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State of the Universe

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My career thus far has been an incredible journey. I searched for the elusive dark matter particle while studying in England on a Marshall Scholarship. During my astrophysics PhD at the University of California at Berkeley, I discovered hundreds of thousands of exploding black holes, otherwise known as quasars. My data analysis and business insights helped a small 12-person start-up become acquired for \$30 million. Today, I am the Director of Data Science for **InstaEDU**, (a **Chegg** Service) an innovative education technology company that connects students with online tutors, extending affordable, individualized, help to students all over the country.

I wouldn't necessarily have predicted that this is where I would find myself when I began my studies. I pursued my PhD in cosmology because the universe fascinates me: How did it begin? What is it made up of? How did we get where we are today? Where are we going? For my thesis work, I used telescopes to observe the millions of galaxies Dr. Urry showed in her **video**. By studying the patterns in their distribution over space and time I was able to understand how our universe behaves at the very largest scales. This work – funded by the DOE's Office of Science, the National Science Foundation, and the Alfred P. Sloan Foundation – contributed significantly to humankind's understanding of the composition, density, and future trajectory of the universe.

My graduate study at Berkeley was a time of incredible growth. I learned technical skills like data analysis, programming, modeling, statistics, and experimental design. I learned professional skills like giving talks, teaching, writing papers, supervising students, working in collaborations, and effectively managing projects. But most importantly I learned how to think critically about complex problems, how not to be intimidated by learning new skills, how to be driven and self-motivated.

When I graduated from Berkeley I had job offers to continue my research, become a college professor, or enter industry as either a consultant or a data scientist. Because I have a passion for helping others learn, particularly for helping those who find the traditional classroom less accessible or ineffective given their learning styles, I chose to become a data scientist in the ever-growing field of education technology. From there I work to improve education while having a much broader sphere of influence than I would from the front of a single classroom.

As a data scientist at InstaEDU, I spend my day using the programming, data analysis, experimental, and statistical skills I honed during my PhD to optimize the education experience

and make learning more effective for our students. We make private tutoring – something that has traditionally been reserved for the wealthiest Americans – affordable and accessible to a much larger group of people.

Data scientists, whether working for an education technology company like InstaEDU or in sectors like e-commerce or even government, hold some of the most challenging positions to fill in the tech industry and beyond. The digital age means that more than ever before organizations want to utilize “big data” to gain vast and rich understanding of their customers and business. **McKinsey and Company projects** that by 2018 the United States will have a talent shortfall of 150,000 people with the advanced analytical skills needed to fill these roles. Data scientists have to be better at statistics than any software engineer, and better at software engineering than any statistician. They have to be able to take complicated business questions and design experiments or mine existing data to find the answers. And they have to be able to communicate, often-complex findings to others with non-technical backgrounds. Perhaps this is why Harvard Business Review called data scientist the **“Sexiest Job of the 21st Century.”**

An expert statistician combined with an expert software engineer is a pretty accurate description of many science PhDs. And astronomers and astrophysicists in particular have unique skill sets that make us ideal for these positions. Training the next generation of astronomers and astrophysicists is not just important to scientific research but also to ensure the overall economic success of our country. If we don't address this shortage, American companies will fall behind those of Europe and Asia.

At InstaEDU, I am not only the Director of Data Science; I am also an online tutor. I get to work with students like Monica, a sophomore from Richland Hills, Texas who is struggling with her physics class. Her mother, Suja, wants Monica to have a female tutor, but couldn't find anyone in her local community. Suja reached out to me via InstaEDU and Monica and I met once a week for video-chat lessons.

Monica suffers from a common problem. Around the age of 12, girls are more susceptible to losing interest in math and science and their performances tend to drop when compared with boys. Researchers have found that around this age girls begin to suffer from **stereotype threat** – the phenomena where knowing that “*people like you*” are less likely to succeed at a given task, negatively effects your performance on that task.

Suja is aware of this phenomenon, and knows that by simply finding Monica a female physics tutor can counteract stereotype threat. By working together, perhaps I can change Monica's mindset about what a physicist looks like. Perhaps I can encourage her to continue studying math and physics at a time when her interest might otherwise fall off. For now, I'll settle for knowing that over our time together, Monica has gone from receiving Bs and Cs in her physics and math classes, to earning straight As. She is now planning on taking AP physics next year.

Using the skills I developed during my astrophysics PhD in my work as a data scientist at InstaEDU means I can make an even bigger difference in the world than I was striving for when I enrolled at Berkeley. Even though I am no longer doing pure astronomy research or in a traditional education environment, I would be unable to do the work I do today if it weren't for

my astrophysics training. I'm proud that on a micro level, I can help an individual student pursue her own science studies. And I'm also proud that I can contribute to a company like InstaEDU, which will become essential in providing more Americans affordable higher education.