**Proving Theorems, Not Stereotypes**
By Katherine Lasonde (Dartmouth College)
Interviewee: Lisa Piccirillo (Massachusetts Institute of Technology)

This knot crosses itself a mere eleven times and appears innocuous at first. For every knot with less than thirteen crossings, mathematicians have determined a property termed “sliceness.” Every knot, that is, except for the Conway knot.

Dr. Piccirillo's broad smile immediately struck me when I joined her Zoom room, and my apprehensions melted away. Somehow full of energy on a Friday at 5 pm, she was approachable and eloquent. Dr. Piccirillo was nothing like what I imagined to be a mathematician to be.

But then again, she never thought she would be a mathematician. While Dr. Piccirillo had a passion for numbers growing up, she didn't consider herself “mathy” until she took linear algebra in college. In this course, Dr. Piccirillo spent hours working through proofs, wholly unencumbered by real-world constraints, and became enamored with theory. After attending a low-dimensional topology seminar late freshman year, she says that she was "mind-blown."

“This was something that I could do 364 days a year… and be excited about every day,” she says. Yet, Dr. Piccirillo was still hesitant to pursue a Ph. D., much less a career in mathematics. She didn’t consider her a stereotypical antisocial and competitive math nerd. She was collaborative, social, and outgoing: "As an undergrad, I didn't have any peers who were taking math seriously… I didn't know a lot of grad students or mathematicians personally. And I had this idea that they're incredibly nerdy, introverted. That wasn’t me."

However, she didn't let her self-doubt stop her from taking more courses and further exploring the world of math as an undergraduate. Topology was far too enticing. She attended a Research Experience for Undergraduates (REU) at Cornell University to give mathematical research a chance. There, she found a friendly and like-minded group of friends and realized math could be for anyone. There isn't one way to look or act to be a mathematician – all that is required is a love for numbers.

In retrospect, Dr. Piccirillo recommends that students who feel isolated in the field of math actively look for new, supportive math communities. They are out there! Even though some corners in the math world are competitive and egotistic, there are just as many uncompetitive and caring communities.

Furthermore, Dr. Piccirillo has realized that as you get older in the math community, members tend to become more social and friendlier. While many of her undergraduate peers seemed aggressive and antisocial, her current peers are always patient and open to helping. “Find a community where you thrive,” she says, because you will be happier and do better math.

As Dr. Piccirillo described her difficulty with finding theoretical math communities, my mind immediately connected her experience to my own. At Dartmouth, I am in a quantum computing research group composed mainly of graduate students. The other group members are outstanding, but I have little in common with them outside of research. While I have yet to meet many other undergraduates and friends in the field, Dr. Piccirillo's words have reassured me that these communities are out there.

Even after finding a community where she thrived, however, Dr. Piccirillo still doubted whether she had what it took to be a great mathematician. After her REU, she applied to a few graduate schools and was deciding between the University of Texas and another school. While Dr. Piccirillo knew she would

do better math at the University of Texas-Austin, she didn't know if she had the talent. Dr. Piccirillo did not consider herself a genius -- she might be more comfortable at the smaller school. Ultimately, though, receiving a National Science Foundation Fellowship pushed her to take a chance on herself and attend UT-Austin.

While there, Dr. Piccirillo practiced applying creative solving techniques to problems outside of her regular classwork. She stumbled upon a fascinating knot and solved it as she would any other practice problem. And thus, after school, in less than a week, Piccirillo solved one of the most challenging issues of her field: The Conway Knot problem. Her proof is widely regarded as a work of beauty.

For a long time, Dr. Piccirillo wasn't sure she could be a mathematician, and now she is a world-class low-dimensional topology scholar. She exemplifies that mathematicians and "geniuses" are derived from all backgrounds, personalities, shapes, and sizes. Not only can anyone be a mathematician, but anyone can be a *world-class* mathematician. Prove theorems, not stereotypes.

Dr. Piccirillo tells students struggling with believing in their abilities that "there are no geniuses. No one is smarter than you if you go carefully." Students should do math "slowly and methodically, reading and speaking carefully." The best math is born through hard work, not natural ability. Perseverance will take you farther than natural talent ever will.

Here again, I couldn't help but notice parallels between my own experiences and Dr. Piccirillo's experiences. Coming into Dartmouth, I anticipated being an engineering major. I didn't enjoy physics, and I had no desire to take more than the bare minimum of physics courses. However, in my freshman year, a research program at Dartmouth paired me with the physics department's quantum computing group. Despite being new to the field and never the strongest physics student in the room, I have fallen in love with the subject. While I may not contribute as immensely to physics as Dr. Piccirillo has to math, I won't know until I try.

Dr. Piccirillo doesn't fit the typical mold of a math researcher. She is interested in traveling, bouldering, vintage motorcycles, running, and drawing! And yet, here she is, a Professor at MIT researching three and four-dimensional manifolds. Dr. Piccirillo pushed on, found communities in which she excelled, and overcame her self-doubt and hesitation. In doing so, she made a massive contribution, and without her, the Conway Knot problem may still be unsolved. If you have a passion, go for it. Anyone can do remarkable things.

**Short (approximately 100 words) biographical sketch of the student contestant. This biographical sketch can be written in the first person, and it should include the student's name, grade level, school, and mathematical interests**

My name is Kat Lasonde, and I am a sophomore at Dartmouth College. I am incredibly interested in the intersection between math, engineering, and physics, and I love to derive and analyze equations based on real-world systems. Fourier series and harmonic approximation is mind boggling to me.

In my free time, I research quantum computing in the Whitfield Group and am a teaching assistant for Data Structures. I also love to run, hike, and try new foods! If I could eat one food for the rest of my life, it would easily be pan-roasted brussel sprouts.

My address is 622 Central Avenue, Wilmette, IL 60091. I can be contacted at (847)707-4695 or katherine.f.lasonde.23@dartmouth.edu. Dr. Piccirillo is reachable at piccirli@mit.edu, and her mailing address is her office: Room 2-275, 77 Massachusetts Avenue Cambridge, MA 02139.