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Revealing Luz: Illuminating Our Identities Through Duoethnography

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Abstract

Hispanic Americans make up 15% of the current US workforce, but they only account for 7% of the STEM Education workforce [8]. One effective way to reach this population, particularly Latinas, is by providing stories and ethnographic biographies of successful Latinas they can relate to. It is important to note that Latinas have been earning Ph.D.s in STEM disciplines outside of the US much longer than US-born Latinas have been earning them inside. Thus we offer the story of a mathematics educator from Peru, Dr. Luz Antonia Mendizábal Gálvez de Rodriguez, a girl who was given a chance to be educated, and whose education opened doors for her and for those she influenced. She earned her Ph.D. in Mathematics Education while raising eight children and working full-time, and later in life became the school superintendent in Lima, awarded a prestigious national award for her teaching and service. Through a narrative that is part biography and part duoethnography, we chronicle milestones in her journey and explore the intersections of her life with the lives of two other US-born mathematics educators, ourselves. We conclude with some thoughts on revising the storyline by presenting new narratives to empower our communities.

Keywords: *Latinx, Latina, mathematician, color, indigenous, Inca, Inka, civil engineering, Peru, Hispanic, South America, academia, motherhood, Ph.D., education, duoethnography*

A Beginning

One day, on the streets of Huancayo, three little girls were walking down the street from the grocery store. They were dressed simply in old clothes, but they were clean and very well mannered. A nun happened upon them and exclaimed, "What beautiful and well-mannered little girls! Are you going to school somewhere?"

The girl in the middle, Luz, was the oldest and had her two little sisters by the hand. She timidly replied, "We would like to go to school, Mother, but we can't afford to go to school." The nun was touched by the sweet and well-spoken response and asked to accompany them to their home, where she could meet their parents.

Luz was delighted! The nun explained the idea to the girl's parents. Their father replied, "I am grateful for your generous offer, Mother, but we have been doing well educating our daughters ourselves."

"Please, call me Sor Bruno. I am pleased to meet you. It is clear that you have been doing an excellent job teaching your daughters. They are well-spoken and well-mannered. However, we would like to teach them science, arithmetic, geometry, and many other subjects. We have experts in many fields. We would consider it an honor to teach these fine young children."

Luz was astounded that Sor Bruno was able to sense that Papa Albino's pride needed to be stroked, and that she was able to diplomatically handle her father so well.

Her father started puffing up with pride at her characterization of his family and a hint of a smile touched the corners of his mouth.

"Sor Bruno, Thank you. I will consider it."

After Sor Bruno left, the mother and father discussed the idea at length. As generous as the offer was, they realized that they could not afford the uniforms nor the books and school supplies required to go to school. Sadly, Luz realized her dreams of going to school were not going to materialize.

The next morning, there was a knock at the door. Luz was shocked to find the same nun at the door. “Señor Mendizábal, have you changed your mind about letting your daughters go to school?” The father explained their situation.

“Please, Señor! You will not have to concern yourself with any of this. I fell in love with your daughters the moment I saw them. Please, let us teach them at our school!” And so it was, that because of the kindness and generosity of this nun, Luz’s dream came true.

Introduction and Context

Marizza: I have heard the story of the nun who gave my grandmother and her sisters an education more than a hundred times. As a young child, my imagination was so active that I could almost see their homemade, well-groomed clothes and the street on which they walked. Of course, I have heard different versions of this story from various relatives, but the core remains the same.

The protagonist in our story later becomes Dr. Luz Antonia Mendizábal Gálvez de Rodríguez. The quote above is a retelling of a story she told many times to her children and grandchildren. What follows below is a recounting of her life gathered through family interviews and deeper research to confirm details of her life. After compiling a short biography, we use it to reflect on her story and our own stories, exploring intersectional emergent storylines of family, education, identity, a sense of belonging, community leadership, and impact. We know that non-dominant students have a lower sense of belonging in college [7], and narratives are an important way to investigate the interplay between learning, culture, and identity [16]. Our goal is to use the stories of our past to expose hidden storylines and challenge narratives about belonging, to allow readers to more readily claim their potential identities as mathematicians.

The intertwining of three stories

Because we would like the reader to know Dr. Gálvez de Rodríguez as personally as we know her or have come to know her, we shall continue her narration as just Luz.

Her story starts in a little mining town in Peru called Huancayo, in 1916. Manuel Albino and Belen Gálvez Mendizábal had six children, Luz Antonia (b. 1916), Alicia Maria (b. 1919), Hortensia Niteza (b. 1920), Hermenia Delfina (b. 1922), Maria Amelia (b. 1924), and Louis Antonio (b. 1930).



Figure 1: Luz Mendizábal at 15.

Albino lost his hand in a mine explosion. Mama Belen was a telegrapher, which was unusual at that time because most housewives didn't work and were not educated. Later, "Papa" Albino found work for the state as a prohibition inspector (rather unpopular profession at the time). In general, this time period is tumultuous for Peru, on the verge of an economic depression and experiencing a number of consecutive military coups. The three little girls referenced in the story were Luz, Alicia, and Hortensia, Luz being the oldest. The nun was Sor Ernesta Bruno. Their order, Maria Auxiliadora, known as FMA for *Filiarum Mariae Auxiliatricis*, was heavily involved in the education of young people around the world. Many schools were chartered by FMA, in particular by Sor Bruno during this time [1]. In 1922, Sor Bruno established a school in Huancayo with five other nuns. They leased property in Huancayo for five years, and so we know that sometime between 1922 and 1926, the life of this little girl in Peru changed forever.

This story starts in many places at once, both in lifetimes and in countries. We, the authors, find ourselves intertwined with the story of Luz for so many reasons. We are all three Latinas. We are mothers. We are teachers of mathematics. All of these commonalities draw our story close to hers, and yet our stories converge even further.

Marizza: I was fortunate enough to have Mami Luz live with me from the time I was 12 until I was 18. She was not only well versed in mathematics, but also in physics, history, chemistry and literature. I loved going into her room and talking to her about everything and anything. Mostly, I loved hearing the stories of her life and how she overcame adversity. She was so strong and had such a positive impact on everyone she met and she helped me see the beauty of math.

I remember when I was in Pre-Algebra in the 7th grade, since I could do most of the algebraic steps in my head, it was hard for me to understand what was meant by "showing all of the steps." My teacher was very severe and, although my answers were correct, I was getting zeros on my homework assignments. When I complained about this to Mami Luz, she began showing me the various proofs of the Pythagorean Theorem. She asked me to write down the proofs and explained that this was how mathematicians communicated with each other.

She taught me about the origins of Algebra and we discussed how difficult it must have been for the Greeks to write proofs without algebra. I was so fascinated by the story, that I completely forgot about being upset with my teacher. That evening, rather than give up, I became more determined to show all of the steps in my work. It was conversations, like these, that kept my passion for math ignited.

Carrie: It was years later, when sitting in a lecture at the Institute for Teaching and Mentoring that I realized why it was so important for me to seek this story. Another Latina Ph.D., Caroline Turner, was talking about her own career path. She started her talk by recounting the farm in California on which she was raised. It was a story that infused a sense of place and a sense of mission. For me, my sense of place lies in my community, and Luz is part of my community (both by blood and by identity as a mathematics educator).

Duoethnography as an Emergent Methodology

Carrie: I initially pursued Luz's story as a biographer. It was prompted by a family reunion in Peru, and my dad suggested that I could connect with and learn about Luz's story by meeting her family and understanding her place. He urged the family to start contributing stories and pictures through email, I began assembling a timeline of significant events of Luz's life through what family members knew. I then sought to verify, and in some cases, to augment the information provided through electronic correspondence through additional sources. It was during this process that my father suggested searching you out, Marizza, as an accomplice in this endeavor; someone with common interests in sharing the story, but with more first-hand knowledge and artifacts to share. Although you were an extended family member who grew up on the other side of the country, and we did not know each other well, I felt like we quickly formed a bond by this need to share Luz's story.

We transitioned from biographers to duoethnographers when you suggested that we, individually and together, reflect on portions and milestones from Luz's life. The evolution of this narrative research trajectory is itself part of duoethnographic methodology [13, pages 60-67]. Where ethnography seeks to study someone else's story and autoethnography seeks to reflect and gain insight on one's own story, duoethnography asks readers to reflect together on their stories — on their similarities and differences — in an effort to go beyond an individual narrative. Throughout the project, we met via Google Hangout and wrote collaboratively, both synchronously and asynchronously, using Google Docs. After we had written the biography portion, we partitioned the story by particular milestones in Luz's life, and one of us would start a freeform written personal response to that part of her life, and then the other would either respond immediately, or discuss the reflection during a meeting and then write a response reflection. The active discussion component, which ultimately revisited each partition and corresponding reflection multiple times, often resulted in new insights which would be incorporated into the duoethnographic written reflection portion. As our process only gradually evolved into a duoethnographic investigation, we did not record our synchronous collaboration sessions but did capture much of the reflection revisions and discussion through chats, Google Docs notes, and editing history.

While we share similarities as family members, as first generation Latinas, and as mathematics teachers, we also have distinct differences, both in the paths we took to become mathematicians and in our relationship to Luz.

Marizza: Mami Luz was an incredibly strong influence throughout my life. She was more of a second mother to me than a grandmother, which means that my observations and reflections are actually treasured memories. Both of my parents are Peruvians, so I'm fluent in Spanish, and my Peruvian heritage is a large part of my identity. Since my father was a mechanical engineer working for a company affiliated with the oil industry, I lived in Iran and Venezuela in my early childhood years,

and we traveled to Peru every summer and Christmas, so even before Mami Luz moved to California, I had a close relationship with her. It was probably her success and passion for her high school students that led me to consider teaching math in high school.

Carrie: My path led me to become a professor in mathematics with a specialization in science and an interest in education. Luz was only mentioned to me when it was discovered that I liked math, and I just recently learned the details of her life. To me, each observation is a new discovery, and I feel like I'm discovering myself through her story. I, also, have less native fluency than Marizza and only recently traveled to Peru during the research of this story. Therefore my journey is also one that searches for Luz's sense of place as well as my own.

The result was a fluid collaboration, in which we quickly bonded during our frequent correspondence. We participated in our shared vulnerabilities of duoethnography [13, page 11], some of which is captured here as we reflect on the obstacles we confronted during our time in the Ph.D. program in mathematics. Some complications were due to juggling the responsibilities of motherhood and the amount of work required to succeed in a Ph.D. program in mathematics. Sometimes the problems arose from combating stereotypes about women or the loneliness of being part of a "small N" of Latinas in mathematics.

With this duoethnographic approach to the biography, we explore how each us found mathematics, how the family has been an essential feature of our journeys, and how each of us has engaged in mathematics teaching community leadership. A visit to Peru resulted in most of the historical information and photographs of Peruvian sites shared in this paper, and this visit also spurred a deeper meaning for the article itself. Thus, the story transitioned to exploring a broader historical and social narrative to reclaim something that was always-already-there [2, 12]. The emergence of decolonization as a way to further gain agency in our identities as part of the effort to connect the narrative research with the broader social context [9, pages 1-14]. This interweaving of narrative, identity, and social justice is at the roots of the duoethnography as a research methodology [15, pages 4-10].

In the next section, we will progress chronologically through the parts of Luz's life that are relevant to this piece of her biography that we chose to explore - an overview of her journey to mathematics and teaching mathematics, her education, and her leadership of the educational community while at the same time raising a family in the context of 1900s Latin America. Each of the narrative sections is followed by snapshots of conversations that occurred as we reflected on her stories. It was through research, reflection, and dialogue that we were able to analyze our own stories and identify shared components of our identities. The process should continue with the reader reflecting on the stories below and beginning a dialogue with colleagues and family members. Just as we questioned and pushed each other to open up and reflect more deeply throughout this process, duoethnography expects you as the reader to propel this conversation further and discover your own "always-already-there" identity [15, 2].

Dr. Luz Antonia Mendizábal Gálvez de Rodríguez

Luz loved learning and sharing the love of learning that was shared with her. Since the injury of her father left Luz's family in economic hardship, she decided to begin working odd jobs at the age of 6 to help support her family. To her delight, the education she was afforded earned her employment at Maria Auxiliadora as a substitute mathematics teacher at age 15. Many years later, during an interview in 1997, she shared that she was always excited when they called her into teach, because it was something she loved to do from the very beginning.

Carrie: I, too, have always felt this way. My own mother returned to college later in life, and I would help her in her math classes. I tutored my younger sister, and by 14, I was tutoring other high school students in math. I have always had a passion for it. Mathematics sometimes came easy, sometimes not. But when I made a breakthrough, the clarity of it was something I wanted to share. When did you first realize you wanted to teach math?

Marizza: I became addicted to teaching at the same age. I started off tutoring at 14, as well. Once I started tutoring, I couldn't get enough.



Figure 2: Pedro and Luz Rodriguez and family. Pictured are their eldest five children: Maria, Pedro, Jesus, Luz, and Rosa.

By the age of 18, Luz was working full-time as a teacher. In 1939, she married a lawyer, Pedro Rodriguez. They had eight children together, passing on their love of learning. Her daughter, Maria, recalled them saying, “We are not going to leave anything to you but your education.” During this time, while raising a family and working full time, she continued her education at the University of San Marcos in Lima.

Marizza: The beginning of my journey as a mother and mathematician is difficult to talk about, not only because of all of the prejudice I encountered but because of the events that led to my return to school.

Although I was still a full-time student after my first daughter was born, my marriage with my first husband soon became dangerous.

I filed for a restraining order and took a leave of absence from the university until the situation became safe for my daughter and me. It was during that tumultuous year that I learned I was carrying his second child. One year later, I applied to return to the university with a 15-month-old and 9 months pregnant. An administrator in the math department who was reviewing my application suggested that I change my major because it would be too difficult for me to earn a degree as a single mother of two young children. I insisted that I loved math and didn't want to major in anything else. She explained that a math degree was harder than most other degrees and that I could major in education or psychology. When I asked if there was anything in my application that would prevent me from being accepted as a math major, she relented.

The belief that I could accomplish this goal and the strength to complete it came from the knowledge that Mami Luz achieved a degree in mathematics while simultaneously raising a large family and working a full-time job. After finishing my undergraduate degree in mathematics, it was this strength that pulled me through 4 years of Ph.D. work while raising 4 children with my second husband. It was also this strength that helped me cope with the sudden retirement of my Ph.D. adviser while I was advancing to candidacy and the painful decision to discontinue my education. Thankfully, it led me to teach high school mathematics like my mother and grandmother before her. Carrie, didn't you have children while you studied math in grad school? What was it like for you?

Carrie: I did not know that Luz was juggling so much! That is incredible grit to pursue further education while raising a family and working full-time, though I imagine her husband's support was crucial, and I am impressed that you did it without. This seems to be a common idea for Latina families pursuing the "American Dream" even in the US — the idea that education is important enough to pursue for the sake of your family, not in spite of it. Both of my parents went to college non-traditionally, while raising a family, so the idea of having a family and going to

school was more normalized for me, despite advice I sometimes received to the contrary. I married while in college, and had two children while pursuing my Ph.D.. I often felt foggy and scrambling to balance grading and research with playdates and nursing. And that was just two children, not eight while working full-time! I too, struggled with finishing my Ph.D., wondering if I should just pursue teaching full-time. It was really difficult, but I did have the support of an amazing husband, and at the time, I was a primary breadwinner, so the monetary value of finishing helped incentivize my persistence. I wish I had known this part of Luz and been able to reach for her memory in times of doubt. It is yet another example of how Luz is a part of my community, but also someone with whom I can relate and admire. And her story is full of more accomplishments yet!

Marizza: Yes! I love that idea! I think many people “pursue education for the sake of the family, not in spite of it.” My daughters are now older than I was when I had my first child and sometimes will express sympathy for what I had to endure while going to school full-time, working part-time and raising a family. The truth is that once I was a single mother with two children, I knew that the only hope that I had to support my family was to finish my education. On the nights when I had four hours of interrupted sleep, it was the fear of not being able to provide for my babies that pulled me out of bed before they woke up so that I could study. On the nights when I wanted nothing more than to fall into bed after putting my daughters to sleep, it was the thought of Mami Luz’s accomplishment that pushed me to make a pot of coffee and study some more. I, actually, got better grades after I returned to school as a single mother than before I became a mom.

Of course, there were days when the money from part-time work, student loans, and grants wasn’t enough, and working full-time became tempting. On the days when I had to survive on one bagel, or left-overs of my kids meals, it was difficult to concentrate on math and I wasn’t sure I could succeed. However, the most difficult obstacle I had to overcome was the guilt;

the guilt for being in class rather than being with my babies, the guilt for playing with my children rather than studying, the guilt for working instead of studying or being with my children, and the guilt for not working full-time and giving my babies the life they deserved.

The University of San Marcos was arguably the most prestigious university in Peru and is the oldest university in the Americas, chartered in 1551. In the fall of 1961, Luz became Dr. Mendizábal Gálvez de Rodríguez earned her Ph.D. in Mathematics Education, with a dissertation titled “Two Didactic Forms in the Teaching and Learning Processes of Spatial Geometry.”

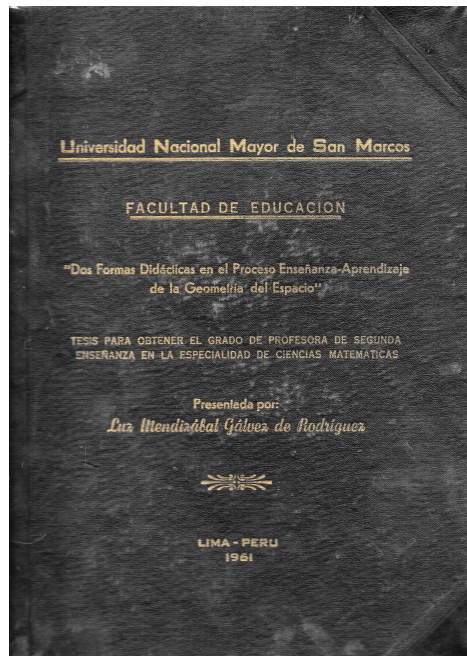


Figure 3: Cover of the dissertation of Luz Mendizábal Gálvez de Rodríguez.

While working at what is now La Institución Educativa Emblemática Teresa González de Fanning, a women’s school in Lima, she became math department chair in the school. Then she took the role of the head of scholastics studies, and finally in 1966, she was promoted and became the school principal. At the time, Teresa González de Fanning was a very well regarded school and one of the largest in the country.

Marizza: I still have her dissertation, and I read portions of it before every academic school year. In fact, during the teacher training, a crowd favorite is hearing about the results of her dissertation. This is another story I've heard hundreds of times.

Mami Luz started by following two groups of students for more than a year, collecting data from assessments they took and ensuring the assessments were diverse enough to analyze every learning style known at the time. She meticulously divided these groups of students into two classes with statistically equivalent averages on every assessment type on which she had data. She asked permission from the school director to teach these two groups of students Geometry in two separate classes using two completely different teaching styles. At the time, teaching with kinesthetic manipulatives and visual aids was all the rage. So, she proceeded to teach each group of students Geometry; one group was taught in a traditional lecture style, "with chalk and chalkboard, only" and without a single visual aid or manipulative, except what she could draw on the board. The other group was taught only using activities, manipulatives and 3-D visual aids that she created.

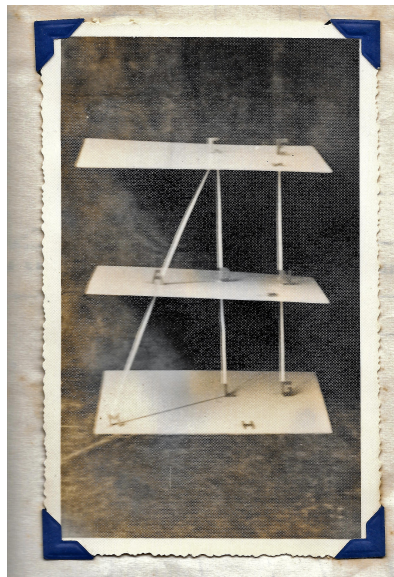


Figure 4: A photograph of a 3D-visual aid used to explain a theorem on lines intersecting three parallel planes.

After an entire year of teaching these groups and analyzing the results from the plethora of assessments she had designed, she found that there was not a statistically significant difference between their results. She was mortified. How was she going to defend this dissertation without significant results? Yet her adviser insisted that she stand in front of the committee and defend her dissertation. After her defense, the adviser stood up and announced, “Therefore, what Mrs. Rodriguez has concluded from this research is that there is no bad teaching method in the hands of a good teacher.” Her face was always filled with such pride when he recited his pronouncement. It is my favorite memory of her, and it is with this story that I end my teacher training as department mentor.

Carrie: I did not know anything of her dissertation work or even that she had received a Ph.D.. When I saw the picture Marizza shared with me from her dissertation, it reminded me of one of the first times I realized that I might actually pursue mathematics as more than just a hobby. I was in Calculus III and showed my professor a trick I had learned in high school to find the distance between two parallel planes. He had not seen it before, and he asked me why it worked. I couldn’t answer on the spot, so I went back to my room and wrote up a page proof and gave it to him the next class. He was surprised, and I realized that my joy in this task was unique. The next semester, I became a peer tutor for the class and as part of a tutor certification project, I had to design a lesson plan. I chose to design one around tangent planes to three-dimensional surfaces for the same Calculus III course, and the image above invokes that memory - that somehow our pedagogical explorations were both anchored in planar geometry.

Leadership and Legacy

Luz’s leadership went well beyond the classroom. In 1969, Luz became Superintendent of Schools (Directora de Nucleo) for the city of Lima. In this capacity, she worked closely with the Ministry of Education, eventually retiring in 1977, due to her husband’s deteriorating health.

In recognition of her extensive years of service to Peruvian education and policy, Luz was awarded the Peruvian Government Palmas Magisteriales Award. And twenty years later, in 1997, she was remembered again, receiving the City of Lima Excellence in Teaching Award. In an interview at the time, she reflected on why she was so passionate about education: “Education shapes the human being, their minds, their hearts. It is not only knowledge, it is the shaping of the individual.”



Figure 5: City of Lima award for teaching presented to Dr. Luz Mendizábal Gálvez de Rodríguez in 1997.

The impact of the opportunity of an education and of Luz’s influence went beyond those she taught in Lima and beyond the borders of Peru. In 1997, at the age of 80 when she received the award from the City of Lima, she was living in California. Luz’s husband, Pedro, had passed away in 1979. Two of their daughters and a son had already immigrated to the United States and in 1990, they brought Luz to the US to care for her. Like her mother, Maria Borodina returned to school, and in 1991 graduated from California State in Fullerton with a degree in mathematics and became a mathematics teacher. Maria’s daughter, and Luz’s namesake - Luz Marizza, followed in her mother’s and grandmother’s footsteps, going on to pursue graduate school in mathematics at the University of California, Irvine.

Marizza: Recalling that Mami Luz mentored teachers as department chair and director, I tried following in her footsteps and helped train new hires in the various math departments for our schools (BASIS). She is the topic of conversation in many of my sessions, and new teachers are still amazed when they hear her story. Drawing on her inspiration, I try to impart the idea that there is no such thing as “math people” and “non-math people.” In knowing how your students conceptualize information, we can devise lessons that will convey mathematical concepts in a manner more familiar to each student. I think that the mathematical community would be less marginalized if we help increase the number of math literate people and reduce the population of math-phobics. Also, in breaking down the barriers of what a mathematician should look like, we make the mathematical community more inclusive, and, I believe, a more diverse mathematical community will make mathematics stronger. What do you think our responsibility is to the mathematical community?

Carrie: Because Marizza is too humble to point out her contribution to the community, I’ll draw your attention to Figure 6.



Figure 6: Luz Marizza Alicia Bailey with Joan Ferrini-Mundy and Francis Cordova of the NSF receiving the Presidential Award for Excellence in Mathematics and Science Teaching in 2016.

In 2016, she too was awarded a prestigious national government award for teaching mathematics, the Presidential Award for Excellence in Mathematics and Science Teaching. This award was announced around the time that we began corresponding and working together on this article. At the time, it seemed like a mirror walk of Luz's life, a great parallel story unfolding in response to the intertwining of our own lives with Luz.

I am in awe of the contributions of my cousin and great-aunt, and of convergences of our (apparently correlated) random walks. While I was at the University of Tennessee for doctoral studies, I won both department and university-wide teaching awards. The awards were also an acknowledgement that I spent time supporting other graduate students in their love of teaching mathematics. This work was driven by a need to support other students' sense of belonging and making room for the identity of an academic mathematician to include practitioners that also love teaching. While not nearly the prestige of a national award, I think it signals something very interesting about our joint commitment to the mathematical teaching community.

As an evolutionary theorist, all of this makes me revisit the nature versus nurture debate. I have spent quite a bit of time pondering how much of my trajectory is a predestined calling, and how much is a result of my dad drawing inspiration from Luz as he encouraged my mathematical curiosity as a child.

Like Marizza and Luz, this nature versus nurture dichotomy plays out in my educational philosophy, where I acknowledge both an innate ability to do mathematics as well as the importance of the opportunity and a nurturing environment to develop this skill. For many years, I taught mathematics only for non-mathematics majors (environmental science and biology students), and have come to redefine who a mathematician is and who can do mathematics. To that extent, it was one of my greatest accomplishments to mentor a wildlife biology student, Kari Lemelin, who won the BIO SIGMAA undergraduate student research award at Mathfest in 2013. Working across disciplinary boundaries has not only exposed the way that mathematics can be exclusionary,

but has forced my research to explore how we can reframe our thinking and language to be more inclusive about the disciplinary approaches we take to understanding and modeling the natural and constructed world (e.g. [3]). I have continued to take leadership roles in my professional community in mathematical biology education, and it is a comfortable and important part of my identity. I imagine Tia Luz was the same way when she took on leadership roles within her schools and with the city of Lima.



Figure 7: Luz (R) and her friends.

Marizza: You know, there is a story about Mami Luz that was revealed during her memorial. She informally adopted two native Peruvians when they were young homeless children. She paid for their tuition from elementary school until they graduated from college. One of them even became a mathematics teacher, himself. This was during the time when Native Peruvians were considered lesser than European Peruvians, but she saw past that and believed that anyone could be educated. I think that idea is pervasive in our family, which is why we both aspire to help diversify the mathematical community.

Luz was not the only young woman to be offered the opportunity of an education that day; her two younger sisters Hortensia and Alicia were with her.

The youngest, Hortensia, became a teacher just as her sister, teaching all subjects to younger ages. She taught for many years in Peru, primarily in southern Peru, before retiring. Her family described her as a free spirit and full of generosity.

The second eldest sister, Alicia, also has a legacy in the United States. Alicia pursued higher education in Lima, first as a premed major for two years, then switching her major to mathematics in the third year. Her education was cut short by marriage and parenting, but her passion for education remained. She had nine children, eight sons and a daughter. Her husband, Cesar Diaz, and eldest sons, Cesar and Hugo Diaz Mendizábal, were the first of the Mendizábal family to immigrate to the United States via California in the 1960s. Both were the first of many sons she named after intellectuals in early history (something the priests were not too happy about). Alicia Mendizábal Diaz worked as a chemist in California, and many of her children pursued degrees in computer science in the United States when it was still a burgeoning field. Hugo Diaz married and eventually settled in New England, raising three daughters and a son. Three of the four pursued civil engineering; the oldest daughter, Alisa, specialized in water engineering, the youngest, Naomi, specialized in earthquake engineering, and Devon, the son, was the third civil engineer. The middle daughter, Carrie, like her grandmother Alicia, pursued biological sciences as her major for the first two years, then switched to mathematics.



Figure 8: Alisa, the water engineer, at Tambomachay pointing out the water engineering features of the Incan ruins.

Carrie: My siblings were engineers, and my family was shocked to hear that I was determined to pursue zoology in college. Once I started, I missed taking math classes. Changing my major to mathematics was like a breath of fresh air. I knew then that all along it had been what I was meant to do, as if it were in my blood. I could solve the mysteries of biology using the tools of mathematics, and I could continue to teach mathematics! It is funny how I did not know that my own abuela changed majors in the same way until I set out on this research. This research makes me feel closer also to Mama Alicia. When did you realize that math was your calling?

Marizza: I knew I loved math more than any other subject when I graduated high school. Some of my family members tried to steer me towards engineering, but I knew that pure mathematics was my calling.

Reclaiming our identity as mathematicians, scientists, and engineers

This story is more than cousins reflecting on their grandparents. This is a story about where we are from, about women's roles in society, and about the impact of the opportunity of education.

In Peru, the Incas assimilated the cultures of many tribes, augmenting their knowledge with contributions from each of the societies they conquered, building on them and creating a civilization that would rule a massive area in South America. They were phenomenal civil engineers, farmers, astronomers, and economists, and the education of their leaders relied on a strong foundation of natural philosophy [23, pages 106–108], that is, theoretical science grounded in philosophy. For example, as drought due to climate change and melting glaciers threatens Peru, modern civil engineers are turning back to water irrigation techniques used by the Incan empire and their predecessors [27], which are also highly earthquake resilient [22]. In addition, pre-Columbian women in many tribes had designated roles that enabled religious and political leadership [19]. At the time Luz lived, these indigenous traditions were likely hidden as they are to us now, but out of motives to assimilate into European constructs [19].

For example, it is only in this decade that incorporating the instruction of Quechua, the Peruvian indigenous language, has become a focal imperative of the Ministry of Education [11]. Now is the time we can proudly gain inspiration from our origins to reclaim our right for a place in the future. Here, we can reconstruct our identity as Latina and indigenous mathematicians.

Carrie: I remember vividly reading the AMS Annual Survey of Earned Doctorates in Mathematical Sciences in about 2000, when I was entertaining the idea of pursuing a doctorate in mathematics. There was an array entry for people like me — Row Latino, Block Female, Column US Citizen — that read “5” and varied little year to year (and only one individual from a Research 1 institution!). It seemed so small. Putting that into perspective, Ruth Gonzalez was the first US-born Mexican American woman to receive her Ph.D. in the United States - and that was not until 1986 [10]. I was the first Latina to graduate with a Ph.D. from the Mathematics department at the University of Tennessee, Knoxville. At the time, seeing my cousin, Luz Marizza, pursuing her Ph.D. made me feel not so alone in my endeavor. I only wish I had known more about Dr. Luz Antonia Mendizábal Gálvez de Rodriguez at that time. Did you meet many women or Latinas while working on your graduate degree in mathematics?

Marizza: In 2000, I went to Kyoto for a conference in Arithmetic Geometry, at the invitation of my adviser. There were hundreds of Arithmetic Geometer’s there: the rock stars of the field. I was the only female that I could see. Later, in 2005, I participated in the AMS-MAA Joint Mathematics conference in San Diego and attended seminars on Algebraic Geometry and Arithmetic Geometry. I was astonished to find that so many of the sessions were led by female speakers. It was incredible to see how far women had come in those short years. When I was in grad school, it was said that “women were better at applied mathematics and men were better at the pure mathematics.” I didn’t think this was the case, but I was often the only female in my arithmetic and algebraic geometry classes and seminars. Yet now, it seems we have broken through that barrier, as well.

I was lucky to have female role models. Since my mom and grandmother were both math teachers who loved math with a passion, I never grew up with the idea that women were inherently worse at math than men. What was it like for you — as a woman in math?

Carrie: Even though I did not know all the stories of Luz growing up, I always felt encouraged in my mathematical endeavors - it seems she had a huge impact on my father and that contributed to his support of my relationship with mathematics. In high school, my family moved and the new public school had an excellent reputation for math team - and though my education was superior, I was no longer the best. I thought perhaps math was not for me professionally, even though I loved it in my heart. I re-discovered that love in college, but stumbled as a Ph.D. candidate.

My community helped me when I needed it the most. I started my job ABD in an effort to solve a two-body problem. However, this meant that I ended up at a teaching-intensive institution that had no other Ph.D.s in Mathematics. When I presented at national conferences about teaching mathematics for biology majors, my colleagues were excited by what I had to say — perhaps more so than when I gave talks about my dissertation research. Through my passion for teaching, I found I was not alone in my community. At one conference which I attended primarily for this teaching community, I sat for half an hour with a colleague, who knew and respected my enthusiasm for teaching, but also knew my research. He let me talk through all of my problems in communicating with my advisor. I believe I bent the ear of a few colleagues in this way when I needed someone to listen that understood my challenges. Although these bonds were created through teaching, it this gave me a much needed bond to and sense of belonging in the broader mathematical community.

Not everyone is fortunate to have that community, but I hope I can help others find it — through this article and special issue, through our professional societies, through our co-workers, through scholarship programs, through our families - wherever that support and those role models might be. *Sí se puede.*



Figure 9: The debate Hall at la Universidad Nacional Mayor de San Marcos (historical site) with Hugo, Bonnie, Carrie, and Alisa, left to right. This is the university Luz would have attended. The headquarters were moved after her graduation to elsewhere in Lima and this historical site now serves as a museum.

The emergence of community and a sense of belonging in our reflections aligns with research that has shown the importance of a sense of belonging for women in mathematics [5]. This research also explains the popularity of and need for the Math Mamas Facebook group, which spawned this special issue of the *Journal of Humanistic Mathematics*. As referred to in other articles in this special issue, Math Mamas is a community, and bringing those narratives forward, showing that we exist not as the exception, but as the rule, helps us find a sense of belonging within our mathematics community. In the process of writing this article, we found ourselves exploring how our social-cultural sense of belonging was influenced by our perceived inclusion in our community of practice. However, exploring our sense of place by understanding the broader contextual history of Peru also became a way to gain agency to reclaim our identities as mathematicians [6, 18]. Acknowledging the interconnectedness in our own sense of belonging and identities may [and perhaps should] change the way we teach (e.g. [21]), and learning is an important bridge between our actual and designated identities [16, 17].

Carrie: In walking the hallways of la Universidad Nacional Mayor de San Marcos in Lima, the tour guide took us to the common areas, where in the 1960s reflected a time of intellectual freedom and expression as artists mixed with mathematicians. She also took us to a lecture hall, where she recounted that the Franciscan philosophy for education was intertwined with the needs of the people, who were a culture in recovery as an imperialized indigenous people. One famous director of the university, Rodriguez de Mendoza, believed in productive and free intellectual debate. He believed that the path to liberation was through education. I was intensely struck at that moment, almost as if I had found a missing tile in the mosaic of my life that brought the picture into focus. How much of me might have been shaped by those I had never met? Could my Incan heritage explain my siblings love of civil engineering? Could a cultural tradition of natural philosophy explain why I crave daily intellectual challenge and debate? Could it explain in part my love the philosophical underpinnings of science? I have to be careful not to ignore that a part of me genetically and culturally inherited Western European traditions as well. Despite my father's family's obvious predisposition to pursue STEM careers, until this point, it was the Western European narrative which framed my designated identity.

We acknowledge that the education offered was itself a Western European construct. However, the opportunity of a Western-style education allowed Luz to find her identity as a mathematics educator and to reclaim a place in the leadership of her country. The importance of an education was also clearly reinforced during Luz's time at the university, and its legacy, passed onto future generations, has impacted perhaps hundreds of thousands of students in both Peru and the US. One of Luz's nephews reflects on the story of the nuns coming to Huancayo:

It's a great story if you think about how the actions of one person can affect future generations of a family — if mom, Tia Luz, and her sisters had not been provided with a good education at a young age would they have been able to achieve all they did as adults and parents? And then passed on to us and our families the opportunity to do so well.

Luz passed away in 2001. The best answer to the musings of my uncle are her own words from her interview twenty years ago: “Education shapes the human being, their minds, their hearts. It is not only knowledge, it is the shaping of the individual.”



Figure 10: Luz Mendizábal in the 80s.

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