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Q&A with Carlos Coimbra



Carlos Coimbra, a professor of mechanical and aerospace engineering, has been named the new Faculty Director of the IDEA Student Center at the Jacobs School of Engineering. He joined the Jacobs School in fall 2011. He is originally from Brazil, got his Ph.D. from UC Irvine, and has been on faculty at the University of Hawaii and UC Merced, where he was involved in many outreach and academic research programs for undergraduate students. Coimbra's professional goal is to develop the smart solar power farms of the future. He uses a network of solar observatories throughout the University of California system to harvest data for forecasting solar power output. He analyzes this data using artificial intelligence methods and a new, sophisticated type of variable order differential equations he developed. He answered some of our questions about his new role, the programs he has been involved with and the importance of diversity.

What are your plans as the new Faculty Director for the IDEA Student Center? Any specific programs you already have in mind?

Coimbra: Terrance Mayes, the director of the IDEA Student Center, and the IDEA Executive Advisory Committee have done a great job in creating a number of supporting programs that retain students very effectively. I would like to focus on including students in the research enterprise at the Jacobs School of Engineering early on. This is essential to mitigate the well-known shrinking pipeline that starts in middle school (or before), but escalates to alarming rates during the first two years of engineering school, and continues to affect disproportionately students coming from a more disadvantaged background and under-represented minorities. One proven way to address the attrition rate of these two categories of students is to expose them to a research environment early on. We are already working on a few ideas to implement this concept within the Jacobs School.

The IDEA Student Center focuses on outreach and recruitment; retention; and research. How do you see your new role fitting within these three pillars, perhaps especially when it comes to research?

Coimbra: There is a reason why the focus is on these three pillars: they cannot be dissociated. We need to reach out and recruit better to start with good numbers and a diversity of ideas and experiences; then we need to retain these students to prevent the shrinking pipeline I mentioned above. The best way to accomplish this in a research university is to expose the students to the research methodology, the research environment and the researcher's mind. I am big proponent of the beneficial effects that the scientific method has in building strong minds. Once you are hooked on it, there is no quitting, there is no going back. Research is more than a job, it's a lifestyle. And if we can reach out and affect groups that are traditionally left out of this lifestyle, we jumpstart a domino process. It's impossible to estimate the long-term effects of including one more student into these activities.

Why is diversity important for the Jacobs School of Engineering, or for that matter, any school of engineering at a research institution?

Coimbra: As Terrance Mayes, the director of the IDEA Student Center likes to point out, increasing the diversity of our engineering students is a matter of national security. On one hand, we have a cohort of traditional applicants that is shrinking every year because of the population in the U.S. is shifting. We are about to become a nation where no one is a majority. If we don't reach out to get growing minority populations interested in engineering, the total number of engineers we graduate can only go down. This is the "First Law" argument—simple accounting. But there is much more—we also have to consider the "Second Law" argument, or the argument of quality. We improve the experience of all students if they are exposed to a diverse set of idea generators and learn how to work with people from all walks of life. In a global economy, learning how to work with everyone, how to design products for diverse populations, how to understand other ways of thinking is an asset. We can provide this at the Jacobs School because this is a highly desirable place to live and study, and one of the best schools of engineering in the world. We should at least reflect the diversity of California, which is incredible place to live—exactly because it's not one-dimensional.

Why is diversity important to you, both as an individual and a researcher?

Coimbra: To promote diversity is a no brainer. Universities, and the U.S. university system in particular, realized this a long time ago, even though there have been setbacks in the overall understanding of the critical need to promote diversity in the past years. Until a decade or so ago, the U.S. effectively selected graduate students from a pool of five to six billion people (not all students, obviously). This added tremendous vitality to the American university system, particularly to the graduate programs.

Countries with strong investment in research and education such as Japan and Germany could not compete with the U.S. because the diversity of their pool of applicants was vastly inferior to the U.S. pool. The same applies to any cohort you choose to consider.

Imagine if there had been no effort in the past to increase the number of women in STEM. If we had continued to enroll mostly men in STEM, we would have today at most half of the population to choose from to become our future innovators and researchers. We would be missing, at a minimum, half of the ideas, half of the creativity, half of the contributions, half of the workforce. This is not the kind of world you would want to live in. A well-known metric for the health (and wealth) of any given population is the equality between its men and women. Nobody argues with the fact that a society with well-educated, empowered women is a better society than one with poorly educated, voiceless women. The same is true for all other groups. We need to reach out to all groups and have their voice in STEM be heard. We need their contributions.

Another way to illustrate this is to consider why top universities don't hire faculty only from their own graduate programs. Don't they have the best graduate programs and therefore generate the best faculty candidates? The reality is that if you only hire faculty (or students, or anyone in general) with similar backgrounds, you miss out on the innovation that comes with diverse experiences. This is well understood in general, but sometimes you still need to convince people that a diverse student body is much richer than a one-dimensional one.

On a personal level, I have two daughters, who may or may not become interested in STEM. If they are, I would like to believe that their path would be a rewarding one, and that their contributions would not be given less weight because of their gender or ethnicity. I don't want them to gain any advantage, I only want them to be measured by the value of their ideas and contributions. It may be a naive thing to wish for, but I think is an ideal worth pursuing.

Our own home is incredibly diverse culturally, and I cannot imagine my life without the diversity our families from the opposite sides of the world bring to the table.

Why is it important for undergraduate students to engage in research as part of their undergraduate education?

Coimbra: The undergraduate experience is a critical time in everyone's life. Undergraduate students go through a major rewiring of their brains that eventually defines who they will be in life. This is the time to get exposed to great thinking, new methodologies, and most importantly, to pioneering ideas. How does one justify attending engineering school at a research university? It's the exposure to state-of-the-art research that gives our students the professional advantage they are seeking. The earlier we start, the better their chances of imprinting the research and innovation bug in their DNAs. In a country where the economy is built on ideas, I don't see a better way to promote continued growth.

Tell us about the outreach and academic research programs that you ran at the University of Hawaii and at UC Merced?

Coimbra: My involvement with outreach and undergraduate research programs was both accidental and natural. Early on in my academic career I noticed that I would be better off "raising" students starting at the sophomore and junior level in my lab so that they would become talented graduate students, rather than expecting graduate students to arrive well trained. It was a lot of work, and it takes time, but the benefits are enormous. While working with a few undergraduate students on aerospace-related problems, I became involved with the Hawaii Space Grant Consortium (funded by NASA's Space Grant Program). Soon a small but diverse group of faculty in Hawaii (including Profs. Wayne Shiroma and Luke Flynn) was advising more than 100 students, building research satellites and launching them into orbit from Kauai. All of this was inspired, directed and realized by the work of undergraduate students, with a little help from a few of our own graduate students in each specialty. This incredibly diverse group of students wrote their own proposals (many got funded for hundreds of thousands of dollars), passing on their knowledge to underclassmen and women and, most importantly, pursuing research careers in industry and academia after graduation. The Space Grant framework allowed this experience to spread in both directions: K-12 and graduate school. That energy was contagious, and I still think very highly of the whole experience (which started about 10 years ago).

When I moved to Merced, the problems to be solved were different—we needed to deliver an undergraduate program and create a graduate program, but we had no faculty, no graduate students and very limited funds. The challenge there was to start everything from scratch, but I am pleased to say that things are going very well for the mechanical engineering and applied mechanics program at UC Merced, and that the impact of the engineering programs in the region is very palpable even at this early stage. The number of lives directly affected by the early action of a few faculty members is very inspiring. I think UC Merced is already a massive social elevator for many students who would not have contact with STEM if the campus didn't exist.

Fun Faves

Favorite place at UC San Diego:

The terrace at Birch Aquarium

Favorite place on Earth:

Tropical beaches, both in the Atlantic and in the Pacific

Favorite hobby:

Snorkeling

Favorite part of your job:

Learning something new every day

Favorite engineering feat:

Mechanical Chronographs: 99.9995+% accuracy with mechanical parts only...

Favorite food:

Feijoada

Favorite way to spend \$10:

Having something cold to drink after a long hike, walk or bicycle ride

Favorite words to live by:

"It's a long shot."

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