Evelyn Lamb: Hello and welcome to the Lathisms podcast. I'm your host Evelyn Lamb. In each episode we invite a Hispanic or Latinx mathematician to share their journey in mathematics. Today I'm happy to welcome Erika Camacho to the show. Hi. How are you?

Erika Camacho: Hi, Evelyn, I'm doing good. Thank you for having me here.

EL: So can you tell us a little bit about yourself?

EC: Yes. So currently I'm an associate professor at Arizona State University, and I'm a professor of applied mathematics. And one of my biggest passions is to mentor and encourage young people to go into mathematics, even if they don't become mathematicians, but to really get a solid foundation in mathematics.

EL: And what were your early experiences with mathematics? Did you always have an interest in it when you were a kid?

EC: Well, it's interesting. So I am an immigrant from Mexico. So when I came to the United States, with math there is no language. Math is a universal language, so it was something that I didn't feel intimidated by. It's something that I didn't feel like I wasn't sure of as much as with other any other discipline. And this is when I was in elementary school right? So for that reason I tended to gravitate towards more mathematics, but I was not super passionate about it, I would say. I mean, it was something where I felt more confident, but it was not something that I thought was going to be the path that I was going to take. It became the path when I was in high school and I met Jaime Escalante, who has been featured in the movie *Stand and Deliver.* And he was the one that really carved the path that I have been following for over 20 years now. He was the one that used to say that mathematics was the great equalizer, that it was going to allow us to go from poverty to a better life, not only that but also have the opportunity to be able to empower others and to be able to change the world, to change society. And he said, “You know, mathematics is in your blood, from the Mayas, from the Inca, from the Aztecs, you always had that quantitative and mathematical thinking and intuition, so you’ve got to dig in and utilize it. And with him I realized that with hard work, discipline and ganas, yes, I could achieve anything I wanted. And ganas means the desire to succeed. So he really instilled in me a passion for mathematics, but most important, a passion for really changing the world, really doing social service, for realizing that any kind of opportunity I have was not just there because of my own merit or because I’m that great but mainly because someone cared about changing the worldm someone took the initiative and did a lot of hard work to create an opportunity, so that I have to do the same. And I try to instill in my students and my mentees the same kind of thing, a passion for, you know, mathematics and qualitative kind of thinking, but also a passion for having some kind of responsibility toward society and trying to do social work and service in any way they can.

EL: So when you went to college then did you immediately become a math major?

EC: So initially I was, I think, well, I mean I wasn't sure what I was going to do. I thought I wanted to go be an engineer. So when I when I was in high school I remember one of the things that Jaime Escalante used to do, he used to bring his past students who were now engineers in some of the engineering companies in Los Angeles area, and they would come and talk about the work they were doing, the lifestyle they had, the environment they lived in, and everything was very appealing, from the work they were doing to the type of life they lived because living in a poverty is not a very appealing thing. But listening to them and realizing how their lives changed completely, I remember wanting to do that. And after one of their his students was

there I remember telling him, “Kemo,” because that's what we would call him, and Kemo is for Kemosabe, the one who knows it all, “Kemo, I want to go to that university where your student went to, uh, T-My-T.” And he said, “No, Erika it’s at MIT, it’s not T-My-T, it’s MIT.” “So yeah, I want to go there.” And then he said, “Well Flaca,” because he would call me the skinny one, he said, “If you stick with me, I will take you all the way to MIT. You just have to stick with me and work hard.” And moving forward for 20 years, so I applied to MIT for graduate school, not for undergrad. (I didn't feel confident enough once the time came to apply for colleges.) I didn't get in but 20 years later, which was just a few years back, a few years ago, I actually was at MIT as a visiting scholar and professor, so I was there teaching for a year in MIT. And it was an incredible experience, but what I realized is that Jaime Escalante, who is no longer with us, kept his promise.

So I remember that I said I wanted to be an engineer, but I didn't feel confident enough. I ended up going to Wellesley College, with which is an all women’s college in Massachusetts, and it's just 45 miles away from MIT. And I went to Wellesley College because being a product of public schools and always being in public schools, I wanted to know what it was to go to a private institution, and to go far from what the public institutions that I've been attending K through 12, and what more different than an all-women's college? Once I got to Wellesley College I realized that the workload was very intense. I was not as prepared coming from a low-performing school. I needed to catch up. There was a lot of work I needed to do. And at that point I I realized that the reason why I had always said engineering is because what I really love is math, and not only that I was taking a physics course for engineers and it didn't go so well, and I didn't have a professor that was very supportive, and in fact I didn't I didn't have a lab partner. I was assigned a lab partner, but when she realized that I was Mexican, she didn't want to work with me because she said that people like me will bring her grade down. And I went and I talked to the professor, and he said, “Well, I don't know why we keep accepting people like you who are not going to make it. I don’t blame her for not wanting to work with you. It is your problem now, so you figure how you're going to get those labs done.” So it was very difficult to do the labs for myself because there was a lot of estimating, a lot of guessing, a lot of running across the room while I'm taking a measurement and then trying to record it. And I passed the course, but I put so much effort, and I felt like it I was just always just hanging there rather than really performing to the best I could. I never felt like that in mathematics. I felt a confidence, so I continued to go with math. In fact, I also start to like economics because I got to see, especially in macroeconomics, some application of calculus and how calculus is used to solve economic problems, so I became a dual major in math and in economics.

EL: And then what made you decide to go to grad school in math?

EC: A summer REU experience. So when I was at Wellesley College, I thought I was going to go to Wall Street. Coming from poverty I though, like many of my friends, why we go to school is really to get out of poverty, to really change drastically the economic status and the environment where we live in. And many of the Wall Street companies would come in to Wellesley College and interview and hire their students, especially economics majors. So I thought I was going to go to Wall Street and investment banking. And so at the end of my junior year I went to an REU program. I got to see the power of mathematics. So I worked in a group, we and we modified an existing model of HIV, right, and how it progresses. And we try to also come up with a component for different therapies, and we used differential equations to model it and to analyze it in some coding and computer simulations to understand it. But then the power is, I felt very accomplished during the summer and at the end of the summer. But a few weeks later I remember getting a *Time* magazine. Looking at the *Time* magazine, on the front was the model of Alan Perelson, which was the HIV model that we had built our work from, and that we had

tried to modify. And for me that was very powerful, to realize as an undergrad that I was working in an actual model that was being utilized by researchers, right? And so Alan Perelson at that time was in Los Alamos National Lab, but he was working with researchers who tried to find therapies for HIV and different kind of a cures for it, and that's when I realized, well, I could do so much more in terms of really impacting the problem and doing really a service to society if I go into mathematics than if I go into investment banking, you know, into anything like that. And not only that, I also was very impacted by the mentoring I got in the summer program, in the summer REU. While I was in Wellesley, I was only one of two Latinas in the entire math department, and I always felt very lonely, especially when it came to talking to my professors. I felt like I was the oddball, like they didn't understand me. I went actually to an area where there was actually underrepresented minority faculty, so for the first time I've seen mathematicians they look like me. And not only that, some of the students were students there were Latinos that came from low-income backgrounds, from poor backgrounds just like I did, so I really felt like, "Wow there is a place for me in mathematics. There is a community and I feel supported." When I was in undergrad there were many times then teachers would tell me, "Oh you should just become a Spanish major, you should just become a Latin American Studies major, because, you know, maybe math is not for you. And the funny thing is the teachers that would tell me that were teachers where I was getting A's in their class.

Or when I was applying to graduate school, I remember going to a faculty and asking her for a letter of recommendation. And I thought, "I admire her, I respect her, and I've gotten A's in her class." I thought, "Well she probably would write me a strong letter." She said, "You know, Erika, I think you will do just fine being a K through 12 teacher. I don't think there's any need for you to go to graduate school. And I'm not even sure if even a Masters you're going to be able to make it." And I remember when she said that and I went back to my dorm, I cried, and for a few days I thought, "You know what, who am I to think that I'm going to make it to graduate school? Who am I to think that? I don't have a chance." But then, you know, I remember what Jaime Escalante told me, and I remember what many mentors have done for me, and I thought, "Heck! I'm going to try, and I'm going to keep on going until they kick me out." So I went ahead and I applied to graduate school, and like I said, I applied, and it was not just the love of mathematics, but more important, seeing the necessity of we need to have more individuals who can empathize with students that come from different and diverse backgrounds and knowing firsthand what it is when you don't have those faculty, when you don't have that support, is what really made me go through to graduate school and go in on.

EL: In your career you've done a lot of mentoring of people from all different backgrounds. Do you have advice that you give them about overcoming challenges, either in their academic work or in other parts of their lives?

EC: I do, and I give them a lot of advice that I wish someone would have given me. One of them is make sure that you build relationships with not just one faculty or a few faculty but with many of them. Not just from your institutions but from other institutions. Build relationships with your peers because your peers will also become your mentors. A lot of my mentors are my peers, and there's times when I mentor them, there's times when they mentor me. But also, like I said, the most important thing: don't let anyone define you. You're the one that has the power to define yourself. And while you might not be doing good in one course or in one subject matter, that does not define you. That just means that whatever that course you're taking or whatever that class and that professor, their teaching style does not match your learning style. But if you really want to strive for certain dreams and certain goals, you should go for them you should not let anything stop you because many times making it, being able to get a Ph.D. in mathematics, is, of course intelligence plays a role, but resilience and the ability to not give up is what really

plays a bigger role in you being able to get that Ph.D. So I always tell them that, and I always stop don't be afraid to ask, to ask for help, and not just in one place but in multiple places because there will be someone there. You might have to knock at three doors before one of them opens, but there will be someone there who will be willing to open the door and not only allow you to walk in but take you under the wing and really fight for you and really be there for you. When people ask me, “How was it that you were successful?” I think I grabbed every opportunity that came my way because you never know when they're going to come again. They might never come again, so if there comes an opportunity that you know that you would like to explore or they you've been waiting for, you grab it and you run with it, even if you're afraid of it. I always tell them that because I think it is important to understand that. And when the opportunities are not there, you create them. You make those opportunities. There have been times where there's not opportunities that are coming my way, there's not opportunities there for me, and there's things that I want to do. So what do I do? I create them. And sometimes I pair and collaborate with other people who have more experience, who are at a place where they're able to actually be successful in what I'm trying to do, and I collaborate with them in creating those opportunities.

EL: So you've mentioned that your first applied math research was modeling HIV. What is your research now?

EC: It is modeling degenerative diseases, of the eye in particular focusing on receptor degeneration, and trying to understand what are the mechanisms that are key in the progression of retinitis and how can we stop it. And mainly I focus on retinitis pigmentosa, but I've also work on retinal detachment, and when that is not reattached on time, what happens to the photoreceptors? How do they degenerate? But I also work on other properties related to the degeneration.

EL: And I'd imagine that that involves an interdisciplinary network where you're working some with mathematicians and then some with biologists to kind of tell you how the eye works and that kind of thing.

EC: Right. A lot of the work I do is very collaborative, it's very interdisciplinary, it’s working with other fields and other experts. So not just doing mathematics in the corner by myself, but it’s really working in team and doing team science. And some of these teams are actually pretty large and involve a lot of people because from one end it is really understanding where the different components play a role but then also performing experiments, testing things, and then going back and forth, back and forth in this communication. And in each end, especially in the experimental side, there's a whole team that is working on the things that we are discovering and we're trying to move forward.

EL: So both in the way that you talk about collaborating in your research and the importance of mentorship in your career path, you know there's this stereotype about math that mathematicians kind of lock themselves in a room and work all by themselves, and it really shows that math is often done by much larger networks than just one person.

EL: Absolutely. I think that it's a social activity. I mean, there's a lot of learning, there's a lot of creativity that goes into creating certain kind of mathematical models, analyzing them. Sometimes when you’re analyzing them you realize that the tools that you currently have are not the appropriate ones and there's not some that exist, so you have to create new tools. In that case sometimes it means calling more mathematicians. It might mean more theoretical, it might mean more pure mathematicians to help you find a way to analyze a system, find certain

methods that are not there, certain techniques that are not there yet. So I think mathematics is more of a social activity, more of a creative activity, than one would think. And like I said, in my work, I collaborate with different, not just with mathematicians, but also with other disciplines, with other experts. I collaborate with the Vision Institute of Paris, the Eye and Ear Infirmary of Massachusetts in Boston, and with other medical centers as well. Ao it is really a collaborative effort. I think that trying to really get insight into complex problems calls for everyone to be at the table, calls for a very diverse group of people to come into the table with their expertise, their perspective, and their experience and be able to tackle the problem. I think many times we think about, oh, all that matters is the knowledge of the subject matter that you have, but your experience, your upbringing, brings a different perspective. It is not going to change the way you do mathematics, it's not going to change the way you are you're going to apply a particular method in a discipline, but it's going to change the approach and the possibilities and the angle that you take.

EL: Well thank you so much for sharing a little bit of your time and talking about your story. I really enjoyed talking with you.

EC: Thank you very much, Evelyn, for having me. I really enjoyed having this conversation, and I think this effort is really important, and I think it is really going to open the pathway for many of our young generation of students, and I think is really going to hopefully entice a lot of more students to go into mathematics.

EL: 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 Gabrielle 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.