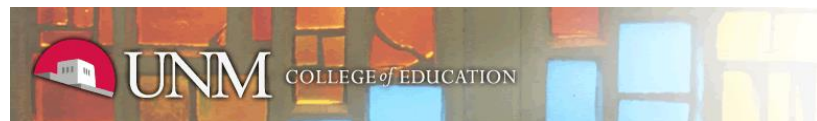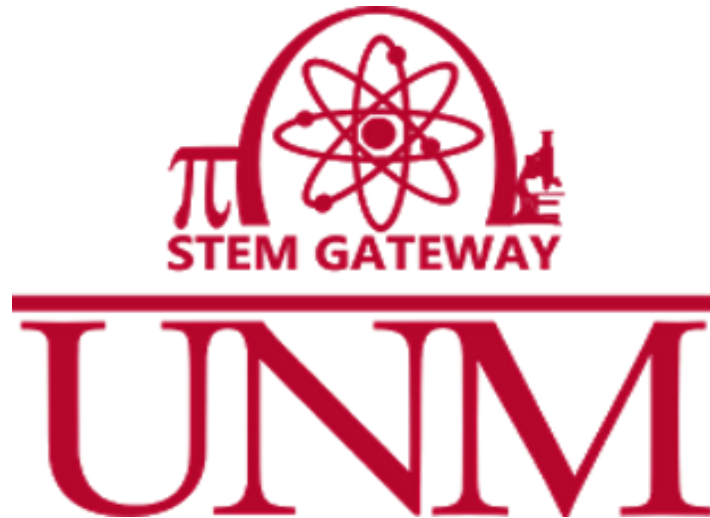# The Experiences of UNM Hispanic Students in STEM Programs

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Funded by

The STEM Gateway program is funded through a U.S. Department of Education Title V grant, 2011-2016 which focuses on improving persistence in STEM disciplines for Hispanic and/or low-income students at the University of New Mexico.

Background

- UNM is a Hispanic Serving Institution and yet shows gaps in STEM graduation on par with national statistics
- New Mexico is home to a Spanish Heritage population that continues 300 years of history in the region, as well as more recent immigrant and U.S. born Latina/o populations
- 2010 Census data for NM: 46.7% Hispanic, 10.1% Native American, 40.2% White
- National Center for Education Statistics (2009) identifies a gap between White an Hispanic students in 4th and 8th grades in math and science that equals national gaps. The difference: New Mexico's Hispanic students make up 58% of 4th & 8th graders
- UNM graduates more White than Hispanic students in nearly all STEM fields

Research Questions

- What are STEM programs like for Hispanic & Latina/o students who come to UNM?

- What factors lead students to drop out?

- What factors lead students to switch out of STEM programs?

- What factors support students who graduate from STEM programs?

- *All names of participants are pseudonyms*

Previous Research

- Minorities and women display cultural and stylistic differences that prevent them from fitting the "traditional" or stereotypical profiles of science students (Tobias, 1990)

- These differences affect the way students are taught and encouraged (or not) to pursue STEM fields, based on teachers' and professors' false assumptions (Drew 2010).

- Dedication, hard work, involvement with faculty, humanizing education, support programs and supportive environments, mentoring, cultural centers, active and collaborative learning, pre-college preparation and enriched experiences contribute to student success (Astin & Astin 1992; Drew 2010, Reinke et. al. 2011; Reyes, 2013; Snead-McDaniel 2010; Museus & Liverman 2010)

Quantitative Research at UNM

- **Stop, Switch or Stay** (Schroeder, 2013) explores STEM degree completion patterns. *For this presentation:*

 http://unmstemgateway.blogspot.com/

       Research Tab, first Quick Link

- Studied 1,503 incoming freshman who declared intent to pursue a STEM degree

- Of these, 334 Graduated with STEM degrees, 639 changed majors, 444 left UNM, and 86 were still enrolled 5 or more years after initial enrollment

- Analyzed by ethnicity, gender, family income, lottery scholarship status, 1st generation college student status, high school GPA, ACT scores, college GPA, # of remedial courses, # of credit hours & semesters completed at time of Switch or Stop, etc.

Quantitative Research at UNM

Preliminary Findings:

Specific Majors correlate to likeliness of graduation, switching, stopping, or continued enrollment

The majority of Hispanic students enrolled either switched (43%) or stopped (31.7%). 17.6% graduated and 7.7% were still enrolled 5 years or more after initial enrollment.

By comparison, 26.2% of White students graduated and 8.3% of Native American students graduated

Hispanic students are .65 times as likely to graduate with a STEM degree than non-Hispanic students ($p=.001$).

Quantitative Research at UNM

- Preliminary Findings among all ethnicities:

- **Low SES** (Pell Grant- Eligible) students 1.43 times as likely to drop out and .46 times as likely to graduate than mid-high SES students

- **1st Generation college students** are 1.62 times as likely to drop out and .42 times as likely to graduate than non-1st generation students

- **Female** students are .48 times as likely to pursue STEM degrees and 1.36 times as likely to switch majors than male students. **Females of color** are .63 times as likely to graduate as compared to all other students.

- **Males of color** are .82 times as likely to switch out of STEM and 1.91 times as likely to still be enrolled 5 or more years after initial enrollment as compared to all other students

Theoretical Framework

- LatCrit (Delgado Bernal, 2002):
  - centrality of Latina/o and/or Hispanic voices, *relatos*, and agency
  - dominant ideologies (Euro-American perspectives) inform institutions and economic structures creating tensions between approaches and racialized experiences
  - Urgency and commitment to social justice
- Cultural Capital (Bourdieu 1991)
  - The accumulation of particular types of cultural knowledge confers advantages
  - Particular types of knowledge and practices are more (or less) valued by institutions
- Learning as a Participatory Process
  - Learning is a situated, participatory, & experiential process ((Berman, 1968; Dewey, 1902; Johri & Olds, 2011; Lave & Wenger, 1991)
  - This process is interwoven with identity development

Methodology

Potential participants:

- Enrolled as first time freshman in the fall of 2005 or 2006

- Self-identified as Hispanic

- Had either graduated or left UNM by fall 2011

- Declared a STEM major and participated for at least 1 semester in their department

This Data

- Sorted by gender and by departmental groups: Arts & Sciences, Biology, Engineering,

- Sorted by STEM trajectory outcome (Graduates, Switchers, Dropouts)

- Recruitment by phone and email.

Methodology

- Issues in recruitment: low response rates
  - Dropouts: 3%, Switchers: 10%, Graduates: 12%
  - 2 participants were found through personal contacts
  - 2 of 5 Dropouts have returned to UNM to finish their degrees, thus a new category: Ex-Dropouts
- Difficulties in achieving balance
  - Overrepresentation of Biology and Computer Science
  - Underrepresentation of STEM disciplines in the Arts & Sciences
  - Gender imbalance: 38% female
- 21 Phenomenological Interviews
  - Semi-structured in casual settings
  - Designed from previous studies, adjusted as new topics arose
  - Recorded and transcribed

The Participants

- 11 Graduates (6 men, 5 women)
- 5 Switchers (4 men, 1 woman)
- 3 Dropouts (1 man, 2 women)
- 2 Ex-Dropouts (2 men)

- 2 spent a significant amount of time living in Mexico
- 1 is a First generation U.S. citizen, 4 are 2nd generation U.S. citizens
- 7 are bilingual in English & Spanish
- 2 trace their heritage to South American countries
- Participants represented a full range of socio-economic status

Methodology: analysis

- Open coding using NVivo Software
- Axial Themes were discovered based on patterns found in the open coding process and in light of the guiding framework
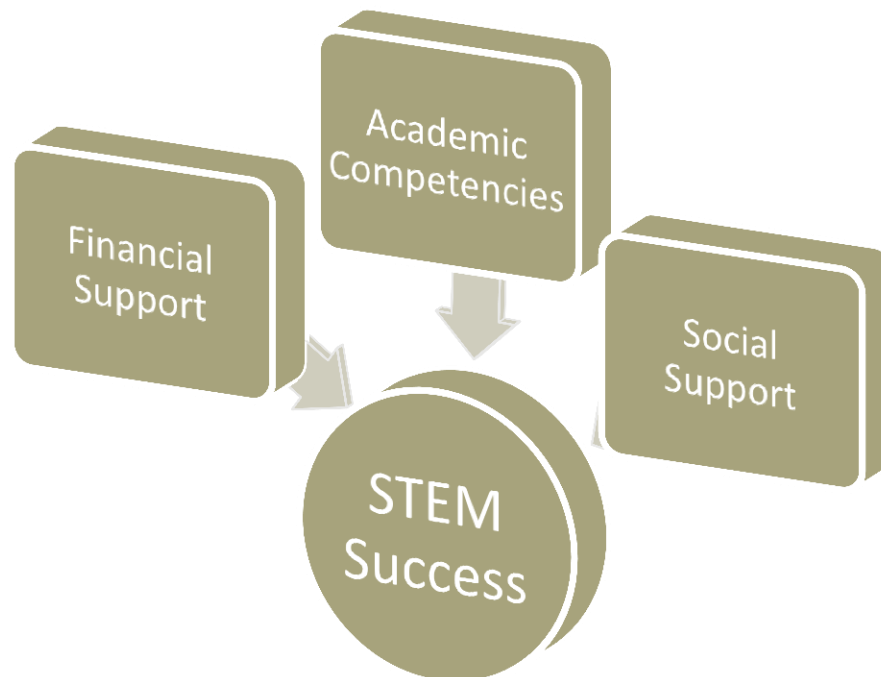
An Emerging Model

- Bourdieu's Theory of Cultural Capital suggests **ACCESS** as a guiding principal to the axial themes

- **Financial Support**: economic resources available to the participants, at times this underlies access to academic competencies and to social support

- **Academic Competencies:** the result of access to content, practices, and understandings necessary for becoming competent in STEM academics and a subsequent career

- **Social Support:** relationships within students' communities, both as part of learning and in the development of an identity. Can take the form of family and friends, but also student organizations, study groups, work colleagues. Includes guidance for and beyond academic purposes.

Findings: Pre-UNM

Table 1: Participants by Generational Status (in reference to university attendance) and

STEM Trajectory Outcome Category

	Grads	Switchers	Dropouts	Ex-Dropouts	Percentage
1st Gen.	6	2	3	2	62%
Not 1st Gen.	5	3	0	0	38%

Table 2: Participants' Description of Academic Identity in Elementary School by Outcome Category

	Grads	Switchers	All Dropouts
Positive Academic ID from youth (%)	90%	50%	50%

- Tracking
  - 98% were placed in advanced/gifted courses, participated in enrichment programs, attended magnet or charter schools during k-12. This did not guarantee university success.

Findings: STEM and Latin@s

- Those with stronger markers of racial identity (accents, ways of being) were more likely to report racialized experiences.
- Those with more mainstream characteristics were:
    - less likely to report racialized experiences
    - more likely to succeed in STEM
    - Evidence: Marissa, Diego, Manuel
- STEM depts. subordinate racial identities
    - Evidence: most participants did not acknowledge ethnic identity
- UNM STEM Structure favors assimilation, not difference

STEM & Latin@s

- Impacts of culture:
  - participants discussed tensions within their families around decisions to study a STEM discipline
  - Critical of community, Loyal to community
  - Diego: saving for quinceañera vs. college
  - Life as a student-parent

- Of little consequence
  - "I can check the box," scholarships & acceptance to college
  - The food at family gatherings
  - Evidence of the institutional environment favoring sameness, not difference

Findings: STEM Latin@s & College Culture

- Albuquerque and New Mexico Public Schools
  - Of 15 who attended these schools, 9 reported they were "too easy"
  - Low Expectations
    - Grading practices: high grades for little effort
      - Failed to develop strong study skills and habits
      - Even after participation in AP classes, some tested into in remedial courses at UNM
    - Lack of support in transitioning to college
  - The consequences of lack of rigor and lack of support were felt more severely by 1st generation college students
  - Students based life decisions (marriage, course load, work load) on their high school experience, which led to unrealistic expectations
   - Examples: Rachel, Diego

STEM, Latin@s, & College Culture: Finances

- Lottery Scholarship: 90%
- Only 2 participants did not work during college
- 1st generation students worked more than their counterparts
- Students worked to support themselves, their families, and to avoid debt in accord with family teachings
  - Students lived at home and worked full-time to avoid debt.
- Work was viewed as obligatory, not optional
- Students with stable jobs and flexible employers had better experiences than those who switched jobs frequently
- 3 1st generation students became homeowners during college
- Those who worked 20 hrs/week took on average 2.5 semesters more to graduate

Finances con't: Work vs. College Culture

- Participants reported lack of flexibility within departments as related to their work schedules (particularly Engineering)

- Students who worked did not have time to participate in campus student groups, office hours, or study groups

  - *"I was a breadwinner first, and then a student second."*

  - *"I didn't enjoy the college life, I didn't actually, you know, do the partying, […] the research groups…I went to class and I was in class. I wasn't talking to the neighbor, I was paying attention to the professor. I left class, I walked straight to my other class…got out of there and went straight to work." -Manuel, Switcher*

Conflicting ideological approaches:

Work, Family, etc.

College

College

Family & Work
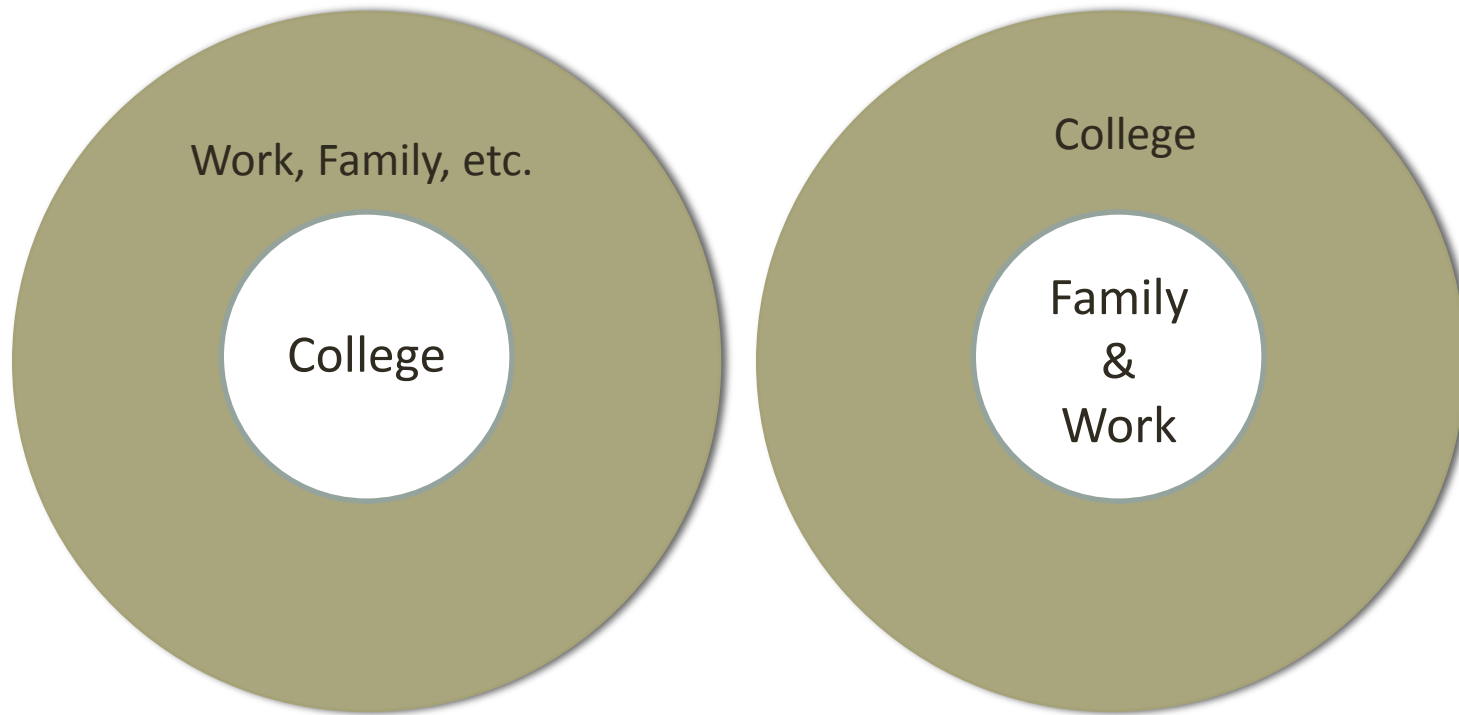
- Finances and family perspectives toward debt = most salient factors in determining students' approach.
- *"It wasn't the 'college experience' by any stretch…"* –Matthew, Switcher

STEM, Latin@s, & College Culture: Work

- Work helped some redefine their career paths
  - Two participants switched from computer science to business as a result of work experiences
  - A Dropout found the relevance of school in his work, leading him to return to UNM to pursue a STEM degree
  - Some refined their focus as the result of work experiences
- The Lottery Scholarship was rarely sufficient for students who were supporting themselves

STEM, Latin@s, & College Culture: Mentors

- A mentor who assisted in navigating the university appeared in 30% of the interviews.

- Graduates without a mentor reported specific departmental and/or community support.

- Mentors were aunts, uncles, boy/girlfriends, siblings: people who knew participants intimately—never UNM advisors

- None of the Dropouts reported a mentor

STEM, Latin@s, & Learning Environments

- Participants felt anonymous, dehumanized, & disconnected in large classrooms:
  - *"Like a sheep! Like a bunch of sheep, you just have a number on you. And if you don't do your homework, they don't care…" Felicia, Graduate*
  - *"You feel like just another student, you feel like a number…it doesn't matter if you're there or not, they don't take attendance…if you want to be there, great, if not they don't care." Eva, Switcher*
  - *"….it's hard to really have a connection with people…" Felix, Switcher*
  - *"You're just a number, a nobody, you're not gonna really learn anybody's name" Marissa, Dropout*
  - *"it wasn't very personal…I felt like more part of the herd" Danny, Graduate*

STEM, Latin@s, & Learning Environs: Teaching Methods

- Lectures and tests are not engaging students nor building communities of practice
  - *"You sit there, you listen to the professor and you take your test...it is definitely an old-school teaching method." -Eva, Switcher*
  - *"...it was dread, it was boring, it was dry...there was no enthusiasm to be there." -Marissa, Dropout*
  - *"I didn't find it too exciting, and it wasn't too appealing for me. It was immensely boring and it was not engaging." -Connor, Switcher*
  - *"...the actual course—I mean, the actual teachings were—I guess, you know really, we could have just read the book." -Manuel, Switcher*

STEM, Latin@s, & Learning Environs: Asking Questions

- Most students did not feel comfortable asking questions in class
- Only 1 female reported feeling comfortable asking questions
- Most blamed themselves
  - *"...if I was like up to date on everything and if I felt like I was understanding it, then, yeah. But uh, if there was something—if I was behind or you know, like did not understand a concept, I WOULD NOT like to ask questions because I felt like I'd ask something and then it'd be like obvious or I'd look dumb or something." -Geoff, Graduate*
  - *"...when I did the summer [bridge] program if I had questions it was ok, they were there, they gave us that one-on-one, they didn't look at you like really, you didn't catch on?" Of her regular classes: "I NEVER asked questions and if I had a question I'd ask somebody sitting next to me and if they didn't know, I left it at that."- Marissa, Dropout*

STEM, Latin@s, & Learning Environs: Belonging

- Switchers and Dropouts expressed feelings of exclusion.
  - *"I didn't really make a whole lot of friends at UNM, it seemed like everybody was kind of caught in trying to meet the requirements and not really approachable and sociable, [...] There's no, you figure, UNM, you see the commercials and everything how the student body is so close knit and everything and its really not. It's really not, you pretty much fend for yourself." -Marissa, Dropout*
- Switchers found community in subsequent departments.
  - *"...the strongest sense of community was in my ceramics classes...we all had to work together...there's just a lot of teamwork and community involved." -Félix, Switcher*
  - *"We're Hispanics, in business." -Manuel, Switcher*
  - Marissa (Dropout) would have stayed *"if I felt like I belonged."*

STEM, Latin@s, & Learning Environs: Belonging

- Participants reported a wide range of experiences
- Linguistic & Cultural difference shaped the experiences of those that felt it strongly:

  - Y mi experiencia en honors math…it was like, como no me siento a gusto, no me sentí a gusto porque habíamos como tres, cuatro hispanos que hablábamos puro español…Y la mayoría eran gente blanca o asiáticos, y pues de primero era como raro porque obviamente nuestra cultura, nuestros hábitos son diferentes a los de ellos, o nuestro tema de conversación o intereses son diferentes. So, no me pude, no sé, no sabía como de que hablar mucho con ellos, o nada pues, hice bien. Seguí con A's, con alta calificación. "…aquí en la escuela…en Engineering, en las…ya que cuando entré aquí fue Calc 1, Calc 2, Calc 3, y siguió la misma trend…

  - English translation:
  - *And my experience in honors math…it was like, like I don't feel comfortable, I didn't feel comfortable because we were like three, four Hispanics that spoke purely in Spanish…and the majority were White or Asian, and well first of all it was strange because obviously our culture, our habits, are different from theirs, or our topics of conversation or interests are different. So, I couldn't, I don't know, I didn't know how to talk a lot with them, or, well anyway, I did well. I continued with A's, with high grades. Here (at UNM) at school…in Engineering, in the, since I began here it was Calc 1, Calc 2, Calc 3, and it followed the same trend* –Diego, Re-Enrolled

STEM, Latin@s, & Learning Environs: Professors

- Professors contributed significantly to feelings of inclusion or exclusion

- Most graduates expressed at least some positive experiences with professors

- Participants from all STEM trajectory outcomes reported feeling "dumb" and/or witnessing favoritism in the presence of professors

- Participants who built strong relationships with professors gained career advantages

- **The more social support integrates with elements of academic development, the more positive and successful the experience of the student.**

Summary of STEM Learning Environments

- Lower Levels:
  - Intimidating environment limits access to academic content
  - Teaching emphasizes transmission of academic content in a banking education model (Bourdieu, 1970)

- Lack of a learning community
  - Social negotiation of meaning and participation in practices of a STEM community (Dewey, 1902; Johri & Olds, 2011) rarely appear in the *relatos*. When they appear, it is at the upper levels or from Switchers discussing different departments.

A STEM Latina & her learning environment: Physics

- Grading practices in small classes embarrassed and alienated
  - *"And you did pages and pages of calculations and it was just like the biggest blow to your self-esteem you ever had...you would come out of there just hating your life, feeling like a moron after taking those tests..."*
- Denied a sense of belonging, was told she would not succeed on the basis of her gender
- Loss of self-confidence, considerable stress
  - *"I definitely wouldn't have felt comfortable in most of the classes, just because I felt like I was just so below everyone else. [...] Because, you know, I just had such a hard time. And I knew that the professor really didn't have any faith in me, so I really didn't feel comfortable."*
- "Supernerds:" a group of white males were at the center of the department.
  - *"I don't fit the mold, you know?...I didn't have a lot of friends."*

A STEM Latina & her agency:

- Felicia (Graduate): difference as strength
  - WISE, HESO, perseverance
  - The influence of Grandmother and uncle
    - "cultural assets and resources that Chicana/Chicano students bring to formal educational environments…"helps students survive the daily experiences of racism, sexism, and classism. […]The application of household knowledge, specifically in the form of bilingualism, biculturalism, and commitment to communities, interrupts the transmission of "official knowledge" and even helps students navigate their way around educational obstacles" (Delgado Bernal, 2002)
  - Worked full-time, graduated debt-free
    - But it took 13 semesters

Application of Findings: a model for success

- Definitions:
- Financial, Social, and Academic support are crucial to entrance into UNM and success in STEM
- Construction of these lines of support begins during the K-12 experience
- Financial support underlies Social Support and Academic Competencies, particularly where the latter 2 converge
- The 3 factors run on a scale and are interrelated
- **Access** to financial & social support and academic competencies becomes the guiding principle

Financial
Support

Financial
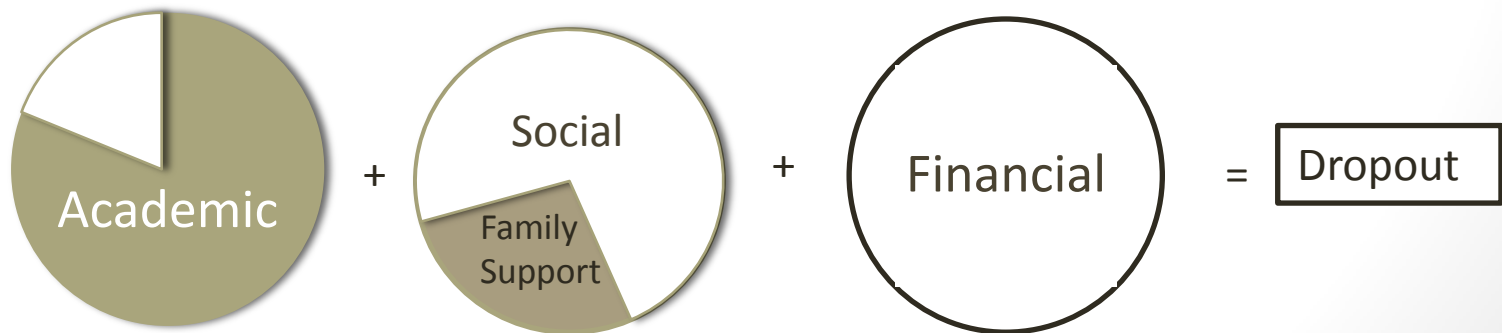& Social
Support

Financial, Social, &
Academic
Competencies

The Creation of a STEM Career: Streams of Access

Application of Findings

- Looking at various cases reveals the efficacy of the model in interpreting participant experiences

- The model also suggests priorities for improving STEM programs at UNM.

- Let's look! The amount of color filling in each circle represents the amount of support experienced by each participant, for that stream. White corresponds to a lack of support.

Marissa, Engineering Dropout

- Financial support was limited, though present at first
- A young mother, family support allowed her to attend UNM
- Strong social support outside of UNM; little to none on campus
- Academic Competencies and science/math identity began development in high school (late by comparison)
- High School mentor disappeared during college
- Troubles with Financial Aid led to leaving UNM

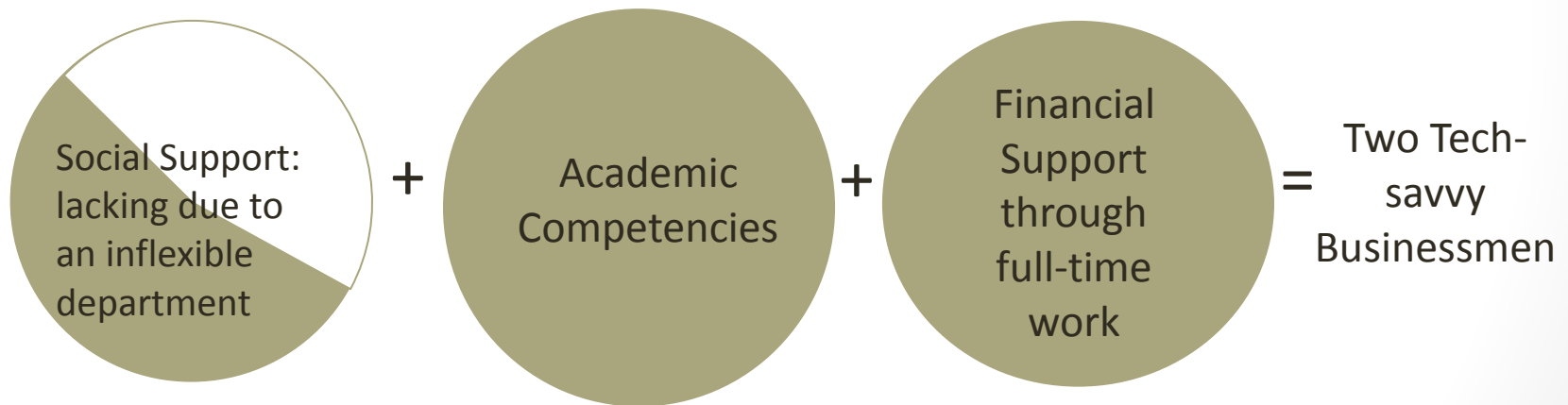Academic + Social / Family Support + Financial = Dropout

Theresa, Physics Graduate

- Presidential Scholarship
- Academic Competencies strong
- Social exclusion, marginalization

Social Support + Academic Support + Financial Support = A physicist, albeit one who will not recommend UNM
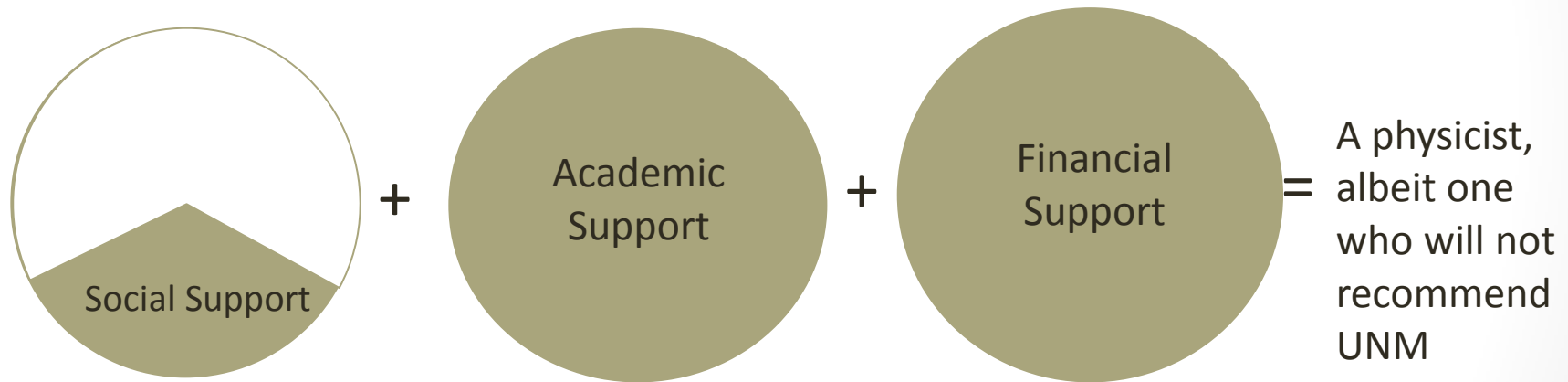
Sometimes, lack of social support can be compensated for through strong academic competencies and student resilience.

Matthew & Manuel: Switchers Computer Science to Business

- Financial support through full-time work
- Needed flexibility from UNM
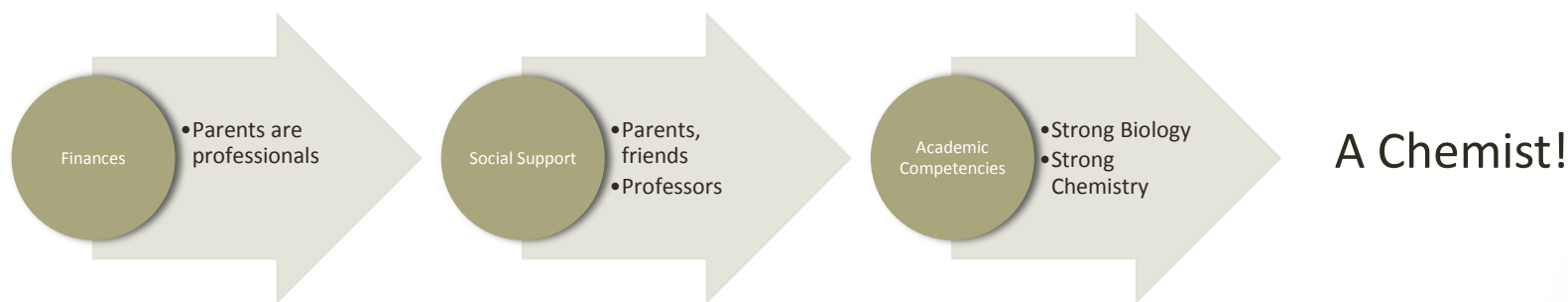- Found it in the Anderson School, coupled with social support

Social Support: lacking due to an inflexible department **+** Academic Competencies **+** Financial Support through full-time work **=** Two Tech-savvy Businessmen

Rachel: Biology Dropout

- Academic challenges: Organic Chemistry

- Financial challenges

- Social challenges due to work

Limited Finances

Limited Social Support

Mediocre Academic Competencies

Stalled STEM Studies: Dropout
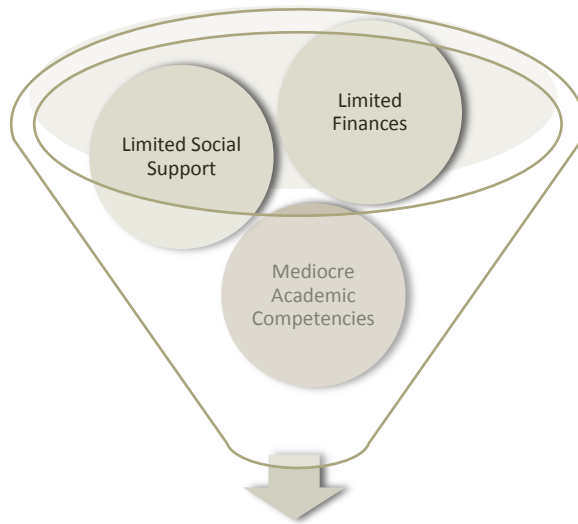
A minimum of each stream may not be enough.

Danny: Chemistry Graduate

- Strong Financial Support
- Strong Social Support
- Strong Academic Competencies
- Relationships with professors led to internships, research publication, acceptance to Ph.D. program, and a career opportunity

Finances
- Parents are professionals

Social Support
- Parents, friends
- Professors

Academic Competencies
- Strong Biology
- Strong Chemistry

A Chemist!

Conclusion

- Access to Financial support, Social support, and Academic Competencies are necessary for success.

- These lines of support may vary in strength, but all are necessary

- When two lines are cut off, chances of student success diminish greatly

- When social support overlaps with the development of academic competencies, the results are positive

- Full-time work can benefit students; it can also present obstacles

- Those who exhibit Latin@ differences struggle to find a place in STEM departments. Latin@ difference is disfavored; mainstream characteristics are favored

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