| Evelyn Lamb: | 00:12 | Hello, and welcome to the Lathisms Podcast. I'm your host, Evelyn Lamb. In each episode I invite Hispanic or Latinx mathematician to share their journey in mathematics. Today I'm very happy to be talking with Tatiana Toro. How are you? |
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| Tatiana Toro: | 00:26 | Fine, thank you. |
| Evelyn Lamb: | 00:28 | Can you tell us a little bit about yourself? |
| Tatiana Toro: | 00:31 | Yeah. I'm a Colombian mathematician. I was born in Bogota. I came to the US for my PhD. Before that, I've always loved math and I've been in the US longer than anywhere else. My trajectory to the US took me from California, to the east coast, to the Midwest, and then, finally, to Seattle. |
| Evelyn Lamb: | 00:56 | And you're at the University of Washington there? |
| Tatiana Toro: | 00:58 | Yes, I'm current at the University of Washington and I've been here since '96. |
| Evelyn Lamb: | 01:03 | You said you grew up liking math. What were some of your experiences with math as a child? |
| Tatiana Toro: | 01:09 | My first very happy memory of math was in first grade. I went to a French immersion school and we had a math teacher that, basically, brought out ... allowed us to play with lots of math toys. The two memories I keep is we learned set theory in first grade by using blocks of different colors and different shapes. We had a small version of them and had a very large version of them that we were able to use in the playground. I remember drawing Venn diagrams on the floor of the playground with chalk. Then putting the blocks in different sets and see what was the intersection, the union, and that was really fun. |
| Tatiana Toro: | 01:59 | We also played to learn how to count in different bases. We had buildings made out of ... they were wood structures, and we had little boxes, where we put beans and that's how we counted the units, the tens, the hundreds, depending on the base. That was a really cool game, so those are my fond memories of when I was very young and enjoying math very much. |
| Evelyn Lamb: | 02:26 | Did your family also enjoy math? |
| Tatiana Toro: | 02:29 | Well, let's see. My parents were both first generation to college and they actually were both physicians, which was, of course, something that, in many ways, their parents wanted them to do |

was the view the way to change one's socioeconomic situation. My mother, later on, said that she would have liked to be an engineer, but that was not really an option to her. I think the day I decided to become a mathematician was a day that my parents, and I was, I don't know, 10, 12. My parents were talking about something, arithmetic, the bank, and my mom mentioned something along the lines, "Oh, I don't remember how to do that." Then she had told me prior that she like math, and I thought, "I really want to make sure that I'm never in that situation. I don't want to forget the math that I have learned."

Evelyn Lamb: 03:29    Did they encourage you to pursue that interest?

Tatiana Toro: 03:31    Well, that's a complicated question. I am Colombian. In Colombia, the thought of being a mathematician was a crazy thought, because I actually had no idea what you could do with a mathematics degree. The only people who I knew, who were mathematicians, were, yes, professors of the university, but that meant they had lots of different contracts in lots of different universities and they, basically, taught all day long. They had salaries that were not especially good. Research was not something I knew about.

Tatiana Toro: 04:06    So, initially, I thought I was going to be an engineer. Then when I told my parents that I wanted to be a mathematician, I think it was a bit of a shock. I decided, I mean I learned that was an option, because when I was in roughly my junior year, there's more years of high school there, there's a slightly different account, but roughly when I was in my junior year, Colombia participated for the first time in a math Olympiad. The math Olympiad was in 1981, in Washington DC. Colombia was invited to participate, and I made it to the team. I came to the US. As I mentioned, I had gone to a French immersion school and I met lots of kids, both from the French team and from the Canadian team, who were doing programs in France that were going to allow them to become mathematicians.

Tatiana Toro: 04:57    I still didn't know what you could do with a math degree, but if they were doing it, meant that you could do it. So I decided that's what I wanted to do. Once I decided, then my mother was very encouraging. My father was not thrilled with the idea of me leaving the country to go to France, because my plan included going to France. But I did that, at least, for a year, and then once I came back, after that year, then I said I really want to be a mathematician. Then both of them were supportive.

Evelyn Lamb: 05:31    You were on that inaugural Colombian IMO team?

| Tatiana Toro: | 05:34 | Yeah. |
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| Evelyn Lamb: | 05:34 | We've heard from several other people on the podcast who have gone through the IMO program in Colombia. When you got to college and grad school, who were some of your mentors? |
| Tatiana Toro: | 05:45 | In grad school, my advisor, not only because of the math aspect, but my advisor was Leon Simon. It was somebody who was very encouraging in the way that I needed to be encouraged, let's say. We connected, also, at a personal level and he was very supportive. He pushed me the right way, which is something I deeply appreciated. |
| Evelyn Lamb: | 06:15 | What field of math did you end up going into? |
| Tatiana Toro: | 06:17 | I went into geometric measure theory and partial differential equations. That's what I learned in grad school, and that's where my thesis was in. I had several postdocs, and later on, another one of my mentors was Carlos Kenig and from him I learned a fair amount of harmonic analysis that then I combined with the things that I knew from before. So if I were to mention my mentors, Carlos Kenig also played a very important role in my mathematical formation. |
| Evelyn Lamb: | 06:52 | And can you tell us some questions you work on? |
| Tatiana Toro: | 06:56 | Yeah. So, let me describe my thesis. Roughly speaking, you have a set. Imagine a blob in free space, and this blob has some properties, so I'm gonna call them approximation properties, which means that when you look at this blob, and you look at a point and a little ball around this point, it looks flat, okay? It looks almost like if it were a piece of the plane, or very close to a piece of a plane. And this happens at every point and at for every ball small enough. Not super small, let's say of radius less than one. So you're very close to a plane. And then, one of the things I did, is I showed that there was a good parametrization, which means a good description of the set that I could find a formula to describe the set from just one plane. |
| Tatiana Toro: | 07:57 | So I had a map that maps a piece of the plane, a ball in the plane, something completely flat, into the surface in a nice way. So, finding parametrization, finding ways of describing sets in our euclidean space, it's something that has proven very useful later on. That was, In some sense, that was my thesis. And later on, one of the things I've been interested and I'm going to give you, is a visual image of what it is. It's not exactly what I do, but |

imagine you have a dam and it's full of water, and then there's cracks and the water starts filtering, and somehow, the soil around the dam becomes wet. There is an interface between the dry soil and the wet soil.

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| Tatiana Toro: | 08:51 | And one of the type of things I do is look at interfaces. I look at interfaces between two areas where they're governed by a partial differential equation. And you may ask, "What's the partial differential equation?" It's the movement of the water. And on the other hand, the dry soil is not moving, it's just there, but somehow the boundaries of the wet thing is moving. And I cared about how fast it's moving, what's the shape of it, how regular is it, and things along those lines. |
| Evelyn Lamb: | 09:25 | That's a really vivid image. I live in Utah and I can picture some of the dams here in the southern part of the state. That's a great picture. |
| Tatiana Toro: | 09:33 | Yeah. Actually, that's one of the places I think when I do the scripture now, this. |
| Evelyn Lamb: | 09:39 | How have you overcome challenges in your career? |
| Tatiana Toro: | 09:41 | I only know that career ... There's been challenges of many types. Let's say ... I think grad school can be a complicated time, and you're working on a problem, it's the first time that you're trying to come up with something original. I gave a talk to middle school girls, and I had to explain what math was, and I tried to draw the similarities between mathematic and artistic creative endeavor and how ... So, when you do your math thesis, which is your first piece of art, and you have to be creative, and you have to come with the idea, and you have to bring it to completion, and that's not always easy. At some point I was very stuck. I felt like I had been working and nothing was happening. And you know, it's easy to find other things to do, even within math, that are not really helping you solve the problem you're supposed to. |
| Tatiana Toro: | 10:48 | So my advisor was ... It was interesting, was a very good judge of character, understood that I was at one of these crucial points where I was very stuck. If nothing happened, maybe I was gonna decide to do something else. And he had something that for many people might not have worked, was a very open, very stern conversation about what mathematics was, how difficult it was, but what was expected. In some sense, it was the first time I was stuck, and facing it. Realizing that, of course, in the big spectrum of things, important, but it's not the most ... |

it's not life and death. But facing the situation has often been a good way for me to deal with it, and understanding that doesn't happen only to you, but it happens to everybody.

Evelyn Lamb: 11:42 Yeah, I think people can feel very alone when they get stuck in grad school. You mentioned giving this talk to middle school girls, what other mentoring and outreach do you do?

Tatiana Toro: 11:54 Just for the record, the middle school talk was an invitation to speak at Pi Day, which was really, really fun. And a while ago, I did spend a lot of time working with elementary schoolkids. It corresponded to a period that my kids were in elementary school, but I ran math fairs for different Seattle public schools, and it was a way to show a different side of math, and to try to make sure that all kids, whether they were good at math or not, in the classroom they enjoyed math, and show them that they were able to do it and that they were good at it. My kids are older now, so one of the things I have been focused on ... and I want to put a date on it, maybe the last six years, is in trying to encourage underrepresented minorities, and in particular, Latinx people to go into the mathematical sciences.

Tatiana Toro: 13:06 Everything started ... and this might seem very obvious, but sometimes we don't see the obvious. Everything started because I was teaching a calculus class at the University of Washington and I noticed that I had a large number of latino students in my class, and some of them started coming to my office for office hours. They had to come because they were part of a program called CAMP. College Assistance Migrant Program is a thoroughly funded program that supports students from agricultural backgrounds during their first year of college. The goal of this program is to make sure that the transition from high school to college goes smoothly, and retention during the first year is a measure of success.

Tatiana Toro: 14:00 They started coming to my office, and they had to have their papers signed because you have to report their progress, and I started to know them, and they were going with other Latinx kids to my class and I thought, okay, there's a large number, but then the final exam came and I noticed that there were very few of them in the final exam. And then I talked to a couple of them, and, first of all, they explained to me that the other kids were not really in my class, they were just attending my lecture, and that for them it had been very important, in particular, the day of the final exam, where 240 kids were sitting in the same room, to walk in and see somebody like me there.

| Tatiana Toro: | 14:49 | Also, one of my TAs was Colombian. For them, having the two us there was very important, that they were afraid to go in this room where they felt so different. And it kind of hit me that the fact that somebody sees that I look like them might make a difference. And one of these kids actually kept on coming, and she asked me one day, "Could you please be my mentor? The truth is, I don't what a mentor is, but I think it would be good for me to have one." She graduated from the University of Washington a few years ago and she's currently a second year in medical school. Of course, she's first generation to college. |
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| Tatiana Toro: | 15:39 | But it was seeing her struggles and her successes, I think, that led me to talk to IPAM and initially to PIMS, the Pacific Institute for the Mathematical Sciences and Institute for Pure and Applied Mathematics about having a conference for Latinx in the mathematical science, and that's how the first conference happened in 2015. And then, we had a second one in IPAM at UCLA in March 2018. We had at some point over 250 people attended. That's one of the things I've been very involved in, in the last few years. |
| Evelyn Lamb: | 16:25 | And what are your feelings on Hispanic Heritage Month? |
| Tatiana Toro: | 16:29 | That one is complicated, and I knew you were gonna ask me this question. I've given it a lot of thought. In one hand, it is important to celebrate the community. On the other hand, one of my concerns is that, okay, we celebrate this community or a different community for a month, but then we don't ... that doesn't mean integration. We cannot forget about them for the other 11 months of the year. I don't know, I have mixed feelings. I think one of the things that's very different, though, and that I'm very aware of ... And I, of course, I only see one side, is that I wasn't never called Hispanic before I came to this country. |
| Tatiana Toro: | 17:25 | I was never looked at differently until I came here. Colombia is a very mixed country, I think. If you're very dark skinned, then it's different, but there's all shades. This is something that I only became aware of when I was 23, and it's very different than if you grew up in this environment, and then, maybe, in that sense the celebration makes more sense, but I honestly don't know. I know it's not a satisfactory answer, but it's the answer. |
| Evelyn Lamb: | 18:02 | Do you have any advice you'd like to give to students who are interested in math? |

| Tatiana Toro: | 18:06 | Yeah, actually, not only interested in math, what I tell my students is to follow their passions. If what they like is math, but they're not sure what comes up from doing math, it doesn't matter. Follow your passion and ask, and things will work out. I wanted to do math and I had no idea. I had no idea you could make a living doing it. And I think that if you do what you love, things will fall into place and will work out very nicely. And don't give up. Persevere. And you should know that you're not alone. That when you're facing difficulties, many people face similar difficulties. Maybe nobody talks about them, but it's important to find somebody you can talk to about them. |
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| Evelyn Lamb: | 18:55 | Thanks so much for taking the time to talk with me. |
| Tatiana Toro: | 18:58 | Thank you very much. |
| Evelyn Lamb: | 19:00 | Thank you for listening to the Lathisms Podcast. It's produced by me, Evelyn Lamb, and made possible by a Tensor-SUMMA grant from the Mathematical Association of America. Our music is "Volveré" by La Floresta. Lathisms is an initiative to celebrate the accomplishments of Hispanic and Latinx mathematicians. It was founded in 2016 by Alexander Diaz-Lopez, Pamela Harris, Alicia Prieto Langarica, and Gabriel Sosa. You can find more information about the project at lathisms.org. That's L-A-T-H-I-S-M-S dot O-R-G. Join us next time to hear from another inspiring mathematician. |