The Early Career Section offers information and suggestions for graduate students, job seekers, early career academics of all types, and those who mentor them. Krystal Taylor and Ben Jaye serve as the editors of this section. Next month's theme will be Moving Forward—From Thoughts On Advising Graduate Students to Alternative Career Paths for PhD Students.

Hispanic History Month

An Interview with Federico Ardila

Anthony Bonato

AB: You're a professor at San Francisco State University, but you're also at Universidad de los Andes in Colombia. How does your work as a professor span the two institutions?

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FA: Even though I had access to mathematics as a kid, I did feel foreign to mathematical culture, especially in the US. One thing that I always felt in US academic spaces is that they're very narrow in their conception of what's valued. We are advised that it's your theorems that you're going to be judged by, so they're the only thing that is important. I reject that, and I always have, and I remember thinking already when I was a freshman, "I'm going to have to do this my way because I don't believe in this idea of just being an academic, period."

I was raised to have an interest in the community, in equity, in trying to make a positive difference. Early on, I knew that I loved mathematics, but that I also wanted to have some bigger involvement with society. I don't want that to sound pretentious, but I just wanted to help a bit with whatever tools I had.

When it came time to decide where to place myself academically when I finished my PhD, I was intentional. Some of my mentors and peers disagreed with my choices. I wanted to be in a position where I could do high-quality research, and, at the same time, I could have an effect outside of research mathematics. I wanted to be in a place where I wanted to live, in a diverse city. I wasn't willing to move just anywhere because of academia. That's how I ended up at San Francisco State University (SFSU). At the same time, I always wanted to do something with Colombia.

SFSU is a very interesting place research-wise for me. One thing that was also important to me and shaped my view of what an academic mathematician does is the community that it serves. More than half of our students are first-generation college students, more than half of them are first-generation Americans, and over seventy-five percent come from ethnic minority groups. When mathematicians visit me, they're often struck by our student population, because that's not what they're used to seeing on a US campus. But I don't think that's accurate; our campus is probably more similar to the average US campus than the typical R-1 university is. I think academic mathematics focuses on a very narrow view of who should be doing mathematics.

I love the Bay Area, and that is one important reason that I'm here. Also, I'm Latino and my partner is Asian, and few places have such a strong Latinx and Asian culture. When I found myself becoming comfortable in San Francisco, I decided that I wanted to set something up with

Colombia so that I could stay in touch and give back to the community that gave a lot to me.

I noticed that there wasn't anybody actively researching combinatorics in Colombia and there weren't courses being offered. I saw a need that maybe I could fill. I started offering joint graduate classes that were taught simultaneously at San Francisco State and in Colombia. This started as kind of a wild experiment; it was before all these online courses became a fad, and this was a very do-it-yourself setup.

I think it's a nice, productive bridge we created. The students not only took the course together, but they truly collaborated. For example, many of the final course projects were done internationally between a student in Colombia and a student in the US, and several became published research projects.

Eventually, I was awarded an NSF CAREER grant that funded my research and allowed me to make this a more systematic program. With that grant, I was able to keep offering these courses and to bring American students to Colombia and Colombian students to the US to do research together. It also allowed me to start the international Encuentro Colombiano de Combinatoria, which meets biannually.

I think that if you want to see minority mathematicians succeed, it's going to be easier to see ten of them succeed than to see just one. You can't just take one person, put them in a sea of otherness, and expect them to thrive easily if there's not a systemic change in the way things work. I wanted to create a wider environment where things were done differently, and there was a deep sense of community.

It's very exciting to me to see that my students in Colombia and the US are friends now, and they collaborate, and they're professors in many places, both in Colombia and in the US. It's become a wonderful community. In mathematics, we're measured by our theorems, and the mathematics needs to be on point. That's crucial. I'm very excited to see the mathematics that this community is doing. They're doing some beautiful stuff.

At the same time, I also like that they're not just doing mathematics and that there is this sense of activism in the community. We are finding ways to be involved with lots of different universities and even people in nearby countries. We are trying to create a different space where many people can thrive and do great mathematics.

AB: You wrote an influential *Notices of the American Mathematical Society* article "Todos Cuentan" or "Everybody Counts."[1] Would you tell us about the article and its message?

FA: Fundamentally, one thing that I believe very deeply is that mathematics is for everybody, and that's not how we have traditionally behaved as a mathematics society. Many of our practices are designed to select and support the "best" people. I try to take a different point of view. If a student shows up in my classroom, then there's a very good reason that they're there, and it's my job to support them.

Society has deep inequities. If we don't address those inequities very mindfully, then they're just going to be reflected in our classroom. That's one of the fundamental reasons why we struggle as a mathematics community to truly welcome diverse perspectives. We have to do our homework and learn about what are those inequities and what we can do about them. I think most math professors entered the university with absolutely no training on what it means to educate our society. We're trained on how to prove theorems, and we're often told that the educational part is not so important, and we shouldn't focus on it because it won't help us get the best job. I think I'm just trying to learn about pedagogy, and about the structural inequities that have taken us to where we are today.

A lot of it is about being thorough and scientific in the same way that we are about our science. What is the scholarship on really trying to make sure that we give equitable access to everybody? How do we move from just getting faces that look different in a classroom, to truly welcoming diverse perspectives?

There are many scholars that I'm very indebted to, who inspired a lot of what I wrote in that article; people like Audre Lorde, bell hooks, Paulo Freire, Estanislao Zuleta, Rochelle Gutiérrez, and Bob Moses. They have researched education and inequity more deeply than mathematicians have. I have also been blessed to be surrounded by wonderful people, doing work of a similar spirit in very different fields. My mother worked in violence prevention, my father in human management, my partner May-Li Khoe in design and education, my sister Natalia in music pedagogy, and my SFSU colleagues in science and in ethnic studies. My dear friends Sita Bhaumik work in art education and food activism and Dania Cabello in sports as a tool for social change. As in my mathematical research, I am always trying to learn from the practices of people in other disciplines.

One very important principle for me is that science is very powerful, and really shouldn't be concentrated in small sectors of the population. And I think science also brings a lot of joy and empowerment that should also be spread widely among our communities. I want to encourage mathematicians to constantly ask ourselves what we can do to make mathematics a tool towards a more equitable society.

[1] https://www.ams.org/journals/notices/201610/rnoti-p1164.pdf

AB: How did you converge to the agreement you include in your course outlines? What's the effect that it's had on students?

FA: I have always wanted to make the classroom a human place, where everyone is welcome, and where we don't only talk about mathematics. The obstacles to student learning are often not mathematical. I try to make my classroom feel like a very comfortable place, where people are welcomed to bring their full perspectives, and they feel safe taking risks and sharing their ideas.

One of my course outlines contains a version of the Agreement: "The goal of this course is to offer a meaningful, rigorous, and rewarding experience to every student; you will build that rich experience by devoting your strongest available effort to the class. You will be challenged and supported. Please be prepared to take an active, patient, and generous role in your learning and that of your classmates."

At the same time, I hope to make clear to my students that they're in the class not only for their own self but also to help and support others. This is good for the classroom, and it is important for their education. That's what's going to help them in society as they go and work in teams, and find out that they are valued not only for how they do but also for how they lift up the people around them.

I work to make sure that this doesn't feel like something I'm imposing on them; it is an agreement among all of us. We take the time for students to discuss what the agreement means to them, what they might add or improve on. I am always impressed by their openness and thoughtfulness in these discussions.

One central principle for me as an educator is to treat students with respect and communicate clearly and openly with them. Many of my better practices as an educator have come from really listening to them.

AB: What advice would you give to young people thinking about studying mathematics?

FA: One thing that I find very important is to recognize the joy of doing mathematics, to seek that joy constantly. At the same time, mathematics can be difficult and frustrating. And it's very important for a young person to know that it's not just them; even Field Medalists find math difficult and spend most of their time struggling. That's the nature of what we do. We're very curious, and we're never satisfied with what we already know. We're always looking for the next thing.

It's important to remember that the joy and the learning are yours. There's an expression that I like a lot in Spanish that I share with my students, "Nadie te quita lo bailado," and that translates to, "Nobody can take away what you've danced." To me, one thing this means is that no one can take away the joy with which you have done things. If you know that you love mathematics, then you can't let a professor or a low grade take that away from you. If you feel the joy and the power of understanding something new, then that joy and that power are yours, and they are real.

You are a good gauge of what you're learning, and sometimes the way that institutions measure you does not accurately reflect your potential as a mathematician. I can't deny that it is useful to learn how to test as well as you can. But I think it's also important to pursue knowledge with the purity of recognizing that you're learning something, that you're enjoying it, and that you're becoming a richer person for it.

AB: I always finish the interviews by looking forward. What would you say are some of the major directions in mathematics?

FA: I find it very hard to say. I know some mathematicians have very ambitious goals of solving big open problems. For me, I've more been driven by walking around the world, and seeing what I see, and trying to uncover something cool. If I see something interesting, I want to open that door and see what's there. Even though it is important to have these long-term goals for mathematics, I also believe that many of the most interesting developments and research directions didn't come that way. They came from unexpected places.

One thing that I think is important is disrespecting every border that people have tried to draw in mathematics. An ambitious student who is just starting out might try to find two fields that people think are unrelated and discover the relationship between them. Mathematics is interconnected in unexpected ways. I think the most interesting work comes from taking two islands in mathematics and showing how they're connected. That's a constant pursuit of mine. For me, it's centered around combinatorics, but I'm always trying to see how this field relates to something that it doesn't seem to be related to. I think that always leads to very interesting mathematics.

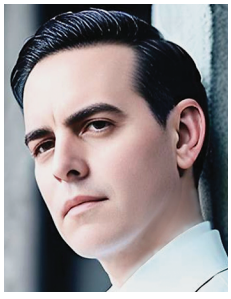
When it comes to the mathematical pursuit as a whole, one very big question I already mentioned is this: How do we make it possible for every community to participate in mathematics, benefit from mathematics, enjoy it, and use its power? This is a very important question.

In my mind, these two questions of mathematics and inclusion are related. Asking ourselves what are the most original mathematical developments of the future is closely related to asking ourselves who will make those developments. I want to see the most diverse group of people possible tackling the deepest mathematical questions. If you care about diversity and inclusion, you recognize that minoritized populations are often judged by higher standards, and you should tie your outreach efforts to the most

interesting mathematics possible. If you care about the development of mathematics, you recognize that many of the most interesting discoveries have come from people who have not been indoctrinated into the ways that most mathematicians think, or who have dared to question those accepted ways of thinking.

My job gives me the opportunity to work with many students who have not been conditioned to think like most mathematicians. When they engage with deep mathematics, I often find that they think very differently from me, and ask very interesting questions that I hadn't asked myself.

I think it makes sense to think that mathematical research also works this way. New groups of people bring new perspectives and ways of thinking, and they might be the ones who see what everyone else has missed.



Anthony Bonato

Credits

Photo of Anthony Bonato is courtesy of Anthony Bonato.

Advice from Our Advisor: Jesús A. De Loera
Consejo de Nuestra Asesor: Jesús A. De Loera

Jamie Haddock and Ruriko Yoshida

Mentoring and advising is a significant and challenging component of any academic career. We learn successful mentorship techniques from the examples in our own lives, and this article will illustrate the example provided by our (the authors') PhD advisor, Jesús A. De Loera. If you, like us, already know Jesús A. De Loera, you know that he is very fond of examples and is a great advisor to his students. In this short article, we will show many examples of the ways in which Jesús is an excellent advisor and the strategies he uses to advise his academic "children."

Jesús A. De Loera was born and raised in Mexico City and received his Bachelor of Science degree in Mathematics from the National University of Mexico in 1989, an MA in Mathematics from Western Michigan in 1990, and a PhD in Applied Mathematics from Cornell University in 1995. He joined the University of California (UC) Davis in 1999, where he is now a professor of mathematics as well as a member of the Graduate groups in Computer Science and Applied Mathematics. He is an expert in the field of Computational Discrete Mathematics and his work has been recognized with numerous awards including being made both a fellow of the American Mathematical Society and a fellow of the Society of Industrial and Applied Mathematics. He is also the current vice president of the American Mathematical Society. For his outstanding mentorship and teaching, he has received the UC Davis Chancellor's Fellow Award, the Award for Excellence in Service to Graduate students by the UC Davis Graduate Student Association, the Mathematical Association of America Golden Section Award, and the UC Davis College of Letters and Science Distinguished Teaching Award.

Over Jesús's career, he has supervised 17 PhD students, 8 postdoctoral scholars, and over 60 undergraduates in a variety of research areas. While there are many things we could say about how Jesús has been so prolific and successful in advising students, we believe that much of this success can be boiled down to only a few principles: (1) Care for your students; (2) Build your students' academic network; (3) Prepare your students for their future career; and (4) Give your students the time and attention they need to develop.

1. Care for Your Students

As a graduate student, Jamie (Jamie Haddock) religiously played pick-up basketball and would often encounter Jesús at the campus gym during his midday visits. Early in their advisor-advisee relationship, Jesús brought up her gym habit in one of their weekly meetings—"So I see you in the gym a lot…" Jamie feared that she would be chastised for spending so much time away from her studies and research playing basketball. However, as her mind started to scramble and she considered ways she could justify her time in the gym, Jesús quashed her fears and assured her he encouraged this healthy habit! After learning of Jamie's affinity for basketball, Jesús regularly brought it up in meetings, inviting her to share her interests and experiences with him. When he learned of an opportunity for a summer intership in sports analytics with a professional basketball team, Jesús eagerly shared it with Jamie and encouraged her to apply.

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