

Científicos Latinx: The Untold Story of Underserved Student Success In STEM

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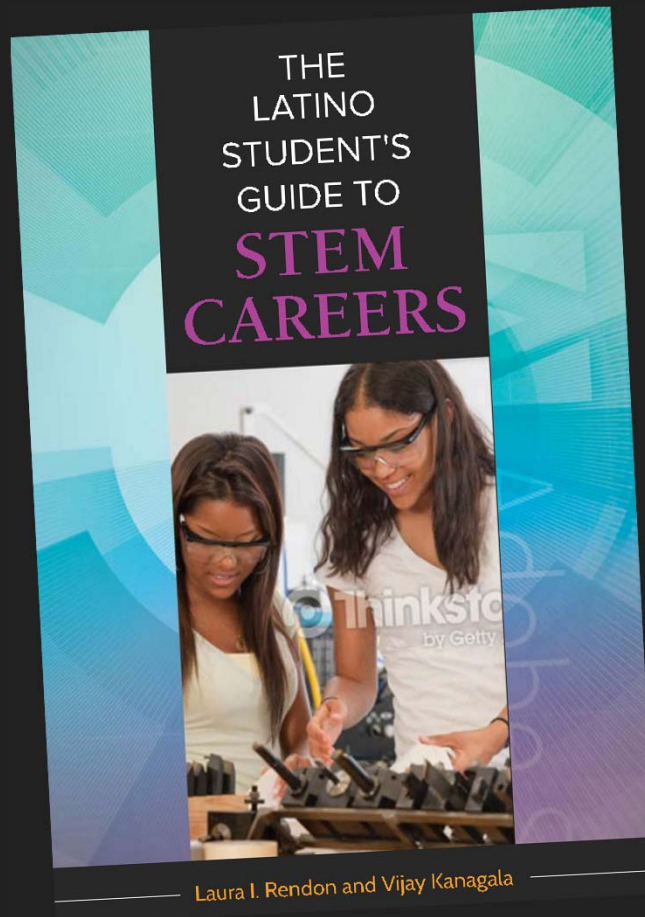
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How I Enter This Work



How Do Underserved Students Manage to Succeed Despite Difficult Life Challenges? What's the Secret to Their Success?

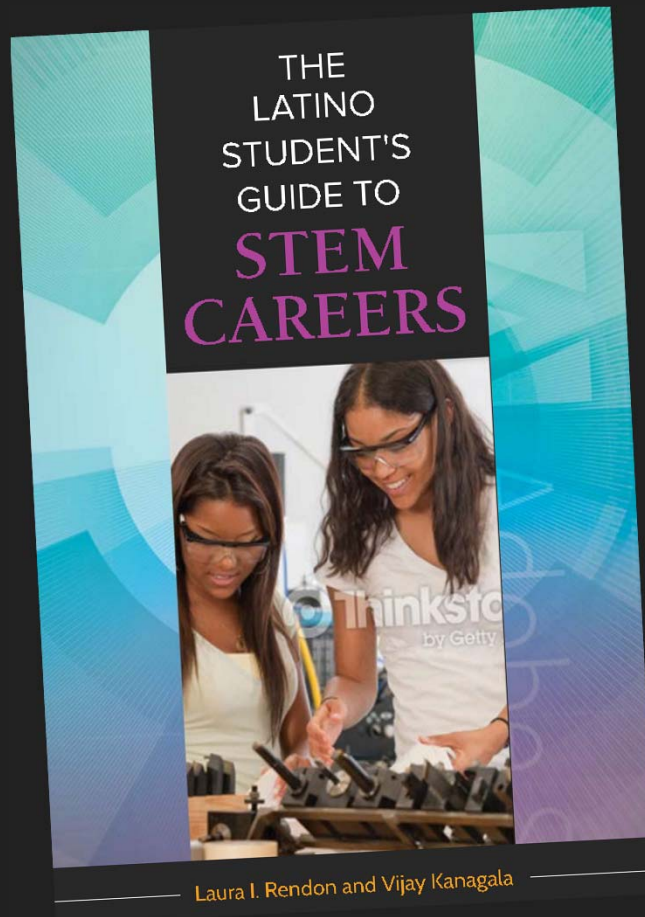
- *The term, scientist, was never used in South Texas because no one had witnessed anyone living his or her life as a scientist. But even with the lack of knowledge of what it entailed to be a scientist, I feel my upbringing in a Latino family prepared me to become a scientist—
Rodolfo Jimenez, Ph.D.*



Purpose:

Illuminate the personal stories and educational journeys of 14 "*científicos Latinx*" (Latinx scientists) who completed or were well on their way to completing a STEM degree

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Analysis of
*TESTIMONIOS/Life
Narratives--Chapter 8*

WRITTEN BY SUCCESSFUL
Latinx STEM Graduates

N=14 Essays

STEM Graduates: Characteristics

Gender

- 10 Females
- 4 Males

First-Gen Status

- 8 First-Gen

Degree Earned

- B.A.=1
- M.S.=7
- Ph.D.=6

Nationality/Ethnicity

- Mexican Am=10
- El Salvador=1
- Mexico=1
- Puerto Rico=1
- Dominican Rep=1

Sample

STEM Participant

- **Stephany Alvarez-Ventura, M.S.**
- **Alejandro Ariaza, B.S., M.S.**
- **Diana Del Angel, M.S.**
- **Julissa Del Bosque, undergrad student, junior; now graduated with B.S.**

Field of Study

- **Agroecology, Environmental Studies**
- **Mathematics, Higher Ed Ad**
- **Environmental Studies**
- **Biology, Medicine**

Profession

- **Program Manager, School of Environment, Arts and Society, FIU**
- **STEM Adviser, Northwest Lakeview College**
- **Gulf Research Program Science Policy Fellow, National Academies of Sciences, Engineering and Medicine**
- **Undergraduate Student, UT-Austin**

Sample

STEM Participant

- **Xiomara Elias Argote, M.S.**
- **Dana M. Garcia, Ph.D.**
- **Karla Gutierrez, M.S.**
- **Rodolfo Jimenez, Ph.D.**

Field of Study

- **Biochemistry, Microbiology, Biotechnology**
- **Zoology, Physiology**
- **Industrial Engineering**
- **Cellular & Molecular Biology, Biochemistry**

Profession

- **Quality Compliance Manager, Food Science Industry**
- **Chair of Biology, Texas State University, San Marcos**
- **Research Associate & Doctoral Candidate, UTEP**
- **STEM Coordinator & Data Analyst, UT-Austin**

Sample

STEM Participant

- **Ricardo Martinez, M.S.**
- **Olivia Moreno, M.S.**
- **Elvia Elisa Niebla, Ph.D.**

Field of Study

- **Mathematics, Curriculum & Instructional Technology and Mathematics Education**
- **Environmental Science & Engineering, Industrial Engineering**
- **Soil Chemistry**

Profession

- **Doctoral Student, Iowa State University**
- **Doctoral Candidate in Environmental Science & Engineering; Program Specialist, US. Dept of Agriculture-Institute of Bioenergy, Climate & Environment**
- **Former National Coordinator for Global Change Research at the Forest Service—USDA**

Sample

STEM Participant

- Semarhy Quinones-Soto, Ph.D.
- Marina B. Suarez, Ph.D.
- Simon Trevino, Ph.D.

Field of Study

- Microbiology
- Geology, Geosciences
- Biological & Biomedical Sciences

Profession

- Biology Lecturer & Academic Adviser, CSU-Sacramento
- Assistant Professor, UTSA
- Postdoctoral Scientist II, Texas Biomedical Research institute, San Antonio, TX

Methodological Approach

- Counter-Storytelling (Solorzano & Yosso, 2002; Delgado, 1989). Informed by critical race theory, a counter-story is a tool to expose, analyze, and challenge majoritarian, dominant narratives based on racial privilege.
 - Examples of Dominant Narratives: 1) Only perseverance and determination can count as determinants of success. 2) If we have too many adversities, we cannot succeed.
- Testimonios/Personal Stories (Latina Feminist Group, 2001). Testimonios are a tool to acknowledge voices and experiences that have been historically marginalized. A testimonio generates knowledge and theory through the documentation and explication of life experiences.

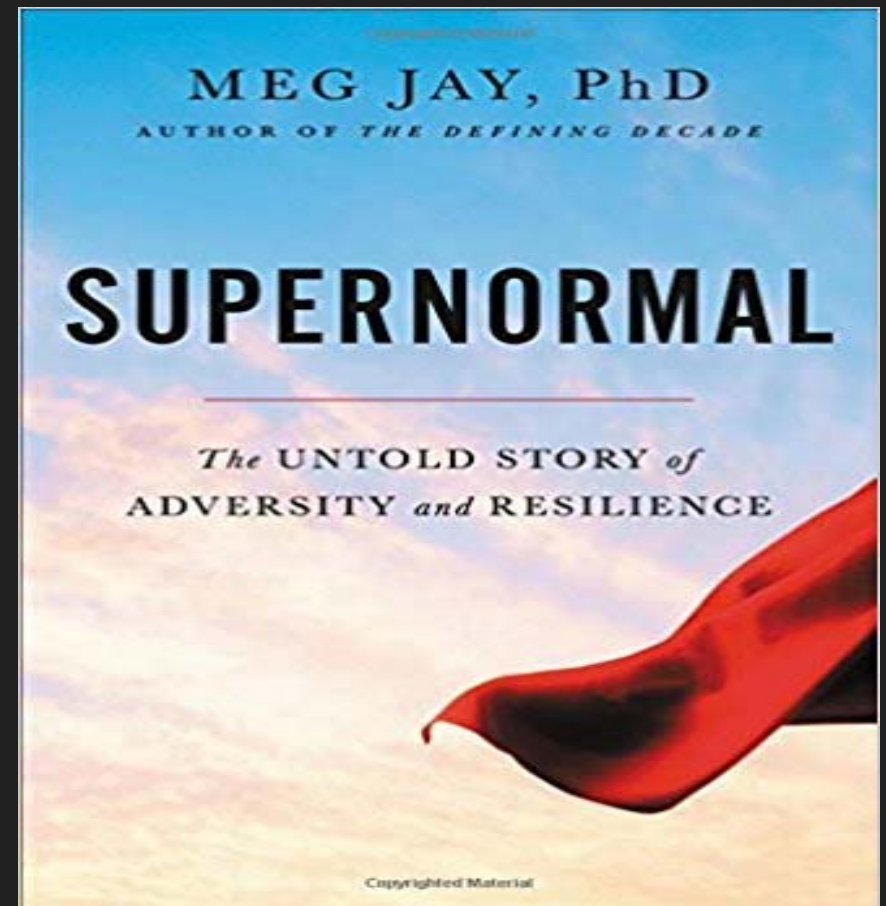
EXAMPLES OF DOMINANT, DEFICIT BASED ENTRENCHED NARRATIVES

Dominant, Deficit-Based Story About Underserved Students and Communities

- Deficit-based thinking pathologizes, stereotypes and marginalizes students (i.e., at risk, marginal, culturally deprived)
- Based on grand narrative that parents and communities do not value education and that low-income families are inferior
- Considered to have too many challenges and adversities to be able to be successful
 - Yosso , 2005; Rendón, Nora & Kanagala, 2014; Jay 2017

Counternarrative: Despite adversities, people can thrive (Jay, 2017).

- Nearly 75% of us experience adversity by the age of 20
- Louis Armstrong left school at fifth grade to support his family
- Eleanor Roosevelt's mother and her father, an alcoholic, died by the time she was 10
- Frida Kahlo suffered devastating bodily injury from an accident and continued to do her art

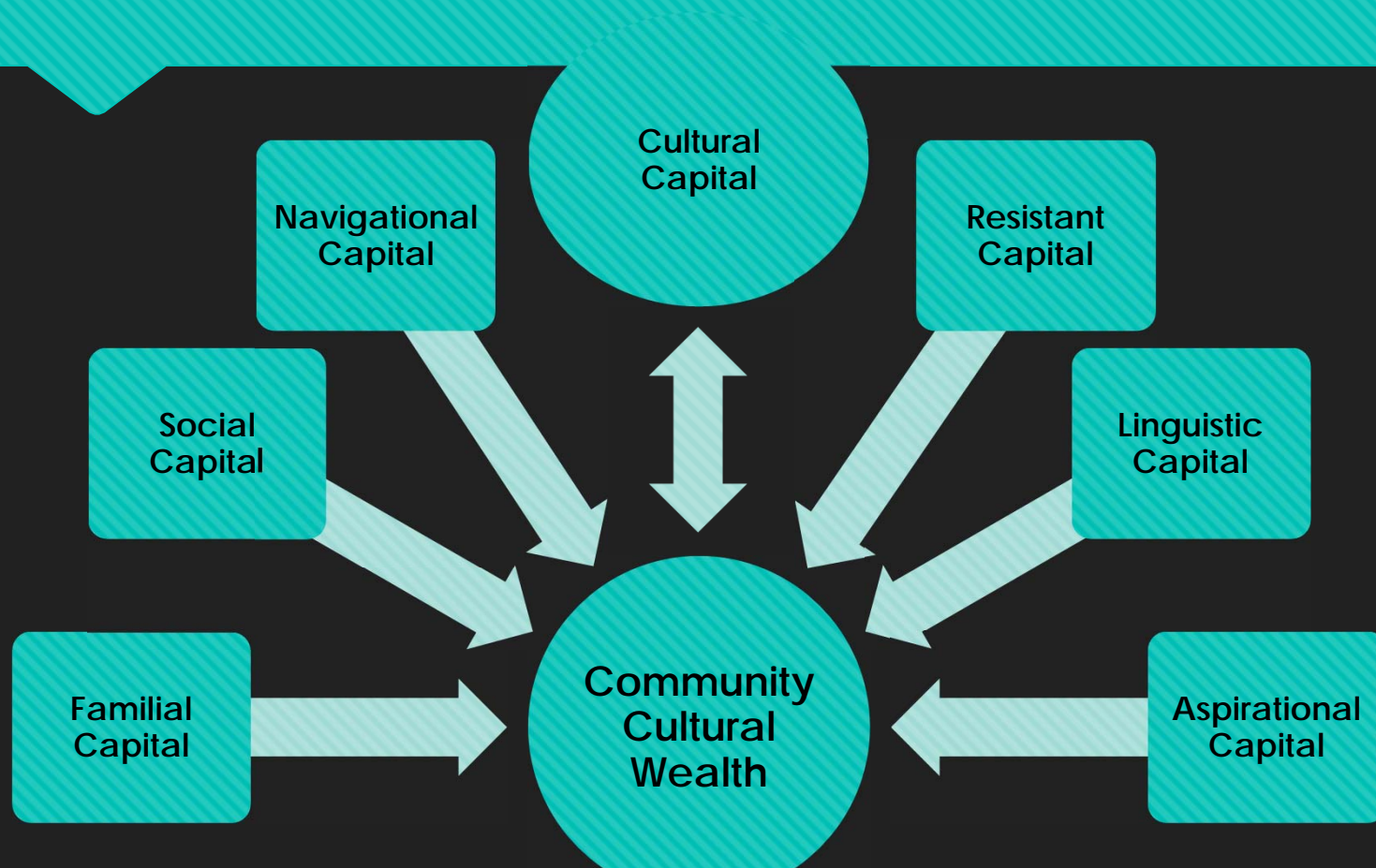


Counter-Story: Low-Income Students of Color Can Be Assisted to Succeed in STEM

- Math Teacher Jaime Escalante

- <https://www.youtube.com/watch?v=IM6blsMhPRO>

Tara Yosso's Community Cultural Wealth Model (2005)



Laura I Rendón's Validation Theory

- Validation is an enabling, confirming and supportive process initiated by in- and out-of-class agents that fosters academic and personal development (Rendón, 1994)
- There are two forms of validation:
 - Academic -- when in- and out-of-class agents take action to assist students to trust their innate capacity to learn and to acquire confidence in being a college student
 - Interpersonal -- when in- and out-of-class agents take action to foster students' personal development and social adjustment

The Latinx Experience of Entering and Succeeding in STEM Fields of Study

Challenges Experienced

EARLY LIFE ADVERSITIES

- Health issues
- Experiencing civil war in native country
- Leaving native country
- Experiencing school segregation
- Death in family
- Growing up in unsafe community
- Undocumented status
- Racism

Academic Challenges

- ESL
- Writing, publishing & presentation skills
- Lack of information about college access, test scores
- Lacked college literacy and STEM info
- Time management
- Dealing with academic failure

Challenges Experienced

FAMILY RESPONSIBILITIES

- Balance academics while caring for family
- Impacted decision to leave family to gain experience in different city

POVERTY

- Problems paying for college
- Problems supporting one's self

GENDER-RELATED INEQUITIES

- Lack of females in STEM fields
- Discriminatory behavior from some male students

WHAT HELPED: HIGH-IMPACT STEM PRACTICES



Experiential, Hands-On Learning



U.S. Based & International Internships,
Especially Connected to Funding



Teaching Assistantships

WHAT HELPED: HIGH-IMPACT STEM Practices

- *Getting hands-on experience was the best method to learning as one can show their work through projects and activities, learn from mistakes, and improve methods that are already established—Xiomara Elias Argote, M.S.*
- *This is my fourth summer interning in Washington, DC with USDA. Upon completion of my doctoral degree this upcoming 2016 spring semester, they will convert me into a full-time government employee. All the training and experience I have been exposed to these summers have been one the most rewarding steps towards my STEM career. Knowing that I am serving my government and serving the people of this country is very gratifying—Oliva Moreno, M.S.*

WHAT HELPED: HIGH-IMPACT STEM PRACTICES



Undergraduate & Graduate
Research Assistantships &
Summer Programs



Research With Faculty Member



Faculty Advising

WHAT HELPED: HIGH-IMPACT STEM PRACTICES

- *One of the options in the Honor's program at Texas A&M was to write an Honor's thesis based on **undergraduate research**. My roommate suggested that I should approach {a professor} about the possibility of doing research in her lab. I met with her, and she accepted me into her laboratory...Either way, one thing she said stuck with me: In science, 90% of your experiments will fail. She was letting me know that success in science requires perseverance and resilience—Dana Garcia, Ph.D.*
- *One **undergraduate assistant** job involved the mapping of vegetation along the Rio Grande river...I would visit sites I would have never visited on my own—Diana Del Angel, M.S.*

What Helped

Financial Support

- High School Scholarships
- President's Endowed Scholarship
- National Merit Scholarship
- NSF Funding for Minority Scientists
- Graduate Fellowships

Latinx-Centered Activities & Organizations

- Hispanic Ambassadors Program
- American Association for Hispanics in Higher Education
- SACNAS
- Career Preparation Institute
- SHPE—Professional Engineers

Early Participation in STEM Activities

- Science Fairs
- MESA
- MAES
- University Visits to Promote STEM
- Summer Science Camp

What Helped: Validating Experiences/Collective Web of Support

Early Schooling

- Teachers
- Best Friends
- Parents
- Family Members

College

- Mentors
- Faculty
- Role Models
- Adviser
- Counselor

Validation Provided

- Encouragement
- Inspiration
- Academic Advice
- Exposure to STEM
- Network of support

Validation Examples

- STEM was not my passion, but I was very interested in pollution and how it affected the environment...{I} found myself at the doorstep of the adviser for environmental studies, Dr. Jack Parker...People tend to choose the path of least resistance. Not Parker. I tried selecting the nonscience path to an environmental studies degree, but he wouldn't have it... He said I could do science and would make a difference in my field...His next words made the difference: "If you do the science you will have more opportunities and get paid more"—Stephany Alvarez Ventura, M.S.
- My mentor, Dr. Dawe, also helped to reassure me I had made the right decision in going to University of Georgia for the summer when he told me, " You have what it takes to be a scientist." It was from that moment when I had no doubt that I would be getting my doctoral degree—Rodolfo Jimenez, Ph.D.

WHAT HELPED: STUDENT ASSETS

Giving Back

- To Latinx community
- To help larger society

Social Justice Consciousness

- Recognition of injustices in society
- STEM connected to eliminating inequality, promoting fairness and equity and advancing humanity

Curiosity

- Appreciate process of discovery
- Curiosity even at early age

ASSET: CURIOSITY

- It had been my dream since I was a kid...to find a dinosaur...to be the first person to lay eyes on something that lived millions of years ago...It turns out the site [we visited] had many bones...One of them was named for my twin sister and me: *Geminiraptor suarezarum*—Marina Suarez, Ph.D.
- If I had to summarize my life journey...I would say it was fueled by a need to know. Even as a young girl, I always wanted to know what happens when you put a snail, a grasshopper, and a fuzzy worm in the same jar? Curiosity can get you stung by insects or punished by your *abuela*, but curiosity can also reroute your career life—Diana del Angel, M.S.
- I was not just interested in learning what was taught, I wanted to go into further detail as to why it was that way. Between the ages of 5 and 10 I was definitely the “why” child of my family—Rodolfo Jimenez, Ph.D.

ASSET: GIVING BACK

- I am grateful for all of the mentors I have had in my life, from family to professors. I feel it is their guidance that has helped me get to where I am today, and I will never forget this. And that is why I take it upon myself to make sure that I give back to my community, as well as the world, in any way that I can—Rodolfo Jimenez, Ph.D.
- In the end, I hope to give back to my community and take my learned experiences back to south Texas—Diana del Angel, M.S.
- The opportunity to give back to the community that I grew up in has been one of the most rewarding parts of my job—Marina B. Suarez, Ph.D.

Asset: Social Justice Consciousness

- With my research, I am establishing my own theory of how people learn to make math more equitable...As a Latino I am proud to contribute to the rich STEM history that is associated with the Latinx culture—Ricardo Martinez, M.S.
- For me, global change, including climate change, is the biggest threat to the planet... In fact, the most rewarding aspect of my work has been knowing that I contributed to the progress of humankind, improving the environment and promoting significant research in the field—Elvia Elisa Niebla, Ph.D.

WHAT HELPED: STUDENT ASSETS

Family

- Provide inspiration and support
- Example of ethic of hard work

Responsibility

- Cared for siblings
- Helped family at home
- Provided financial assistance to family

Resistance

- Overcame poverty
- Overcame microaggressions
- Overcame patriarchy

WHAT HELPED: STUDENT ASSETS

Navigational

- Leaving native country & learning new culture
- Leaving friends and family behind
- Changing majors
- Transferring from two-to four-year college

Ganas/ Perseverance

- Courage
- Determination
- Resilience

Academic

- Mastered material
- Adhered to high scientific standards
- Accepted academic challenges
- Remained focused

WHAT HELPED: LATINX CULTURAL PEDAGOGICS

Family Work Ethic

- Witnessed family strength in action
- Developed sense of responsibility & importance of family
- Developed ethic of hard work
- Shaped personal views and habits

Family Cariño

- Developed inspiration; felt cared for

Family Moral & Practical Guidance

- Nurtured future success
- Developed motivation to succeed

WHAT HELPED: LATINX CULTURAL PEDAGOGICS

- My mother has been the strongest motivator in my life. She was the first in the family to get a high school degree... I learned to refine my work and redo things over and over again until I would get them right, even for simple things like laundry. For sure, my socks were extra clean as she used to inspect carefully all the pieces I washed. Going back, simple acts like this shaped my views and habits at a very early age, which have been very useful in a science field where attention to detail and perseverance are highly appreciated—Xiomara Elias Argote
- Obviously, my family, especially my mother and my aunts, influenced my life. Tia Chuly...was a strong, opinionated woman who held her own in political debates and who read to me from literary and political works. She was my role model--Elvia Elisa Niebla
- My father loved exploring local marine life. From a very early age, he would take me snorkeling and taught me about the diverse and fragile marine ecology. ..Through my father, I gained my deep respect and appreciation for zoology and biodiversity--Semarhy Quinones-Soto

The New Counter-Story of Latinx Success in STEM

What we learned from STEM graduates' *testimonios*, which allow the creation of theory and knowledge through personal experiences—*Latina Feminist Group, 2001.*

The Counter-Story Explains How Latinx Succeeded: A Story of Courage, Resilience & Spiritual Nobility



The Counter-Story Dispels Entrenched Narratives

- PERSEVERANCE ALONE ACCOUNTS FOR SUCCESS—NOT TRUE
- LATINX STUDENTS ARE NOT ACADEMICALLY PROFICIENT AND CANNOT SUCCEED IN STEM—NOT TRUE
- INDIVIDUAL EFFORT/ACHIEVEMENT ALONE PROPELS STUDENTS TO SUCCEED—NOT TRUE
- ALL LATINX FAMILIES DO NOT CARE ABOUT THEIR CHILDREN'S EDUCATIONAL PURSUITS—NOT TRUE

The Counter-Story Calls for STEM Educators To Step Up!

- STOP talking about how students succeed against the odds. Instead CHANGE/IMPROVE/SHATTER THE ODDS!
- STOP talking about how students can succeed if only they emulated what White students do. Instead recognize that Latinx students have their OWN WAYS OF SUCCEEDING, their own POWERFUL WAYS OF KNOWING.
- STOP employing deficit language! Instead focus on LATINX STUDENT STRENGTHS.
- STOP ignoring the socio-political dimensions of STEM education.
 - To what extent is the deficit-based paradigm shaping STEM education? How can this be replaced with an asset-based framework?
 - What STEM policies and practices act to preclude Latinx from succeeding in STEM?
 - How do we bring voices and experiences from the margins to shape the future of STEM education?

RECOMMENDATIONS

- **PLAY TO STUDENT STRENGTHS (GIVING BACK, SOCIAL JUSTICE CONSCIOUSNESS, CURIOSITY, ETC.)**
 - Leverage student assets. Cover important material, but also engage students in reflective deep learning experiences. These could be projects impacting their communities (diabetes, water quality, cancer, obesity, mental health, climate change, declining infrastructures, antibiotic resistant bacteria, etc.).

RECOMMENDATIONS

- **PROVIDE PROFESSIONAL DEVELOPMENT TO STEM FACULTY AND STAFF**
 - Learn to employ STEM HIPs (hands-on learning, research with a faculty member, internships, etc.)
 - Learn to create validation-rich in and out of class teaching and counseling environment. Positive, uplifting relationships are important!
 - Learn to work effectively with students from underserved communities.

RECOMMENDATIONS

- Create STEM Student Success Centers—hub for resources and space for peer networking and creation of validating communities.
 - EXAMPLE: The Cal NERDS - New Experience for Research & Diversity in Science - provides undergraduate students in Science, Technology, Engineering, and Mathematics (STEM) with opportunities in undergraduate research, higher education and graduate school readiness, career preparation, diversity, leadership, and community service (Diana Lizarraga, Director).
- FOCUS ON EARLY PREPARATION FOR STEM.

The Larger Meaning of Latinx STEM Success

- *In 2011 I completed my graduate degree after many years of hard work. The first calls I made the day I received my PhD degree were to my abuelas to whom I shouted: “Yo soy doctora.” Those were heavy words! They recapped all the tears, all my struggles in graduate school, and the time away from my family. They also meant I had achieved a lifetime goal, and I had made my family proud—Semarhy Quinones-Soto*