities and there should be a line out the door, right? Well, unfortunately, it's not that simple. Even though minorities make up about 70% of the population, they only make up about 35% of the STEM workforce. So there's a gap here. Something is happening that's preventing minorities from entering and persisting in STEM fields. So what's going on?

Remember that exercise that we did at the very beginning? That was a TEDx version of a real study called the Draw a Scientist test, and the premise is simple. You just tell the subject to draw a scientist. Easy enough, right? Well, this test has been conducted dozens of times over the last 60 years in over 30 different countries and across age groups from primary school all the way through college and beyond. This test has also been given to people of different races, genders, and socioeconomic backgrounds. And the majority of these people, they tend to draw a white male scientist. Even Chinese students living in China, when they're asked to draw a scientist, they draw a white man.

Now, I don't know about you guys, but this is crazy to me. And even though the results have improved slightly over the past 60 years, it's not nearly as much as you would hope. So this raises the question, why can't we minorities see ourselves as the average scientist? Take my friend, Sarah, for example. When Sarah was a little girl, she was really good at math and science, and she was lucky because the adults around her encouraged her to be an engineer. But Sarah didn't want to be an engineer, because to her, the only girls who did that were tomboys or nerds, and Sarah was neither of these things. She grew up playing with dolls. She loved the color pink. She was a girly girl, not an engineer. Well, one day, some engineering students from her local university came to talk to her class, and one of them happened to be a very feminine female engineer. Now, Sarah was really interested in what this woman studied, but most importantly, she was amazed that somebody just like her could do engineering. I mean, suddenly she could see herself in this career, and she decided to pursue it. She now has a PhD in biomedical engineering.

Now, Sarah was lucky to have this kind of role model, because minorities are pulling themselves out of the STEM race as early as middle school. And it's not because they're not interested in STEM, or because they're not capable. There are two main factors that are making us lose talent at every point in the STEM pipeline. Number one is socialization, and number two is institutional bias.

Let's talk about the first one, socialization, because your ability to see yourself as a scientist, or your science identity, is what actually determines whether you will even begin a career in STEM. And I have a funny story that illustrates this. Okay, true story. When I was three, I refused to obey anything that my mom told me to do, unless she gave me a valid explanation. So she would sit with me for hours, sometimes to the verge of tears, because she was arguing with a three-year-old, who would not budge unless the answer made sense. Now, my mom could have grounded me. She could have called me bossy or annoying. She could have told me because “I said so,” but she did not. Now, my mom was not an astronomist. She didn't know that she was training a future scientist, or that she was encouraging me to ask questions and not be okay with just any answer. But these moments with my mom helped to shape my identity, and at critical times in my career, it was the only thing that saved me from quitting.

Now, studies show that, at least for minority women, there are three things that determine a strong science identity. How good we think we are at science, how well we actually perform, and how much recognition we receive for our work. And out of these three, by far, the biggest factor for determining a strong science identity is recognition. That is, being seen as a legitimate scientist by members of the scientific community. So, if you feel like you don't belong in STEM, having someone who has made it encourage you can actually make a difference.

The problem is that this encouragement is not likely to come along if we consider the second factor keeping minorities out of STEM, and that is institutional bias. Now, before anybody gets defensive, I want to point out that everybody has bias, including me, and everyone in this room, and anybody watching this. And if you don't believe me, you can take the Harvard Implicit Association test, and then get back to me and let me know how it goes.

Now, recently, a group of Yale scientists created a fake resume for a laboratory manager, and they sent it to over 100 professors all over the country. The professors were supposed to evaluate the candidate, decide whether they would hire them or not, and propose a salary. Now, everybody got exactly the same resume, but half the professors got one with the name John, and the other half got one with the name Jennifer. And across the board, the professors rated John as more competent, more qualified, and offered a 15% higher salary than Jennifer, regardless of whether the professor was male or female. I'm going to let that sink in. The exact same resume yielded very different results based completely on the applicant's gender, and nobody escaped this bias.

Now, a similar study was done where hiring committees at different companies were sent four fake resumes, two of them highly qualified and two of them poorly qualified. And the resumes were randomly assigned either a typical white name or a typical black name. And even in the companies where diversity was a priority, the highly qualified black candidate was consistently rated below the poorly qualified white candidate.

So even if we are committed to diversifying STEM, it's still possible for us to be biased against minorities. And this goes back to our society's image of what a scientist is, and also to deeply entrenched racial and gender prejudices that we all grew up with. The tragedy is that for minorities who have made it this far, they will be removed from the race because a system that we consider to be merit-based is actually riddled with bias.

Now, I'd like to conclude with a message for everybody out there like me. If because you're different, you don't feel like you can pursue a career in STEM, I want to tell you that I did. And you can too. First of all, because you're capable, but also because you have no idea how much the STEM sector would benefit from what you have to offer. Yes, we have a lot of work to do to change this image that we have of what a scientist looks like. But as my friend Sarah discovered, we don't have to give up our identity to pursue a career in STEM.

And to those of you who have made it, regardless of your race, your gender, or your sexual preference, I urge you to consider that there may be biases preventing your workplace from becoming more diverse. And I encourage you to become an ally to those people like me who have to fight so much harder just because of our appearance. Without you, we will never be able to change the face of STEM.

Thank you.

(Audience) Applause.

(TEDx outro music)

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