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FACTORS FOR SUCCESS OF INTERNATIONAL FEMALE DOCTORAL STUDENTS  
IN SCIENCE IN THE UNITED STATES

by

MARIA PATRICIA CANTU

A DISSERTATION

Presented to the Faculty of the University of the Incarnate Word  
in partial fulfillment of the requirements  
for the degree of

DOCTOR OF PHILOSOPHY

UNIVERSITY OF THE INCARNATE WORD

May 2022

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2022

## ACKNOWLEDGMENTS

*“I can do all things through Christ which strengthened me Philippians” 4:13 Context KJV*

*“God is our refuge and strength, a very present help in trouble” Psalm 46:1 KJV*

*“Trust in the LORD with all your heart, and do not lean on your own understanding. In all your ways acknowledge him, and he will make straight your paths.” Proverbs 3:5-6*

*“And not only so, but we glory in tribulations also: knowing that tribulation worketh patience, experience; and experience hope: And hope maketh not ashamed; because the love of God is shred abroad in in our hearts by the Holy Ghost which is given unto us.*

I first give thanks and praise to my Lord Jesus Christ who walked with me in every step of my PhD and Dissertation Journey and to the Holy Spirit who gave me wisdom. I felt their presence and their unconditional love and encouragement, even in the most difficult times. They made me strong in severe chronic pain and physical illness, which led to my permanent disability. They gave me hope in dealing with the devastating death of my only child and son. My husband and I were miraculously saved after contracting CoVid-19.

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Maria Patricia Cantu.

DEDICATION

In Loving Memory of my Only Child and Son, Paul Andrew Cantu

1991-2019



TO ALL FUTURE INTERNATIONAL DOCTORAL FEMALE STUDENTS  
IN THE UNITED STATES.

## FACTORS FOR SUCCESS OF INTERNATIONAL DOCTORAL FEMALE STUDENTS IN SCIENCE IN THE UNITED STATES

Maria Patricia Cantu, PhD

University of the Incarnate Word, 2022

Many international doctoral female students in the sciences in the United States do not obtain a degree despite their large investment in time, effort, and financial resources. The loss of highly prepared and credentialed international female doctoral students, who have a genuine interest in science but who choose not to pursue their studies to graduation or switch careers due to real or perceived barriers, signifies such a loss not just for the women themselves and their families but for their countries of origin, their hosts universities, the scientific professions, and society in general (Castillo et al., 2014). The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international female doctoral students who succeeded in their doctoral programs in the United States in science, technology, engineering, and mathematics (STEM), or completed a professional program in the health sciences.

I utilized a transcendental descriptive phenomenological approach to explore, describe, and understand how international female doctoral students succeeded in their doctoral programs in the United States in the sciences. To improve the methodological validity of the study, triangulation of data sources and data methods were used. Through multiple methods and multiple sources, I gathered data which provided a rich description of the phenomenon

investigated (Bloomberg & Volpe, 2016). I utilized Arts Based Research and *testimonios* to arrive at key findings.

Key findings explained *the what, the why, and how* these participants overcame insurmountable barriers and succeeded in their doctoral science programs in the United States. Families provided what was needed in terms of finances, resources, and support. Regardless of specific traditional religions or spirituality, faith gave strength and provided endurance to all participants during crisis. Support from academic advisors, research supervisors, faculty, and mentors were the number one factor for retention and student success for female international STEM and doctoral health science students in the United States. The role of peers was important. Balance also played an important role in the success of international doctoral females in the sciences. The most resilient group was high risk students. The participants persevered due to personal, social, and institutional factors. Participants underwent a process of transformation to create their new doctoral and scientific identities. Findings from *Testimonios* revealed that participants contributed human capital, and suffered cultural dissonance, discrimination, sexual harassment, and gender, cultural, and class microaggressions.

Universities in the United States can provide “safe spaces” on their campuses to serve as refuge centers that deliver a sense of belonging and support for those international female doctoral science students who suffer from discrimination, alienation, and/or microaggressions. Universities must provide safe methods, formal and informal, to report sexual harassment and provide fair and equitable access to resources for all employees and doctoral students. They must create policies that support faculty and doctoral students during times when family and personal life demands are overwhelming, specifically for raising young children, taking care of an ill or disabled family member, caring for elderly parents, or when in a personal crisis.

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## **Introduction and Background**

In the past decades, the enrollment of international female students in doctoral and professional programs in the sciences (e.g., Science, Technology, Engineering, and Math—STEM) in the United States has increased (Blackburn, 2017; NSF, 2013). Women gained a better chance in obtaining a college degree and continuing to graduate studies more than their predecessors such as their mothers and grandmothers did. Greater access by women to advanced degrees occurred in both developed and developing countries. The number of women in scientific fields continues to rise. However, men continue to outnumber them, particularly in the upper levels of these professions in the United States (Hill et al., 2010; NASEM, 2020).

### **Why so few Women in STEM**

Women from all over the world have made substantial progress in education and in the workforce. Even in traditionally male-dominated professions such as business, law, journalism, and communications, women have made outstanding achievements (UNESCO, 2020). In the scientific fields, however, the representation by women is very low, and in the workforce, it is even lower. In the current environment, when so many women are even outnumbering men in many fields, why are there so few women becoming scientists? (NASEM, 2020)

Laws prohibiting discrimination on the basis of sex have been implemented for more than half a century in the United States, which should lead to equal production of doctoral and professional male and female graduates in the sciences. Additionally, most Americans believe that men and women should have equal rights. Nonetheless, the American egalitarian culture contrasts with the shortage of STEM female professionals (UNESCO, n.d.). The low representation of women in the STEM and health science professions has ignited campaigns



from the government, industry, health sciences agencies, and universities to recruit women into these fields (Charles, 2011; Noe-Bustamonte et al., 2020).

### **The United States is Falling Behind**

Rather than presenting itself as a leader with regard to the representation of women in scientific fields, the United States is falling behind compared with other nations (UNESCO, 2020.). Iran, Oman, Saudi Arabia, United Arab Emirates (UAE), Romania, Algeria, Bulgaria, Malesia, Kyrgyzstan, and Italy are some of the countries that have surpassed the United States in terms of women representation in these fields (Charles, 2011). The pre-existing assumption by Americans is that women in more economically and culturally advanced nations enjoy greater equality in different areas due to egalitarian societies (Charles, 2011; Noe-Bustamonte et al., 2020). However, this is just not true for scientific fields. A study of 84 countries from 2005 to 2008 conducted by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2010) with male and female graduates earning science degrees revealed that the number of females in science programs was larger in Iran, Uzbekistan, Azerbaijan, Saudi Arabia, and Oman than in the United States. The United States ranks in the middle of the distribution of high technological and industrialized countries, very close to the number of females in the sciences in Ecuador and Mongolia. Surprisingly, the Netherlands, considered a country that favors gender equality in Europe, was 50% lower in female representation in the sciences than the majority of Muslim countries (UNESCO, 2010).

A recent article by Huang et al. (2020) focused on longitudinal studies in gender differences in the performance of STEM and health science publishing careers in academia. These authors recreated the entire publication history of more than 1.5 million gender-identified authors whose publishing careers ended between 1955 and 2010, covering 83 countries and 13

disciplines. The findings revealed that the rise of contributions of females in science over the past 60 years was accompanied by a rise of gender differences in both productivity and effect.

Huang et al. (2020) concluded that the STEM and health science organizations in academia are losing females at increased rates in every stage of their professions. The aggregate influence of these science professions' wide effect dramatically increases the gender disparity for senior mentors in higher education. Furthermore, this continues the cycle of decreased retention and low advancement of female faculty.

### **International Doctoral Female Students in Science Continue to Come**

With the increased representation of female students in higher education in the sciences in other countries, there has been a deluge of international female students from developing countries seeking doctoral and professional degrees in science in the United States (National Center for Science and Engineering Statistics (NCSES), 2018). For those international students who are accepted, they face many acculturation, language, and social barriers (Wu et al., 2015; Wu, 2016). In the sciences, they face serious academic and technological deficiencies compared to their domestic counterparts (Spaulding & Rockinson-Szapkiw, 2012; Wu, 2016). For example, they do not know how to use mega-computers and sophisticated spectrophotometers (Bergeron, & Gordon, 2017). Their attrition rate is high, and few fulfill their goals (Castillo et al., 2014).

Additionally, doctoral female students in STEM and health science fields who belong to minority groups such as African Americans, Latinas, Native Americans, Pacific Islanders, international female students (Armstrong and Jovanovic, 2017; Blackburn & Heppler, 2020; Leggett-Robinson & Villa, 2019) and Gay, Lesbian, Queer, Bisexual, Trans, Intersex, and Asexual (GLQBTIA) students had to overcome pervasive intersectional obstacles encompassing

homophobia, bullying, institutional racism, and tokenism (Armstrong & Jovanovic, 2015; Blackburn & Heppler, 2020; Cascio, 2017).

Despite all odds, some international female students do persevere and obtain their STEM PhDs or Doctorate in the health sciences in the United States (NASEM, 2020). This qualitative study explored the lived experiences of eight international female scientists who successfully completed their PhD programs in science in the United States in public universities, even though they faced many barriers. Summaries of the main problem, and the factors contributing to the problem, are stated bellow. Detailed information on the doctoral programs in STEM and health sciences in the United States and their effects on the international female doctoral science students will be described in the second chapter, Literature Review. Current research studies on the experiences of international female doctoral science students in the United States will also be provided in the Literature Review.

### **Statement of the Problem**

Many international female doctoral students in the sciences in the United States do not obtain a degree despite their significant investment in time, effort, and financial resources (Castillo et al., 2014). The loss of these highly prepared and credentialed students, who have a genuine interest in science, choose not to pursue their studies to graduation or switch careers due to real or perceived barriers. This signifies a loss, not just for the women themselves and their families, but for their countries of origin, their host universities, the scientific professions, and society in general (Castillo et al., 2014).

### **Reasons to Study International Doctoral Female Science Students in the United States**

I am a female, a scientist by trade, and a life-long learner. I completed high school in the

United States and obtained a B.S. in Bacteriology from Javeriana University in Colombia, South America. After graduating, I obtained a Fulbright Scholarship and came back to the United States as an international student to pursue graduate studies in microbiology. [Please Refer to Role of the Researcher Section].

This study is a merging of three areas of research interests: the health sciences; STEM [termed in this study as science]; the field of education and passion for service trying to find factors which contribute to fight against global gender inequalities which had a positive convergence.

There is very limited research on international female doctoral students completing their doctoral studies in the STEM fields or health sciences in the United States prior to 2007. From 2007 to 2020, there has been a significant increase in the literature (Blackburn & Heppler, 2020). A major portion of these research studies focuses on international women students and faculty, recruitment and retention of this important population, and their experiences in the United States (Blackburn, 2017).

Historically, access to institutions of higher education in the United States in the sciences has been very important to international female students because it empowers them to obtain positions of leadership upon return to their home countries (NASEM, 2020). Obtaining a doctoral or professional degree in the sciences from the United States can guarantee financial independence, upward movement to a higher social status, and career advancement (Blackburn 2020). There is, however, a huge gap in the literature of studies and research on international female doctoral students, specifically in non-conventional areas of study like the sciences (Blackburn, 2017). This lack of information on the experiences and learning processes of these students in the sciences is a cause for concern, primarily because their voices need to be heard

and other international and domestic science students need to learn from their experiences. Additionally, further research will help American universities in admission, retention, and graduation rates of these students and for future policy implications (NASEM, 2020)

It is false to assume that the main reason international female doctoral students in science leave their doctoral programs due to academic deficiencies in their specific fields (NASEM, 2020; NASEM, 2018; Pawley, 2011). Alternatively, numerous research studies point to biases [implicit and explicit] that discourage these important populations to remain in their fields of study (Cheryan et al., 2015; Master et al., 2016; NASEM, 2020) or pressures them to leave (Hunt, 2016; NASEM, 2020). There are also interpersonal interactions and/or departmental ordinances and cultural issues that block their progress (Grogan, 2018; Urry, 2015).

### **Research Questions**

The following research question guided this study:

What are the lived experiences of successful female scientists who earned a PhD as international doctoral students in Science, Technology, Engineering, and Mathematics (STEM) or completed a doctorate professional program in the health sciences in the United States?

In addition to the overarching research question, following a review of the current and related literature for the noted topic, I made the decision to create sub-questions. My decision was also based on discussions with cohorts and my dissertation Chair and Committee members. I had made an initial assumption that international female doctoral students experienced barriers in the United States while pursuing their educational goals. Additionally, there were factors and

attributes, previously unknown to me, that helped these students navigate those barriers. This background guided the development of the additional questions. These were my sub-questions:

1. What factors do participants perceive enabled them to complete their program of study and graduate in a timely manner?
2. What barriers did successful international doctoral female students experience while completing a STEM PhD or a dual PhD and/or professional program in the health sciences and graduate?
3. How did successful international doctoral female students in STEM fields or in a dual PhD or a dual PhD and/or professional program in the health sciences in the United States navigate identified barriers?
4. What attributes contributed to the success of international doctoral female students who completed a STEM PhD or a dual PhD and/or professional program in the health sciences in the United States and graduate in a timely manner?

### **Role of the Researcher**

This section addresses my personal and educational background, which played a significant role in my interest in researching this topic. I hold two nationalities: Colombian by birth and American by Naturalization. I was born in Bogota, Colombia, South America. After graduating from high school in New York City, I returned to my country of origin and attended Pontificia Universidad Javeriana, a private Ivy League Catholic University in Bogota, Colombia. I graduated with honors with a Bachelor of Science in Bacteriology (Microbiology).

Upon graduation, I chose to work for one year in a very rural and impoverished area of Colombia, in the middle of the civil war, where numerous women and children were dying as victims of the crossfire between the guerrilla forces and the military. This work and the

simultaneous research I conducted in malaria helped me obtain a very coveted Fulbright Scholarship to conduct research in the United States. I returned once more to the United States as an international student and Fulbright Scholar (Graduate Department of Microbiology) where I did research in Immunology.

I went back to Colombia to serve my native country. In Colombia, I taught Immunology, at my alma mater in the Department or School of Medicine and also Chemistry in Colegio Nueva Granada (CNG). I married an American and relocated permanently to the United States where my husband attended the University of Texas Law School in Austin, Texas. After my husband's graduation, we relocated permanently to San Antonio, Texas. I took time to raise my only child before returning to graduate school. I graduated as a cytotechnologist from the University of Texas Health Science Center at San Antonio (UTHSC-SA) and a few years later obtained my Composite Science Teacher Certification and Master's in Curriculum and Instruction as a Robert Noyce Scholar (National Science Foundation) from the University of Texas at San Antonio (UTSA). This background helps to explain my interest in the health sciences and STEM and my personal experiences as an international female graduate student in a non-conventional science program (Microbiology) in the United States. It also explains my interest and experience in the field of Education. For most of my life, I have been concerned with factors that contribute to global gender inequalities and trying to understand the advantages and limitations of higher education for women. Therefore, I tried to identify specific ways in which education addresses the needs of women.

My previous studies, profession, research, and teaching have been in scientific fields. Hence, the two major fields of study in science and education that I pursued throughout my

lifetime, along with my honest desire to help improve conditions for women and children around the world, have culminated in this research project.

### **Purpose of the Study**

The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international doctoral female students who succeeded in their PhD programs in STEM fields or completed a Doctoral program in the health sciences in the United States. Following is a delineation of the research purpose at two levels: personal and theoretical, following Maxwell (2013). The research purpose at a practical level is subsequently discussed.

Personal level:

1. To strive to profoundly understand the phenomenon of the lived experiences of international female doctoral students in science in the United States and their migration to this country to pursue doctoral studies in non-conventional fields.
2. To comprehend, with the participants, the personal experiences of this underrepresented group of international female doctoral students in programs designed to prepare them for scientific professions that remain predominantly male.
3. To explore the influence of institutional practices, policies, faculty, and advising on the lives of international female doctoral students in scientific fields who, upon graduation, will return to their countries of origin and in turn impact the lives of future scientists around the world.
4. To strengthen my commitment to internationalization in higher education and scientific and educational advancement in developing countries.



5. To understand the role of social justice; international human rights, and equity-focused programs and their impact in women's lives and global gender equality.

Theoretical /conceptual level (learning goals):

Very little research has addressed international female doctoral student's choices and experiences in non-conventional fields like the sciences in the United States. This transcendental descriptive phenomenological study will add to the existing research, which, for the most part, addresses rates of program completion by focusing on the impact of these doctoral programs on international females who enter the scientific fields in the United States and in various countries around the globe.

The present study will fill a gap in the body of literature with regard to: (a) international doctoral students, (b) international female doctoral students, and (c) international female doctoral student's choices and lived experiences in non-conventional fields like the sciences.

### **Research Vision**

The desired outcomes of the research have been identified as:

1. Hope/expect to see: filling in the literature gap.
2. Like to see: profoundly understanding the phenomenon of international female students' lived experiences in the United States and their migration to the United States to obtain a doctoral or professional degree in science.
3. Love to see and accomplish:
  - a. Being a voice for this vulnerable student population [educating and informing all stakeholders: faculty, academic advisors, and administrators in doctoral programs in science, student affairs, international student services, the community, the city, the state, and the United States at large; globally].

- b. Being an agent of change: increasing the graduation rates of international female doctoral students in the sciences.
- c. Creating an awareness of the importance of international scientific and academic collaboration by means of internationalization [internationalizing the faculty, curricula, student abroad programs, recruiting, and retaining doctoral international students].

### **Overview of Methodology**

Qualitative research is based, for the most part, on a constructivist philosophical stance; it deals with how the intricacies of the sociocultural world are experienced, construed, and comprehended from the participants' views in a specific context and at a given point of time (Bloomberg & Volpe, 2016). The goal of qualitative research is to investigate social circumstances in which the researcher becomes immersed in the lives of others, trying to understand them (Bloomberg & Volpe, 2016; Maxwell, 2013; Merriam, 2009; Patton, 1990). Qualitative research was a good fit for this study because I wanted to explore the phenomenon of international female students' lived experiences after migrating to the United States to pursue doctoral studies in non-conventional fields of science. "The researcher is interested in understanding how participants make meaning of the situation or phenomenon, this meaning is mediated through the researcher as instrument, the strategy is inductive, and the outcome is descriptive" (Merriam, 2002, p. 6).

The main goal of phenomenological research is to describe the configuration, meaning, and essence of the lived experiences of a person or group of persons involved in a specific phenomenon. Descriptive phenomenology strives to explore and describe the meaning or essence of the shared lived experiences of all participants (Moustakas, 1994). This methodology is based

on the exploration and description of the lived experiences of 8 international female students in STEM PhD or doctoral programs in the health sciences in the United States. The description encompasses *what* they experienced and *how* they experienced it within a specific context, situations, and circumstances (Creswell, 2014).

In this study, the phenomenon under investigation is the lived experiences of 8 doctoral international females who migrated to the United States to study science. Bloomberg and Volpe (2012) posited that qualitative research questions are generally open-ended and typically begin with “what” and “how,” providing a structure for understanding a phenomenon. My research questions are descriptive, as they ask “*what was happening* as far as specific noticeable events and real behaviors that took place. Yet, they explore the meanings of the *essences* of the lived experiences, of the participants under specific conditions, circumstances, and context Bloomberg and Volpe, 2012; Maxwell 2013). My research paradigm is of social constructivism, which, according to Moustakas (1994), is displayed in phenomenology when the participants describe their lived experiences.

Moustakas (1994) is credited to be the forefather of phenomenology. He revisits the experience to acquire broad descriptions, which constitute the basis for reflective analysis to depict the essence of the experience. I described the configuration of the experiences of the international female doctoral students in science programs in the United States based on the interpretation and reflection of their stories. The goal was to determine what their experiences meant to these participants. From there, general themes emerged. I also used an inductive approach of a purposefully selected sample. Creswell (2012) explains that “in purposeful sampling, researchers intentionally select individuals and sites to learn or understand the central phenomenon” (p. 206).

I conducted this qualitative research study of international female students who completed a PhD in STEM or a Doctoral program in health Sciences studies [a Doctoral degree in sciences] at state universities in the United States. As a researcher, I had face-to-face interactions with the participants in the natural setting where the international female scientists who graduated with a Doctoral degree in the sciences in the United States work as faculty and researchers [either in state or private universities]. I chose a setting that was accessible, advice that Creswell and Poth (2013) provided when choosing specific settings. Furthermore, Patton (1990) recommended choosing individuals and sites that are “information rich” (p. 169). All participants and university sites provided rich data.

Criteria for participants’ selection:

1. To have come to the United States as “true” international students. [In the US International students are "Individuals studying in the United States on a non-immigrant, temporary visa that allows for academic study at the post- secondary level. Immigrants, permanent residents, citizens, resident aliens ("Green Card" holders), and refugees are excluded from this definition."

[https://en.wikipedia.org/wiki/International\\_student#National\\_definitions](https://en.wikipedia.org/wiki/International_student#National_definitions)

For purposes of this study, my dissertation committee and I defined “True International Students” to differentiate them from “Immigrants, permanent residents, citizens, resident aliens ("Green Card" holders), and refugees.”

2. To be female students.
3. To have learned English as a second language.

4. To have graduated in a Science, Technology, Engineering or Mathematics (STEM) PhD program or a doctoral program in the health sciences in the United States within the last 20 years.
5. To be willing to share their experiences and perspectives related to the research inquiry.

### **Rationale and Significance**

According to the Institute of International Education *Open Doors Report* (# IEW 2020), there were 1,075,496 international students in the United States during the academic year 2019/2020, including those in academic programs and Optional Practical Training (OPT). Approximately 52% of all international students studied in STEM fields; 21% studied engineering; 19% studied math and computer science; 8% studied physical and life sciences; and 3% studied health sciences. Approximately 38% undergraduate international students and 62% of graduate students majored in STEM fields, and 68% of all Optional Practical Training (OPT) for international students were in STEM. International students contributed 44.7 billion dollars to the U.S. economy in the academic year 2019-2020 (Institute of International Education (IIE) *Open Doors Report* (2020). Additionally, 415,996 direct and indirect jobs were created or supported by international students. (NAFSA Association of International educators as cited in international Education Open Doors Report (# IEW2020).

While engineering remains the top field of study for all international students (graduate and undergraduate), the number of international students in math and computer science programs grew by 0.9% surpassing business and management to become the second-largest field of study for international students. Fifty three percent of international students came from China and India, during the academic year of 2019-2020. Five percent came from South Korea. Brazil,

Canada, Japan, South Korea, Taiwan, and Vietnam, each contributed to 2% of International Students in the United States from their specific countries to the United States during the academic year of 2019-2020. The United States remains the top host of international students globally. One out of three international students studied in California, New York, and Texas. (Institute of International Education, *(IIE) Open Doors Report on International Educational Exchange 2020*).

According to the National Science Foundation, 2020 *Science & Engineering Indicators Report*, in contrast to the undergraduate enrollment, international graduate student enrollment rose slightly from 2017 to 2018 (from 368,000 to 369,000) after a substantial decline (6%) between 2016 and 2017. Additionally, the number studying S&E fields increased (by 2%). Although these increases do not erase the declines of the previous year, they force us to wonder whether those declines represent a trend. Just as with the data provides for undergraduates, the rise in science and engineering graduate enrollment was determined by those studying science fields, with numbers increasing back to 2016 levels. The number of those studying engineering, however, declined for the second year in a row. Since 2016, countries like Iran and Saudi Arabia have seen declines in the numbers of graduate students, especially in engineering. But China and India, and the difference between them, dominate the discussion because of the large numbers of students from those countries who study in the United States. According to World Economics' Forum Report 2020 as cited in Institute of International Education, *(IIE) Open Doors Report (2020)*. In 2018, there were 150,000 graduate [Masters and PhD Programs] international students enrolled in science programs and about 100,000 enrolled in engineering (p.41). The female representation in doctoral STEM and health science fields of international students is only about 30%.

### **Significance at the Practical Level**

This study may have very positive implications for the international doctoral female science students who are currently enrolled in doctoral programs in the United States. They may learn what strategies contributed to the success of other international doctoral female science students who just like them faced but overcame many barriers, graduated and are now successful scientists in the United States. Potential female international doctoral applicants in science programs in the United States, can realistically learn some of the challenges they will expect to find in doctoral programs in science in the USA.

The potential female international applicants and those seriously interested in applying or admission and pursuing a PhD in STEM or a Doctoral program in the health sciences may research in advance which University and Program is their best fit for their academic goals; financially seek Teaching (TA) or Research Assistantships (RA) in advance and or secure financial aid from their countries of origin; prepare to pass the GRE and English language entrance exams; improve their American English language skills; take academic courses online to improve any academic deficiencies in Science they may have; become very familiar with the Immigration Policies and types of Visa they will require and start building systems of support prior to arriving in the United States.

Prospective International Female Doctoral Science Students planning to study and live in the United States can learn ahead of time social and cultural norms of the United States and prepare plans on how to overcome acculturation and cultural shock. They may want to research in advance, the city and state where they will reside, learn about safety, and health conditions and be prepared to avoid violence, and unsafe situations. All countries are now facing a pandemic. Country of origin travel restrictions and the host country of the United States and

specific cities and states have their own policies, ordinance, and laws. Hence, they will have to adjust and prepare more than ever before.

This study may help successful international doctoral female Scientists who graduated in the United States become role models as faculty and mentors of new generations of female scientists in the United States or abroad. It is expected that the identification and comprehension of the motivation and challenges of the international doctoral female science students; their learning styles; needs; systems of support and use of academic resources will provide rich data to doctoral science programs and universities in the United States on this underrepresented group. This in turn may inform better institutional practices, policies, faculty and advising relationships for international female doctoral science students. This study may also inform policy and decision making in science doctoral programs in the areas of recruitment, retention, and increased graduation rates of international doctoral female science students in universities in the United States.

Furthermore, this study may improve American universities' administration, student affairs, advising and teaching practices as it relates to international doctoral female science students. This study is important because it may improve policy and decision making in the areas of recruitment, retention and increase graduation records of international doctoral female students in the science programs in universities in the United States.

### **Research Assumptions**

An initial assumption is that the international female doctoral students in the STEM and health science fields overcame many barriers in the United States. This is based on the fact that although many do not complete their degrees, these specific participants in my study persevered, graduated, and are practicing their scientific field of studies. The participants successfully



completed all academic requirements including qualifying exams, and dissertation defense and graduation.

A second assumption is that the international female doctoral science participants in this study who chose to remain in the United States after graduation and work as either university professors, scientists or researchers have proper academic credentials in STEM or the health sciences. This is based on the premise that to be offered a contract of employment and/or be allowed to remain in the United States to work in these capacities, foreign nationals must undergo strict scrutiny and verification of their scientific credentials for immigration and security purposes by the universities, research companies, or the private companies that employ them.

A third assumption is that my participants had accurate perceptions of their own personal realities, developed subjective meanings from their experiences (constructivist world view), had insight into their personal perceptions, and would share them honestly with me.

### **Delimitations and Limitations**

This is a qualitative transcendental descriptive phenomenological study, and the delimitations, according to Bloomberg and Volpe (2016), are defined by the contextual boundaries of public universities in the United States. The characteristics of the participants were restricted to international female doctoral students in STEM or professional programs in the health sciences who successfully completed their programs of study and had graduated and passed qualifying exams, dissertation defense, and completed all academic requirements. The sample consisted of only 8 participants.

A possible first limitation is what Maxwell (2013) referred to as *participant reactivity*. A few of the participants have the same country of origin as I do or speak my native language (Spanish). Hence, they may have provided the responses they think I, as the researcher, was

looking for or go out of their way to please me. Another possible limitation is that the participants may have reserved their true responses out of a sense of embarrassment or shame. To prepare for these events, I discussed the goal of the study and stated its assumptions before the start of the investigation. The following precautions were made ahead of time: coding schemes and documents and transcriptions were supervised by faculty and by means of peer review. I removed all names of participants and coding from the interview transcripts. I blinded the participants' identities to avoid linking data and materials to a specific individual. In addition, I created an environment of open communications.

Researching this population was more challenging than research with native English-speaking groups. All participants spoke the American English language fluently. Nonetheless, they spoke with accents just like I did, which at times created communication barriers that were overcome by asking what they meant, or clarification was sought during second interviews. Likewise, I repeated what I said if the participants did not understand my accent. Limitations arose from the limited sample size of 8 participants and to control this limitation, I addressed *transferability*, not generalizability (Bloomberg & Volpe 2016; Lincoln & Guba, 2000).

### **Definition of Terms**

ABD is used for "all but dissertation." A doctoral student who has completed all required courses and qualifying exams for the academic program in which they are enrolled but have not completed a dissertation is considered to be *ABD*.

Academic Resilience: The ability to achieve in an educational setting despite exposure to risk factors (Morales, 2008).

Academic Success: For purposes of this study, academic success refers to the completion of a doctoral and/or professional degree prescribed by the American university and subsequent

graduation. There may be also cultural implications depending on the country of origin related to academic success.

**Acculturation:** The degree of adaptation to cultures other than one's own as a result of contact, life, and/ or exposure to that culture. The process may involve complete immersion and acceptance of a culture by a group or individual, or it may imply the merging of both cultural traits. In the case of international students, it involves the process of orientation to the new environment and an adjustment to different educational systems (Oblong, 1997).

**Culture:** This is a rather complex and difficult term to define, as it includes customs, morals, laws, systems of beliefs, arts, and other traits of members of a specific society (Kottak, 2002).

**Cultural Shock:** A common reaction of foreign students who are learning a new language and culture. The reaction may involve confusion, irritability, hostility, panic, and estrangement (Furnham & Bochner, 1986).

**Doctoral Degree:** For purposes of this study, a doctoral degree (also known as PhD) is a terminal degree awarded after completion of at least 66 credit hours of coursework including a minimum of 9 hours for dissertation writing. To be awarded a doctoral degree, the student must complete a minimum residency requirement of 54 credit hours; successfully complete the course of study as specified in the degree plan, including the dissertation, within a 10-year period; pass a qualifying examination as designed and administered by the student's Qualifying Committee; and be successfully advanced to candidacy. The student must also successfully defend the doctoral dissertation as directed and approved by the Dissertation Committee. A specific program concentration may require additional completion requirements. The doctoral degree is granted when all requirements are met, and the Dean of Graduate Studies and Research has

signed the Dissertation Clearance Form. Different American universities have different requirements. Hence, this is just an approximate definition. A student may have one or sometimes two master's degrees from another university, the same university, or may be completing an additional master's degree along with the doctoral degree. A selected few completed a doctoral degree or professional degree in the health sciences.

G.A: The term means graduate assistant. It refers to a student who receives tuition reduction or a monthly stipend in exchange for part-time work (20 hours or less). The work usually involves conducting research (R.A. or "research assistant") for a faculty member in the University; it may also involve assisting a professor who teaches specific courses (T.A. or "teaching assistant"). In some cases, the graduate assistant helps tutor other students, write grants, or may perform other administrative duties as assigned.

Gender: "Gender refers to the characteristics of women, men, girls, and boys that are socially constructed. This includes norms, behaviors and roles associated with being a woman, man, girl, or boy, as well as relationships with each other. As a social construct, gender varies from society to society and can change over time. Gender interacts with but is different from sex, which refers to the different biological and physiological characteristics of females, males, and intersex persons, such as chromosomes, hormones, and reproductive organs. Gender and sex are related to but different from gender identity" (World Health Organization, [https://www.who.int/health-topics/gender#tab=tab\\_1](https://www.who.int/health-topics/gender#tab=tab_1)).

Gender Identity: "Gender identity refers to a person's deeply felt, internal and individual experience of gender, which may or may not correspond to the person's physiology or designated sex at birth" (World Health Organization, [https://www.who.int/health-topics/gender#tab=tab\\_1](https://www.who.int/health-topics/gender#tab=tab_1)).

**Gender Inequality:** “Gender is hierarchical and produces inequalities that intersect with other social and economic inequalities. Gender-based discrimination intersects with other factors of discrimination, such as ethnicity, socioeconomic status, disability, age, geographic location, gender identity and sexual orientation, among others. This is referred to as intersectionality” (World Health Organization, [https://www.who.int/health-topics/gender#tab=tab\\_1](https://www.who.int/health-topics/gender#tab=tab_1)).

**International Students:** In the International Student Census, an international student is defined as an individual who is enrolled in coursework at an accredited, degree-granting higher education institution in the United States on a temporary visa that allows for academic study. Individuals who do not meet this definition, such as immigrants (permanent resident with an I-151 or Green Card), U.S. citizens, undocumented immigrants, those with deferred action status, or refugees/asylees are not included. Individuals participating in Optional Practical Training (OPT) are considered students in the Department of Homeland Security’s Student and Exchange Visitor Information System and are included in the *Open Doors* international student totals. Institute of International Education (IIE) Open Doors: About International Student Census. (<https://opendoorsdata.org/about/about-international-student-census/>)

**Professional Degree:** A terminal degree conferred to students in the health sciences and or allied health fields. For purposes of this study, the term includes the following: Doctor of Nutrition, Doctor of Pharmacy (Pharm D), Doctor in Public Health (Graduate Bulletins, 2019-2020 editions).

**“True” International Students:** In the US International students are "individuals studying in the United States on a non-immigrant, temporary visa that allows for academic study at the post- secondary level. Immigrants, permanent residents, citizens, resident aliens ("Green Card"

holders), and refugees are excluded from this definition."

[https://en.wikipedia.org/wiki/International\\_student#National\\_definitions](https://en.wikipedia.org/wiki/International_student#National_definitions)

For purposes of this study my dissertation committee and I defined "True" International Students to differentiate them from Immigrants, permanent residents, citizens, resident aliens ("Green Card" holders), and refugees.

Socio-Cultural Adaptation: The term indicates the degree to which an acculturating student is able to manage the pressures of daily life in a new cultural environment (Ward & Kennedy, 1993).

Resilience: Hassinger and Plourde (2005) defined the term as "the ability to cope with adversity and overcome the most challenging circumstances" (p. 319).

Retention: For purposes of this study, the term is defined as the process of continuation of student status and involvement in the career of choice and academic endeavors to ensure graduation.

STEM: "STEM is an acronym that stands for science, technology, engineering, and mathematics" (April 21, 2021, Dale Stokdyk. <https://www.snhu.edu/about-us/newsroom/stem/what-does-stem-mean-for-you>)

Sciences: For purpose of this study, the term involves academic programs in the Science, Technology, Engineering and Mathematics fields (STEM) and the health professions or allied health fields.

## **Summary**

In this chapter, the topic of international doctoral female students in the sciences was introduced. The historical background of international doctoral female students in science in the United States was discussed, along with a statement of the problem, factors contributing to the

problem, the rationale and significance of the study, the research question and sub-questions, and the purpose of the study. This initial chapter concluded with a definition of terms. A review of the current literature is presented in the next chapter.

## Literature Review

The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international doctoral female students who succeeded in their PhD programs in STEM fields or completed a Doctoral program in the health sciences in the United States. The intent of this literature review is to evaluate, critique, and synthesize current research to support my problem statement along with my personal education and experiences previously outlined in the first chapter. The main problem is that many international doctoral female students in the sciences in the United States do not obtain a degree, despite their large investment in time, effort, and financial resources (Castillo et al., 2014).

This literature review also seeks to develop a conceptual framework and acquire new perspectives. The review of current literature will continue through data collection and procedures, data analysis synthesis, and interpretation processes, and will surface throughout the project. My research topic came from observing and discussing real life problems with international doctoral female science students and my previous personal experiences as an international graduate female science student in the United States. Furthermore, I attempted to find critical gaps and oversights in the literature. Disputed studies are included and discussed within this review (Bloomberg & Volpe 2016; Torracco, 2005).

Moustakas (1994) explains the purpose of the literature review in a phenomenological research study:

Preparing to conduct a phenomenological study involves review of the professional and research literature connected with the research topic and question. The investigator assesses the prior relevant studies; distinguishes their designs, methodologies, and findings from the investigator's own study; and indicates what new knowledge he or she is seeking and expects to obtain. (p. 111)



## **The Last Decades of Research on International Students in the United States**

Krsmanovic (2021) discusses a study completed by the Institute of International Education that focuses “on the main pull factors” motivating international students to choose a particular destination. Findings reported 77% of prospective international students felt that the quality of U.S. education was superior to that of global competitors, and 78% were attracted by specific universities and educational programs; 68% believed that the United States is accepting and welcoming to international students. Krsmanovic (2021) discusses the World Education Services survey (Skinner et al., 2019) of international students in the United States that proved the predeparture perceptions of the international students was accurate. The survey revealed that 89% of the international students was pleased with the quality of American academic teaching and programs. Moreover, 83% found it easy to adjust to new environments and new educational experiences, while more than 90% believed university staff and faculty welcomed them (Krsmanovic, 2021).

Nonetheless, Krsmanovic (2021) reports that the survey’s findings revealed that the international students’ initial excitement and positive perceptions became toned-down by multiple barriers and challenges they encountered during the acculturation period. Thus, more than 80% disclosed that their social relationships included either students from their home countries or other international students and approximately 60% of respondents stated they were not actively involved in activities and events at their host universities. According to the author, more than half of the respondents reported problems in developing close relationships with domestic students.

Other stumbling blocks diminishing their positive experiences included academic stress, language and cultural barriers, and the absence of campus networks to support community

integration. Previous literature repeatedly supported the claim that international students were very afraid of initiating out-of-class communication with faculty, establishing positive relationships with faculty members and/or seeking academic advising, mentoring, and support, (Kim et al., 2015; Kim et al., 2017; Krsmanovic, 2021; Leong, 2015; Mamiseishvili, 2012a, 2012b).

The international students' negative social experiences and their strangeness with the American culture surfaced as the most predominant barrier to successful assimilation (Andrade, 2005; Kim et al., 2015; Kim et al., 2017; Krsmanovic, 2021). Furthermore, the research identified numerous cases of international students' incapability to develop positive friendships with their domestic peers and community. Consequently, international students become lonely and turn to both involuntary and voluntary social isolation, and/or involuntary separation (Krsmanovic, 2020; Krsmanovic, 2021; Leong, 2015; Wu et al., 2015). Finally, elevated levels of acculturative stress and acculturation at decreased levels were positively correlated with students' depression and psychological distress (Krsmanovic, 2020; Shadowen et al., 2019)

All these negative effects of acculturation, and cultural shock demand an all-inclusive understanding of the multifaceted lived experiences of international students in U.S. universities. Analyzing prior research in this important topic is imperative for faculty, student affairs, and admission and international students' offices that are responsible for ensuring the success of international students in academics as well as social and cultural experiences. A comprehensive review of past literature can shed light on critical topics and trends of this important student population to ensure future practical remediation efforts effectively and efficiently support the international students and help them achieve their academic goals, graduate, and succeed (Krsmanovic, 2021).

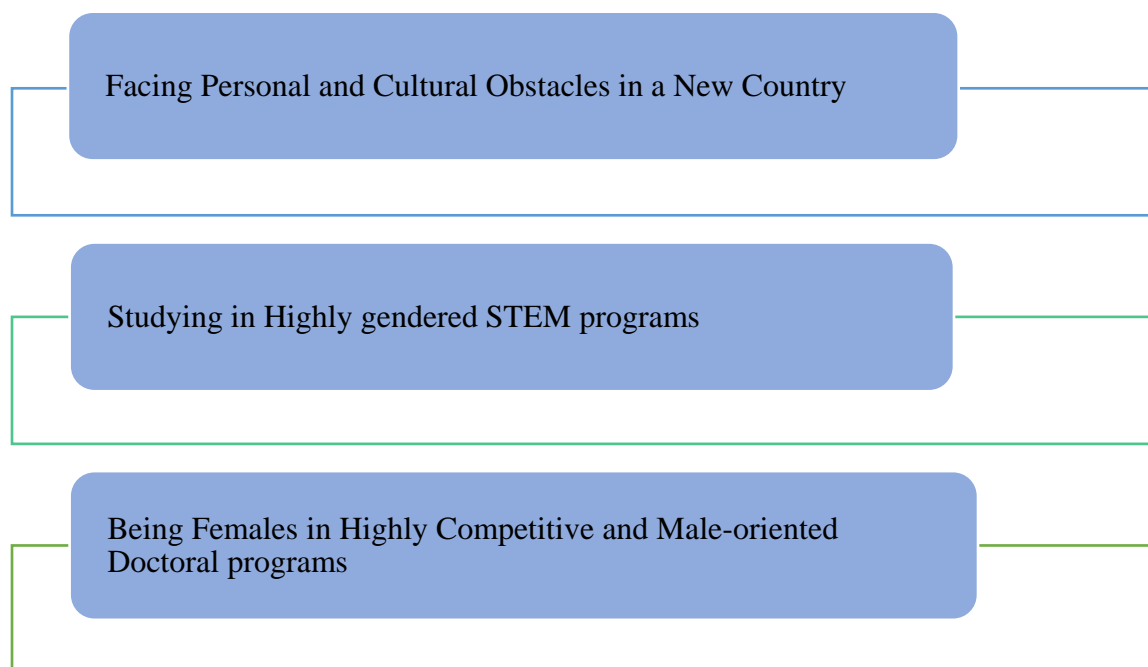
## **Barriers Faced by Female International Students**

Although there is an extensive body of literature regarding international students who have come to the United States and faced numerous barriers and acculturation processes, these studies do not address the barriers faced by female international students (Altbach & Teichler, 2001; Hsu, 2003; Misra et al., 2003; Ip et al., 2009; Krsmanovic, 2020; Krsmanovic, 2021; Leong, 2015; Sawir et al., 2008; Wu et al., 2015; Zhao et al., 2008). The literature informs readers about the barriers faced by women in the STEM fields of study; however, there is limited research on doctoral representation of women in these fields. Furthermore, although research has addressed the underrepresentation of women in STEM programs, there is a dearth of research addressing the specific underrepresentation of international women in STEM programs.

Hence, international doctoral female students in the sciences in the United States could face “triple jeopardy,” (illustrated in Figure 1) and experience triple marginalization: (a) as international students facing personal and cultural obstacles in a new country, (b) by issue of studying in STEM programs that are usually non-accepting toward females highly gendered, and (c) by being females in highly competitive and male-oriented doctoral programs. The selection of these specific groups of participants will attempt to fill the literature gap that exists in the literature because it specifically examines the experiences of international doctoral female students in STEM programs and the health sciences in the United States.

**Figure 1**

*Triple Jeopardy: International Doctoral Female Students in the Sciences in the United States*

**Current Review of Literature on Doctoral Female Science Students in the United States**

A comprehensive review of the participation of women authors writing on the topic of the current status of females in the STEM and the health science fields in academia in the United States from 2007-2018 was conducted by Blackburn and Heppler (2020). The authors gathered the gender identities of first and senior authors from 647 citations. Furthermore, the authors also reviewed the citations to obtain the journals and publishers who were most prolific in the literature on this topic. The authors found that females comprised 34% first authorship and 59% overall authorship. The top publishers in this topic included Elsevier, Sage Publications, and Springer/Nature. Female representation accounted for 60% of the first authors in STEM literature on the status of females and 38% of senior authors.

Even though there was an increase over time in first authorship in STEM literature written by females, they remain a minority in senior authorship. Blackburn and Heppler (2020) suggest it is women in the STEM and health science fields in academia who are researching and writing about their own lived experiences as a form of self-advocacy. Hence, they became leaders on this dialogue. These research studies cover many topics as shown in Table 1.

**Table 1**

*Research Studies on the Lived Experiences as a Form of Self-Advocacy*

Topic	Authors
Biases	Blackburn & Heppler, 2020; Handley et al., 2015; LaCosse et al., 2016; Moss-Racusin et al., 2018
Campus culture	Blackburn & Heppler, 2020; Crenshaw et al., 2017; Dresden et al., 2018
Identity	Beals, 2016; Robnett et al., 2015
Lived experiences	Alexander & Hermann, 2016; Blackburn & Heppler, 2020; Maltese & Tai, 2011; Smith & Gayles, 2018
Self-concept	Blackburn & Heppler, 2020; Koul et al., 2016; Morton & Parsons, 2018; Sax et al., 2015
Self-efficacy	Blackburn & Heppler, 2020; Dugan et al., 2013; Verdín & Godwin, 2018
Stereotypes	Banchefsky & Park, 2018; Barth et al., 2016; Blackburn & Heppler, 2020; Cheryan et al., 2015
Student motivation	Chumbley et al., 2015; Graziano et al., 2012; Leaper & Starr, 2018; Smith et al., 2012; Talley and Ortiz, 2017

## Current Research on Female Science Faculty in the United States

Studies focusing on female STEM and health science faculty in the United States include various topics, as shown in Table 2.

**Table 2**

### *Current Research on Female Faculty in the Sciences in the United States*

Topic	Authors
Work-life balance	Adamo, 2013; Blackburn & Heppler, 2020; O'Brien and Hebl, 2008; Pedersen & Minnotte, 2017
Overcoming obstacles to tenure	Blackburn & Heppler, 2020; Skewes et al., 2017; Williams & Ceci, 2015
Overcoming obstacles to administrative advancement	Avallone et al., 2013; Lopez et al., 2018
Obstacle of gendered academic teaching loads	Blackburn & Heppler, 2020; Carrigan et al., 2011
Obstacle of oppressive departmental policies	Blackburn & Heppler, 2020; Holmes et al., 2016
Obstacle of discriminatory biases in diversity hiring traditions	Blackburn & Heppler, 2020; Easley, 2013; King, 2013; Smith et al., 2015; Williams and Ceci, 2015

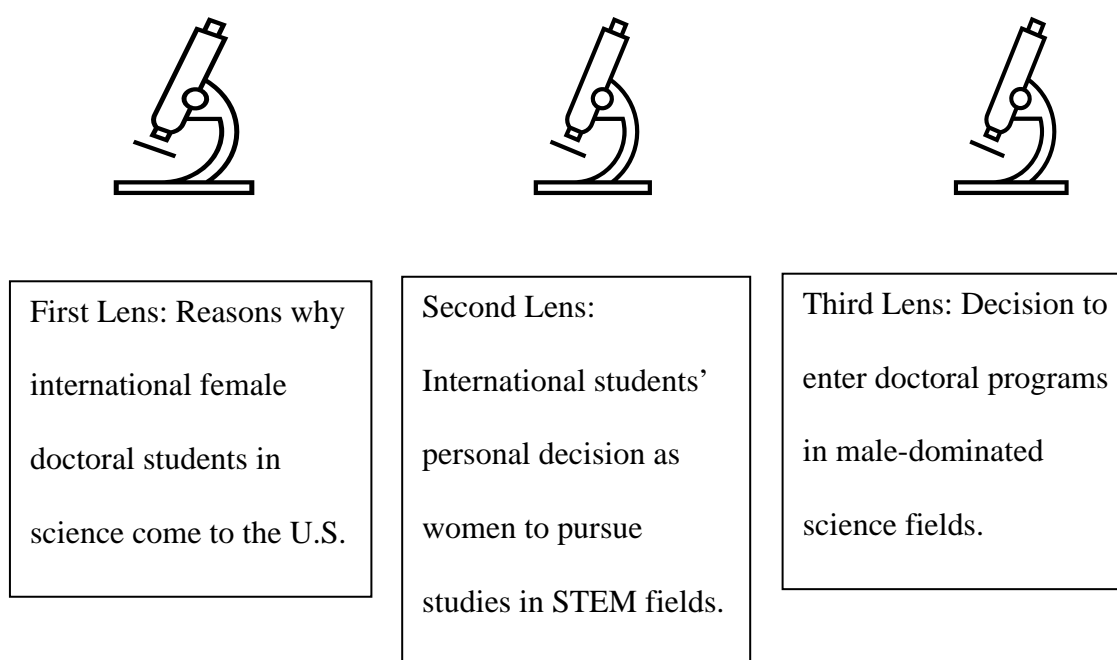
## The Migration of International Female Doctoral Science Students in Science to the United States

The phenomenon of international female doctoral science students migrating to the United States is best understood if we look at it from three different lenses: (a) reasons why

international female doctoral students in science come to the United States, (b) reasons why international women pursue studies in STEM Fields, and (c) international students' decisions to enroll in U.S. STEM doctoral programs despite previous knowledge that these fields are dominated by males. Figure 2 provides a visual representation of these lenses.

## Figure 2

*Three Lenses: Migration of International Female Doctoral Students in Science to the United States.*



### ***First Lens***

This lens (reasons why international female doctoral students in science come to the United States) is based on the students' decision to leave their home countries to study in the United States. There are many factors prompting these students to study abroad. Female international students share these factors with the general population of international students. These factors include wanting to visit a foreign country, learn a foreign language, explore the culture, connect with people across the world, establish new friendships, learn about other ways

of life, expand their thinking and behavior processes, and improve their content-specific and cross-cultural knowledge and skills (Andrade, 2006; McClure, 2007). While there are many benefits (e.g., to increase their knowledge, to obtain a coveted degree, to mature and become more independent through new life experiences, to master the English language) for international students who come to America, they are also a very vulnerable population (Sherry et al., 2010).

There are numerous studies discussing the reasons that “push” international students to leave their home countries and “pull” them to a specific host university (Cantu, 2013; Daily et al. 2010; Mazzarol & Soutar, 2002). Mazzarol and Soutar (2002) explained that two factors were critical to push students to study in a foreign country, regardless of the country of origin. First, the students decide that their country of origin does not have sufficient institutions to pursue their program of study or obtain a specific degree, or students feel that the programs offered in their home countries lack the quality or credentials they are seeking. Second, the students want to explore and learn about a specific culture by living and studying in a foreign country. Contributing factors in the selection of the host country include “recommendations from professors, family and friends, cost, financial aid and scholarships, social implications, availability and possibility to work part-time, a low crime-rate and the presence of a good percentage of the student’s home country population in the total number of international students in the host country” (Cantu, 2013, p.5). Additionally, the United States is still the first choice of destination for most international students (IIE, *Open Doors Report*, 2020).

### ***Second Lens***

Even though there are many studies regarding women’s representation in STEM fields (Blackburn & Heppler, 2020) and the gendered character of STEM (Cheryan et al., 2015; Barth



et al., 2017; Banchefsky & Park, 2018), the studies regarding the personal choices women make to study science are contradictory and inconsistent. Additionally, in the case of international women, they vary depending on cultural, political, religious, and socio-economic factors of their country of origin (NASEM, 2020). After reviewing more than 400 research articles on this topic, Ceci and Williams (2011) concluded that in the United States the main contributing factors to women's underrepresentation in STEM fields are personal choices both freely made, or enforced, and career preferences determined by social roles. A second factor is their performance in entrance exams such as SATs and GREs, most likely resulting from socio-cultural rather than biological causes. Furthermore, to a great extent, expected family roles determine young girls' planning of future careers and influence their choices (Castillo et al., 2014).

In Latin America, stereotypes and patriarchal societies have played a significant role impeding women to enter these fields (Zubieta, 2006). Women's enrollment in these fields and participation has been attributed to family background, such as having a female relative in the field or the presence of a positive female role model in these male-dominated careers. These include women in the STEM fields who inspire younger generations of scientists in Latin America (Castillo et al., 2014; OECD, 2008; Suter, 2006; Xie, 2006).

### ***Third Lens***

International female doctoral science students are aware that PhD STEM programs are mostly dominated by men. Yet they make a conscious decision to apply for these programs and enter these programs upon acceptance in the United States. A study conducted by Lubienski et al. (2018) indicated that male doctoral students publish a larger number of research articles compared to female doctoral students in STEM after being motivated and asked to conduct research by their faculty and academic advisors. Male doctoral students in STEM have larger

numbers of research assistantships than female doctoral students. By contrast, female doctoral students in STEM have a larger number of teaching assistantships compared to male doctoral students.

Assistantships in doctoral STEM programs are usually provided by faculty members in the specific programs. If the faculty members in male-dominated STEM fields are more likely to be males who possess biases against females [such as females are more suited for teaching positions than males or men are more capable in scientific math research than women], they may instinctively provide more female doctoral students with teaching assistantships (Lubienski et al., 2018). There is proof of the existence of implicit or subconscious bias against women in STEM fields in higher education in the United States. Doctoral students in American universities are more likely to grade the same abstracts on conferences as lower quality of scientific research if the author's name is female instead of male specifically when the area of study or the STEM fields are considered masculine, such as engineering (Donaldson & Franck, 2020). These authors, along with Moss-Racusin et al. (2012), provided further evidence of implicit or subconscious bias against females in STEM fields in doctoral programs in the United States when faculty and research supervisors graded them as less capable and were less likely to recommend females for jobs as lab managers compared to males with exactly the same educational background, experience, and credentials. Furthermore, more female doctoral students compared to male doctoral students reported that their gender biased science program climate negatively affected their work in their specific fields of study and future career trajectories.

There was also a huge difference in the career goals to pursue tenure track teaching as university faculty followed doctoral science graduation by females in contrast to tenure-track

research as university faculty by males upon graduation of same science programs (Donaldson & Franck, 2020; Solanki & Xu, 2018). These authors recommended that further studies are needed to investigate how gendered organizational practices and gender biased program climates in male-dominated STEM and science fields adds to gender inequalities in doctoral students' future career paths. This study explores this phenomenon in the fifth chapter, *Testimonios*.

### **Literature Referring to the Problem**

The problem is that many international female doctoral students in the sciences in the United States do not obtain a degree despite their large investment in time, effort, and financial resources (Castillo et al., 2014), as previously noted in the first chapter. This problem affects not only the international female doctoral science students themselves and their families but their countries of origin, their hosts universities, the United States as their host country, the scientific professions, and society in general (Castillo et al., 2014). Within the literature, there is discussion on the effects for each stakeholder.

### ***Impact on Individual International Female Doctoral Science Students***

The personal, financial, and professional impact of attrition to the doctoral student is huge. Many doctoral students who depart from their studies have accumulated a large amount of debt from student loans and accept lower paying jobs because of diminished self-esteem, experiencing severe emotional symptoms such as anxiety, depression, and hopelessness (Lovitts, 2001). The personal loss and emotional damage to these students who leave their programs can be devastating (Gardner, 2008). As Lovitts (2001) further posited: "The most important reason to be concerned about graduate student attrition is that it can ruin individuals' lives" (p. 6).

Consequently, some students may attempt suicide (Lovitts, 2001; Smallwood, 2004). The emotional shock can be extremely hurtful for international female doctoral students in STEM

because once they suspend their studies in the United States, their student visa expires and they must leave the country within 40 days (Siegmond et al., 2016). Further research is needed to create policy and reinforce it to fight and abolish the causes of these gender disparities and make improvements in science departments and universities' international student programs or student affairs which contribute to their demise (Castillo et al., 2014).

### ***Impact on International Female Doctoral Science Students' Countries of Origin***

PhD graduates are indispensable internationally due to their capacity to produce and disseminate knowledge, become leaders, force the progression of constructing their home countries, and endorse innovation and achievement (Baram-Tsabari & Lewenstein, 2013; Castillo et al., 2014). The small numbers of female international PhD STEM graduates and doctoral programs in the health sciences in the United States results in a loss of aptitude to their native countries. Additionally, it results in the loss of potential research, patents, publications, and the loss of role models, faculty, and mentors for the next generations of scientists from diverse nations who aspire to scientific or professional careers (NASEM, 2020).

### ***Impact on Universities in the United States***

The American Council in Education (2012) reports that internationalization in higher education (also called campus internationalization): “refers to the efforts of institutions to incorporate global perspectives into teaching, learning, and research; building international and intercultural competence among students, faculty, and staff; and establishing relationships and collaborations with people and institutions abroad” (p. 3). One of the most important strategies in internationalization in higher education in the United States is the recruitment of international students (Cantu, 2013). The United States attracts many international female doctoral students in their STEM programs because of their extensive research opportunities, preparation of faculty,

diverse faculty, universities' facilities, cutting-edge technology, and different teaching styles (Altbach et al., 2005; Komura, 2013). "However, it is not merely enough to bring international students; it is critical to serve them, retain them, and graduate them" (Korobova, 2012, p. 2).

The United States risks losing billions of dollars in revenues from this underrepresented group; international scientific collaboration with their countries of origin; scientific international female faculty and its supremacy in vital scientific and technological fields (Council of Graduate Schools, 2007; IIE *Open Doors Report, 2020*; Kniola et al., 2012). The United States is the most prominent center for scientific training. International students represented half of the U.S. STEM PhD graduates in 2020 (IIE, *Open Doors Report, 2020*). The United States stands to waste its considerable investment [in recruitment and admission, faculty time, years of preparation, research, and teaching assistantships] in these highly qualified international female doctoral science students, and their prospective contributions to U.S. innovation, if they return to their home countries without completing their degrees (Hang & Appelbaum, 2016).

### ***Worldwide Impact of Women Underrepresentation in STEM***

Scarcities in the supply of professionals in STEM fields weakens inventions, economic development, and scientific advance (Castillo et al., 2014). Researchers Autor et al. (2003) explain how future jobs will require skills and aptitudes associated or learned in STEM fields. For instance, professions that create the largest number of jobs require greater concentration and complex analytic skills to include constant use of mathematics and critical thinking. Positions of the future will require unpredictable and collaborative assignments (Council of Economic Advisers, 2021). Further, it is predicted that innovations in science and technology will determine the kinds of jobs that will be available in the future (Whittington et al., 2019). For

example, Americans started working in new positions that did not exist 40 years ago (Council of Economic Advisers, 2021).

All over the world, a wide gender gap has been consistent in all disciplines and all educational levels in STEM. Even though women have made great advances in higher education, the underrepresentation of females persists. In addition, it seems to escalate in academic, governmental, and industrial hierarchies (Castillo et al., 2014). In the United States, except for humanities, 40% of recent PhD graduates were women. However, in academia only 34% were associate professors and only 19% were full professors (Zinovyeva & Bagues, 2011). These authors report a very similar trend in Europe where women comprised 45% of recent PhD graduates yet only 36% were working as associate professors and 18% as full professors in STEM programs in European universities.

UNESCO 2020 reported that the gender gap is also prevalent in Latin America even though 60% of PhD graduates and 45% of researchers in Latin America are females, exceeding other continents to include Europe (33.9%), Oceania (39.2%), and Asia (18%). In STEM fields, the women representation is only 36%. Only 11% of Latin American PhD graduates are in STEM fields, despite new enrollments of Latin American women in doctoral programs in STEM. Therefore, the number of Latin American women in a higher hierarchy in scientific fields is very scarce. For instance, in Brazil, 49% of all researchers are female yet only 27% of women occupy positions of leadership in research groups as opposed to 32% of men (Castillo et al., 2014; CNPq, 2012).

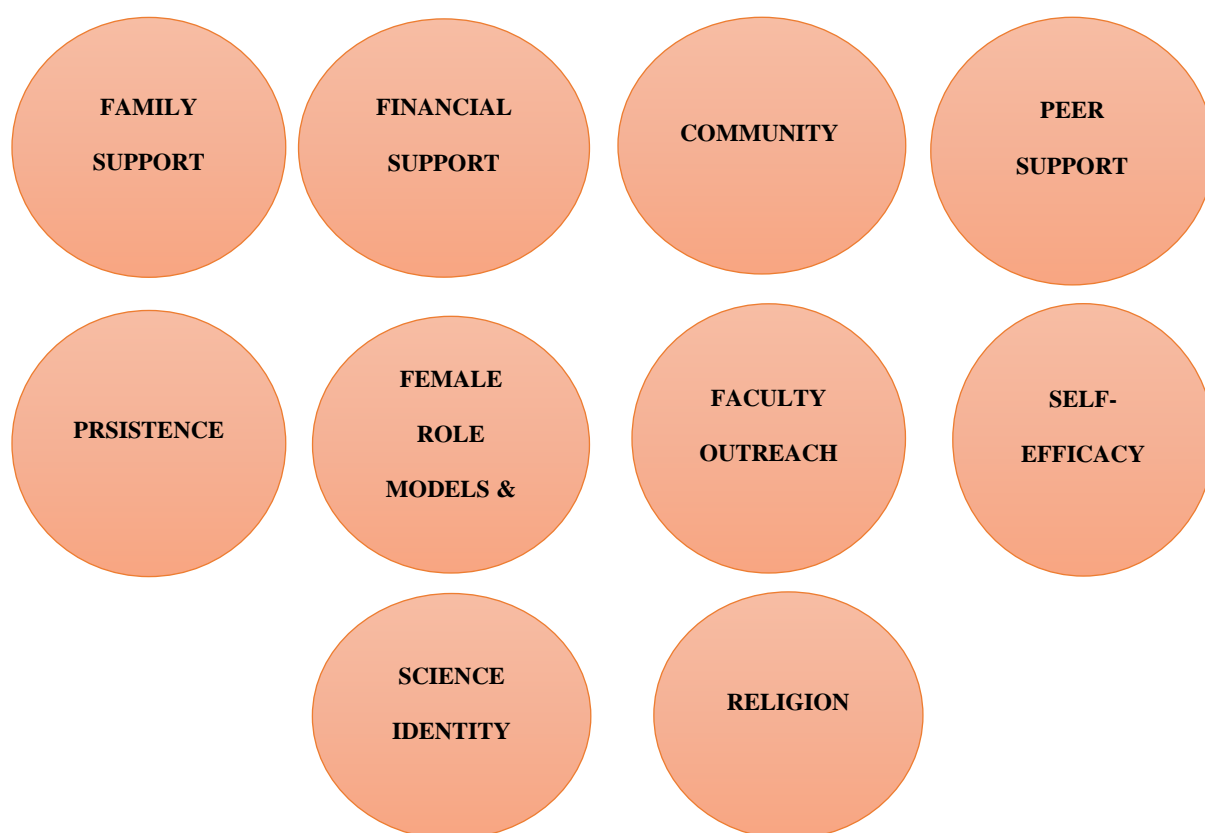
### ***Factors for Success of International Female Doctoral Students in Science in the United States***

My preliminary review on the literature regarding the success of these students revealed the following 10 main factors, as outlined in Figure 3.

**Family Support.** The influence of families on student achievement was first documented in the United States in two important studies: the Coleman Report (Coleman et al., 1966) and the Jencks Report (Jencks et al., 1972). Since then, current American research consistently reaffirmed the positive effect of parents and family on STEM student success (Craig et al., 2018; Ratelle et al., 2005).

### Figure 3

*Literature Topics on Factors for Success of International Doctoral Female Students*



Witherspoon (2018) reported family support as an important factor for female success and motivation to finish STEM and science related programs. A research study by McGee et al. (2016) reported that black students believe in the importance of family and extended family

members' systems of support in their enrollment and persistence in STEM PhD and doctoral science programs. Similarly, Ceglie's (2013) study found that for all minority students, family support was an important factor for success in their academic STEM-related programs.

**Financial Support.** Witherspoon, (2018) dissertation's findings revealed having adequate financial support was a factor for success in graduating from doctoral programs in STEM and science. A research study by Strayhorn et al. (2013) found that female minority doctoral students in science programs, such as international female students, were specifically interested in their financial awards or access to financial aid when choosing a university and doctoral science program compared to males.

Ong et al.'s (2011) research found that costs associated with doctoral programs in U.S. universities were a critical factor in retaining women of color in graduate STEM programs. These authors reiterated the importance of financial support in fighting what the authors called "the double bind" [female gender and black race] that impedes graduation of women of color in STEM fields in undergraduate and graduate programs in the United States.

**Community and Peer Support.** A study conducted by Maton et al. (2016) on the Meyerhoff Scholar programs revealed that STEM and doctoral science students were most likely to complete their study programs if they had a strong sense of community. Joseph and Baker's (2012) study identified the need for international students to have a sense of community in their new environment. International students who are invited to become members of a community or find existing communities that they can identify with, do not experience cultural shock or they can overcome it thanks to the support they receive from these communities.

Witherspoon (2018) reported the importance of peer support and labeled it a "success factor" in motivating and ensuring graduation for female STEM Doctoral students. According to



the author these systems of peer support included formal study group settings or in casual and informal settings with their classrooms. Mwenda (2010) stated that “five out of the eight minority interviewees and one of the five minority students who responded to the survey’s open-ended question reported that they perceived social support from their peers to have a positive impact around their academic success” (p. 91) Likewise, Espinosa’s (2011) research findings reported that academic peer relationships were an important factor for success of women of color in STEM-related programs. These women often had difficulties establishing meaningful relationships in their classrooms and labs where the majority of the students were male and/or white.

**Persistence.** Witherspoon (2018) reported persistence as a factor for success among PhD students in STEM related fields. Additionally, a research study conducted by Maton et al. (2016) revealed that doctoral students in science were most likely to graduate if they were persistent in their studies. Other authors document the importance of persistence: Andrade (2005, 2006), Kwai (2009), and Mamiseishvili (2012b).

Andrade (2006) identified several factors that influence the international students’ decision to stay or to leave the institution of higher learning, such as vision, educational background, spirituality, validation, skills, personalities, and academic engagement. Kwai (2009) identified the ability of international students to re-enroll every semester despite their many challenges and continue to fight against adversity as one of the most important indicators for retention and graduation.

Mamiseishvili’s (2012b) results from logistic regression analysis of a study of first year post-secondary students revealed that academic involvement, GPA, and degree plans were positively correlated to persistence of international students while low levels of English

proficiency and social skills had a negative correlation on their persistence. Persistent students with strong work ethics and constant study habits were more likely to graduate and achieve their academic goals.

**Female Role Models and Mentors.** Research has proven that having strong female role models and mentors has a positive influence on female STEM and science students and their subsequent career trajectories following graduation (Amelink & Creamer 2010; Beaman et al., 2012; Cheryan et al., 2011; Donaldson & Franck, 2020). Cannady et al. (2014) discussed the problem of “leaky pipeline syndrome,” or loss of females in STEM and science. Worldwide, girls are attracted to science at school and enter scientific fields graduating as the majority compared to males with bachelor’s and master’s degrees (Wood, 2020).

However, there is a drastic decrease in numbers at the PhD level and an even greater decrease at the researcher levels. With positive female role models and mentors in the sciences, STEM female doctoral students are more likely to pursue careers in STEM fields as compared to STEM undergraduate and master’s students (Donaldson & Franck, 2020). As a result, research regarding international STEM and health sciences doctoral female students’ identity formation, and how they follow careers in STEM and science, this study will fill the gap in the literature.

**Faculty Outreach.** Witherspoon (2018) discussed the important role of faculty in the motivational factors for female PhD students to enroll and persist in STEM related fields. A research study conducted by McGee et al. (2016) found that faculty outreach and support played

a major role in determining Black students’ choice to matriculate in a Ph.D. engineering program ... without assistance from others in navigating the pathways to the Ph.D., these students acknowledged they most likely would have embarked on a trajectory that did not include obtaining a Ph.D. in engineering. (p. 184)

Sherry et al. (2010) described the need for American faculty and American universities to reach out to the specific needs of international students. Other researchers’ findings support their

views. For example, Yamashita and Schwartz (2012) explained the importance of domestic faculty in understanding and establishing boundaries and fostering friendly and professional relationships with international students and the need for the faculty to understand the students' backgrounds. Furthermore, Bloom (2009) identified the different strategies of culturally responsive teaching.

**Self-Efficacy and Science Identity.** Witherspoon (2018) explained the importance of self-efficacy in understanding motivational factors to enroll and persist in STEM related fields by PhD students. Maton et al. (2016) stated that STEM PhD students will succeed if they are able to develop a high degree of self-efficiency during their doctoral programs because it improves their perceptions of fitting into their respective fields of study. Chemers et al. (2011) discussed the importance of efficacy in scientific career commitment among underrepresented minority students. The authors' findings revealed self-efficacy contributed to their graduation and success.

Witherspoon (2018) discussed the important role of developing science identity as a motivational factor for female PhD students to enroll and persist in STEM and science related fields. The research study conducted by Maton et al. (2016) revealed that doctoral students in science were most likely to graduate if they had developed a strong science identity early on in their chosen fields of study. Chemers et al.'s (2011) research study found that having a strong identity as a scientist is a greater predictor for dedication to a field in science than institutional support.

**Religion.** Witherspoon (2018) discussed the important role of religion in the motivational factors for female PhD students to enroll and persist in STEM related fields.

Ceglie (2013) described religion as a form of cultural and social capital. Furthermore, this author found out that religion in academic doctoral science contexts had a positive influence on African Americans and Hispanic students' persistence and degree completion.

In my study, religion played a very important role in ensuring the participants' resilience and persistence to graduate in their scientific doctoral programs regardless of the participants' specific religion (Muslim, Hinduism, Catholic, or Protestant). It provided an exploration of more inclusive academic settings and culturally responsive teaching (Ceglie, 2013).

### **Barriers Faced by International Doctoral Female Science Students**

A study by Khanal and Gaulee (2019) addressed the barriers international students from the leading sending countries to the top host countries. The barriers were classified as pre-departure, post-departure, and post-study. The authors' findings showed pre-departure barriers included obtaining precise information regarding their host countries, study programs, specific universities, understanding the admission process, and preparing documents to secure the international student visa. In post-departure, international students had to deal with learning the new language barriers, financial difficulties, and cultural adjustment once they arrive in their host countries. Uncertainty about the future and completing paperwork to return to their home countries or to remain in the host country as permanent residents are the main challenges of post-study.

China is the world's major source of international students. In the academic year 2019-2020, there were 372,532 international students from China in the United States. (IIE, *Open Doors Report*, 2020). Of these, 33% were graduate students and 62% majored in STEM; about 30% were female. Some of the most common Pre-Departure barriers for Chinese Students include choosing the top university and best program that fits their academic goals, deciding

whether or not to use an agent, and mastering American English (Khanal & Gaulee, 2019). International Chinese students are very conscientious of university rankings. The Chinese International students search *The Times Higher Education*, *The Guardian*, *QS World University Rankings*, and *Shanghai Rankings* before choosing a university and program to study in the United States (Khanal & Gaulee, 2019).

Chen (2017) posited that Chinese students believe that graduating from a prestigious university will have a positive impact on their future and personal careers. His research found out that few actually enroll in these high-ranking universities. Hence, Chinese international doctoral science students face many barriers being accepted to high-ranking prestigious universities in the United States or cannot afford them even if accepted. (Khanal & Gaulee, 2019). Furthermore, there has been a steady decline in the number of international student visas to science doctoral students including females since 2017 (Kavilanz, 2018).

The world's second major source of international students is India. In the academic year 2019-2020, there were 193,124 international students from India in the United States (IIE, *Open Doors Report*, 2020). Of these Indian International Students 44% were graduate students, 78% majored in the STEM fields with an estimated 35% being females (IIE, *Open Doors Report*, 2020). According to Falcone (2017), by 2025, India is predicted to become the leading country to send international students. Kavilanz (2018) posited that the most prevalent pre-departure barriers for Indian international students involved passing the GRE, securing a visa, and getting the appropriate vaccinations.

The most salient post-departure barrier for all international students is acculturation and cultural shock. Other prominent barriers included financial barriers and psychological barriers that involved socio-cultural adaptation and general living barriers. Not being proficient in the

host country's language was the major impediment to academic success and social relations (Khanal & Gaulee, 2019).

Khanal and Gaulee (2019) reported that not all the international students are allowed to remain in the United States after graduation. Many of these international students face pressure, strict immigration policies and uncertainty after graduation. Although most international students want to remain in their host country to practice their new careers, policies barriers, strict immigration laws, and exhaustive documentation impedes them to follow that dream. Those students who return to their countries of origin experience what is called reverse cultural shock. These students spent such a long time in their host country that they changed which makes it difficult for them to adapt back to their native country. They may not find their dream job and have to settle for low-paying jobs. The students who are allowed to remain in the United States continue to face the many barriers they experienced as international students.

### **International Student's Acculturation**

U.S institutions of higher education continue to be indifferent to the acculturation problems faced by international students (Hirschell, 2011). The author established a negative correlation between discrimination and positive acculturation processes by international students. Ajayi-Nabors and Omotola (2011) stressed the importance of international students to be able to seek counseling or psychological treatment to help them overcome their feelings of loneliness, homesickness, or crisis to achieve better levels of adaptation. Negative feelings toward seeking counseling were directly correlated with low levels of adaptation and acculturation. This research contradicts the findings of Li et al. (2016), who did not find any significant correlation between international students' adaptation, coping skills, and seeking professional help.

Furthermore, Li et al. (2016) identified the following stressors for acculturation: racial discrimination, low levels of English language, high levels of cultural shock, financial difficulties, loneliness or homesickness, academic achievement, living arrangements, socio-economic status, and the social environment.

### **Isolation**

A study conducted by Rajapaksa et al. (2002) revealed that international students feel more isolated and homesick than domestic students. Their adjustment was measured by feelings of loneliness which was affected by their contentment with their social networks. In general, international students tend to befriend other international students as opposed to domestic ones (Andrade, 2006). Additionally, country of origin, gender, and number of years in the university may also affect adjustment. Senyshyn et al. (2000) reported that Canadians and western Europeans adjust better than Asians, while males report less barriers in cultural adaptation compared to females. Moreover, adjustment is a linear gradual process (Lee & Wesche, 2000; Schutz & Richards, 2003) with difficulties decreasing from the first to the final year (Andrade, 2006). Female international doctoral students in science and STEM programs reported feeling isolated by their gender, specific programs of studies, and the culture of the science fields (Hall & Sandler, 1982; Hall & Sandler, 1986).

Male-dominated disciplines like STEM often create what has been called “a chilly climate” for females (Schulz, 2014, p. 3). This climate occurs when students are treated differently due to gender, gender orientation, ethnicity, country of origin, race, or disability. Often, these oppressive environments can be traced back to specific faculty, administrators, or departments. When faculty or administrators treat students differently, it creates a hierarchy of power imbalance. Students who are treated with favor feel motivated and encouraged and will

most likely persist in the program and graduate. Those students who are treated unfavorably will experience feelings of isolation and powerlessness and are more likely to leave the doctoral program and/or the university (Schulz, 2014). Of interest is the fact that those women who leave tend to have higher GPAs than the men who stay, and if they are international students, they are more accomplished and prepared than the domestic ones (Stage & Hubbard, (2008).

### **English Language Proficiency**

The importance of English language proficiency has been documented extensively (Mori, 2000, Leong, 2015; Li, et al., 2016). Sherry et al. (2010) detailed the importance for international students to master the English language as an important acculturative process. These authors further reported the desire of international students to improve their verbal abilities (as opposed to written English) to improve verbal communication with American students and socialize with them.

Furthermore, Andrade (2006, 2009) stated the importance of the English language for academic success and socialization, while Leong (2015) and Li et al. (2016) note that the greatest impediment to both academic success and overcoming cultural shock and isolation is the English language.

### **Academic Barriers**

The findings of Wu (2016) and Vermunt (2005) revealed that the way international doctoral students deal with their learning difficulties and develop strategies to overcome them is associated with their academic accomplishment. The Institute of International Education reported that 70% of all international students in doctoral programs in STEM work as either research or teaching assistants (IIE, 2019, 2020). Ren and Hagedorn (2012) revealed that international doctoral students who work as research or teaching assistants may face difficulties and added



levels of stress balancing the demands of completing research projects and/or preparing teaching courses while conducting their own academic workload.

Academic achievement in the STEM doctoral programs for international doctoral students may not depend as strongly on their English language proficiency levels because the STEM fields require more quantitative competencies (Light, Xu & Mossop, 1987; Ren & Hagedorn, 2012). Additionally, many international women doctoral students in STEM experience academic difficulties due to time management. Effective time management requires the following time-management skills: (a) time analysis, (b) planning, (c) goal setting, (d) prioritizing, (e) scheduling, (f) organizing, and (g) establishing new and improved time habits (Barkas, 1984; Hellsten, 2012; Hellsten & Rogers, 2009; Jonson, 2002; Jorde, 1982; Lakein, 1973; Mackenzie, 1972, 1975, 1990; Morris, 2001; Woolfolk & Woolfolk, 1986). Most international doctoral women in STEM have perceptions of difficulty balancing difficult science courses' studies, long hours of lab work, research, teaching and their family, children and or household responsibilities (Rathgeber, 2009).

To utilize their time efficiently and effectively, doctoral STEM students need to be able to forecast the time each task or assignment will take to complete (Hellsten, 2012). Hoskins and Goldberg (2005) stressed the importance of a good program fit, and academic and social relationships for academic success. Poor academic fit results from the negative association between the students' goals and academic preparation with the doctoral program requirements, whereas poor social-personal fit results from lack or inability to form positive relationships with faculty, mentors, advisors, and peers.

Tinto's (1993) integration theory describes doctoral students' persistence as being "shaped by the personal and intellectual interactions that occur within and between students and

faculty and the various communities that make academic and social systems of the institution” (p. 231). On the contrary, when doctoral students cannot incorporate into the department or university’s academic and social communities, they will most likely leave the doctoral program and/or withdraw from the university (Spaulding & Rockinson-Szapkiw, 2012; Tinto, 1993; Wu, 2016). Tinto’s (1975, 1987, 1993) theory is supported by numerous studies that researched students’ resilience, persistence, and attrition. (Hoskins & Goldberg, 2005; Spaulding & Rockinson-Szapkiw, 2012). Additionally, Golde (2000) posited: “Paradoxically, the most academically capable, most academically successful, most stringently evaluated, and most carefully selected students in the entire higher education system-doctoral students- are the least likely to complete their chosen academic goals” (p. 199).

Golde (2000) further state that attrition rates are very high. Forty to sixty percent of doctoral candidates do not obtain their PhDs, becoming ABD in what the authors call “one of academia’s well-kept secrets” (p. 199). Many studies support Golde (2000) assertions (Berelson, 1960; Council of Graduate Schools, 2008; Spaulding & Rockinson-Szapkiw, 2012; Wu, 2016). For international female doctoral students in STEM fields, the attrition rate is estimated to be higher, at 50% to 75%, for underrepresented minorities (Gonzalez & Kuenzi, 2012). Attrition and an extended time to graduation can be expensive to institutions, while highly distressing and harmful for students because of personal, financial, and professional repercussions (Lovitts, 2001; Spaulding & Rockinson-Szapkiw, 2012; Terrell et al., 2009; Wao, 2010).

### **Stereotypes and the Science Culture**

A common barrier to female scientists and researchers is the gender stereotypes of male and female roles in society. This is specifically regarding the engagement of women in the field of science. Many young international doctoral students and their academic advisors have been

negatively affected by stereotypes, which leads them to believe that specific jobs in STEM fields are meant to be for men only. Consequently, well qualified and academically prepared international female students may not receive the most accurate information on STEM careers they seek. As a result, they are steered into other fields of study (UNESCO, 2020).

The organizational culture of the science departments and the academic and social assimilation of international female doctoral students in STEM fields are important factors related to retention and graduation of doctoral students (Tinto, 1997). Litzler et al. (2005) posited that, “negative perceptions about departmental climate during graduate school can hinder the development of relationships with faculty and peers that are critical to graduate students’ social and academic integration into academic departments” (p. 1). Perceptions about the science department climate, difficulties maintaining balance in work/family responsibilities, and incorporation in doctoral science communities vary significantly for males and females (Ginorio, 1995; Litzler et al., 2005; Maher et al., 2004).

The term “chilly climate,” used to describe the science culture of STEM programs, was first coined by Sandler and Hall in the 1980’s to describe the classroom atmosphere experienced by undergraduate females. It is now a broader term that includes female science graduate students, faculty, and administrators outside classroom experiences; and inside the classroom and lab and academic workplace (Hall & Sandler, 1982, 1986). A chilly climate is characterized by subtle discrimination, isolation, and small inequalities experienced by women and minorities in STEM academic settings. Sandler and Hall defined it as specific behaviors that stereotype, ignore, target, and undermine women concerning biases relating to the capacity of women to succeed in scientific academic settings. All these factors may hinder and delay these women’s academic goals (Pederson, 1991).

## **Financial Need**

The cost of tuition in the United States is much higher than other competing countries except for Australia. The average cost for tuition and fees in a state public university for a PhD program in STEM for the 2015-2016 academic year was \$21,000 and \$30,000 in a private university. European universities typically charge less than \$1,000 per year in tuition and fees. European students who are guaranteed admission to publicly funded universities are not motivated to migrate to the United States to study STEM fields in doctorate programs because they are offered strong financial incentives to stay in their native countries (Siegmund & Rawdon, 2016).

Many researchers have denounced the problem U.S. universities face in terms of competitors (Altbach, 2004; Altbach & Knight, 2007; Bhandari, 2017; Douglass & Edelstein, 2009; Marginson, 2006; Siegmund & Rawdon, 2016; Wu 2016). Many countries are revising their policies, developing strategic planning and goals, and offering generous financial assistance and grants to increase the number of international students (Altbach, 2004; Wu 2016). The United States continues to increase tuition and fees for international students while European countries have reduced tuition and fees for international students (Douglass & Edelstein, 2009; Siegmund & Rawdon, 2016; Wu, 2016). European countries are offering both master's and PhD programs in Asia to reduce financial barriers for Asian students (Altbach & Knight, 2007; Wu, 2016).

Marginson (2006), Siegmund and Rawdon (2016), and Wu (2016) posit that Australia and the United Kingdom have increased their academic financial support and entrepreneurship strategies to attract more international students. China's goal is to become an international

educational hub in the coming years (Sharma, 2011; Wu 2016). Canada announced that it plans to double the number of international students by year 2022 (Wu 2016).

The effect of rising costs of tuition and fees in the United States regarding international doctoral students' recruitment, retention, time of degree completion, and attrition remains uncertain. Currently, only 20% of the income of public state universities that grant STEM doctoral programs in the United States comes from tuition and fees. The rest comes from other sources including state, federal, and local funding, grants or contracts, services from hospitals or other businesses, philanthropy, private donors, fund raising, and/or university endowments' returns. Student tuition and fees provide only 32% of revenues in private not-for-profit universities, but more than 90 % of revenue in for-profit private universities (Siegmond & Rawdon, 2016).

Ampaw (2010) reports in her study that the kind of financial aid received, and at what stage of the doctoral program it is received, has different effects on students' retention at various stages. In general, students who are awarded research assistantships have the highest probability of degree completion compared to students who are awarded other forms of financial assistance. Other authors supported her results (Ehrenberg & Mavros, 1995, Gillingham et al., 1991). These authors found that receiving teaching assistantships increases the time of doctoral degree completion while lowering the possibility of degree completion. By contrast, receiving research assistantships will have the opposite effect; decrease in the time of doctoral degree completion and increase in the possibility of degree completion, even as compared to those students who receive fellowships. Consequently, financial support is an important variable in predicting doctoral student retention (Ampaw, 2010).

Kuh (2011) posited that the economy is one of the driving forces that contributes to student growth. In times of a recession or poor economy, there are documented cases of increases in the number of students enrolled in doctoral programs. Many authors have reported this phenomenon (Ampaw, 2010; Blum, 1991; Magnan, 2002; Schneider, 1998). Furthermore, the lack of financial assistance is a great burden on international doctoral female students. Kuh et al. (2006) listed inadequate financial resources as a factor that forces students to leave a doctoral program.

When female doctoral STEM students leave their programs, particularly after finishing their coursework, “they take with them thousands of hours of expensive training and experience, often paid for by federal and state taxes. Conservative estimates ... put the economic cost of a newly minted STEM PhD at approximately US \$500,000” (Rosser & Taylor, 2008, p. 22). The second most quoted cause for concern for international students who come to study in STEM doctoral programs is the visa process (Siegmund & Rawdon, 2016).

### **International Student Visas**

It has been more than 20 years since the September 11, 2001, terrorist acts of violence against the United States by nationals of foreign countries [including various terrorists who held student visas]. Issues of security remain. Potential international students planning to come to the United States, along with other foreigners, must comply with the Department of State consular officers oversees and immigration agents upon arrival to prove that they are eligible for visas and do not fall in the category of inadmissible under the Immigration and Nationality Act, which includes security and terrorist matters. The international consular officers are obligated by law to check the National Counterterrorism Center’s automated watch systems before issuing visas.

Due to these security measures, current policy and legislative deliberations contain both market-labor and security provisions (Haddal, 2006).

Siegmund and Rawdon (2016, p. 8) posited that some international students think the student visa process is very rigid and governmental. However, immigration officials believe their perception is false. The criteria for obtaining an international student visa includes the following:

1. Student must be enrolled in an academic educational program, a language-training program, or a vocational program.
2. The student's school must be approved by the Student and Exchange Visitors Program, Immigration & Customs Enforcement.
3. Student must be enrolled as a full-time student at the institution.
4. Student must be proficient in English or be enrolled in courses leading to English Proficiency.
5. Student must have sufficient funds available for self-support during the entire proposed course of study.
6. Student must maintain a residence abroad, which they have no intention of giving up.

All international students are allotted one of three types of visas, which are monitored and tracked by the Department of Homeland Security. The visa types issued to international students are: (a) F visas for academic study, (b) M visas for vocational study, and (c) J visas for cultural exchange. The Student and Exchange Visitor Information System (SEVIS) seeks to track and monitor all foreign students. Participation in the SEVIS program is now obligatory for all colleges and universities enrolling foreign students (Haddal, 2006).

Upon completion of their programs, international students on F-1 visas can take part in temporary employment in the United States, also known as Optional Practical Training (OPT), in

jobs directly related to an F-1 student's major area of study. Usually, an international student can work up to 12 months in OPT status. The Department of Homeland Security expanded the OPT work period to 29 months for F-1 students in STEM fields in 2008 (Wasem, 2012). Universities in the United States are worried about their capacity to recruit great quantities of the best quality of international students. As a result, they are evaluating whether the security immigration systems put in place after September 11, 2001, hinders the admissions of potential good students in American higher education institutions. The STEM fields constitute a high priority in most research universities and depend on the active recruitment of international students. Further, international STEM doctoral students connect the labor markets with the academic communities and the American economy needs the skills and patents produced by these fields. Therefore, the private sector is partnering with higher education to open the gateway for international STEM students' immigration (Haddal, 2006).

The STEM Jobs Act of 2015 passed in the U.S. Congress on January 7, 2015, and amends the Immigration and Nationality Act, which made up to 55,000 visas available in FY2016 and subsequent fiscal years to qualified immigrants who (a) have a doctorate degree in a field of science, technology, engineering, or mathematics (STEM degree) from a U.S. doctoral institution of higher education; and (b) have taken all doctoral courses in a STEM field, including all courses taken by correspondence or by distance education, while physically present in the United States (U.S. Congress/Senate Bill S.98 -114<sup>th</sup>, 2015).

### **Theoretical Review Related to Overcoming the Problem**

This phenomenological study is based on three specific theories: theory of acculturation, resiliency theory, and persistence theory.

#### ***Theory of Acculturation.***



During most of the 20th century, social science researchers started proposing theories regarding the process by which most immigrants and sojourners arriving in the United States adapted and became part of their new culture; they became known as the “melting pot theorists” (Padilla & Perez, 2003). Robert Park, a sociologist from the University of Chicago, developed an ecological framework, which consisted of three phases, contact, accommodation, and assimilation (Park, 1914, as cited in Padilla & Perez, 2003). According to Park, to avoid or minimize conflict, newly arrived immigrants learned to adjust to living in the United States. For Park, this process of cultural adjustment was gradual, permanent, and unalterable.

The anthropologists Redfield et al. (1936) became the second group to expand on the accommodation model. The authors explained that acculturation takes place “when groups of individuals from different cultures come into continuous contact with each other, and subsequently, there are changes in the original cultural patterns of either or both groups” (Redfield et al., 1936, as cited in Padilla & Perez, 2003, p. 36). Redfield et al. first defined acculturation as a cultural change which results after the first interaction between two different cultural groups. Graves (1967) renamed it psychological acculturation and re-categorized it as an individual phenomenon rather than a group’s phenomenon. From this perspective, psychological acculturation refers to changes in an individual both behaviorally and internally (Graves, 1967; Berry et al., 1987).

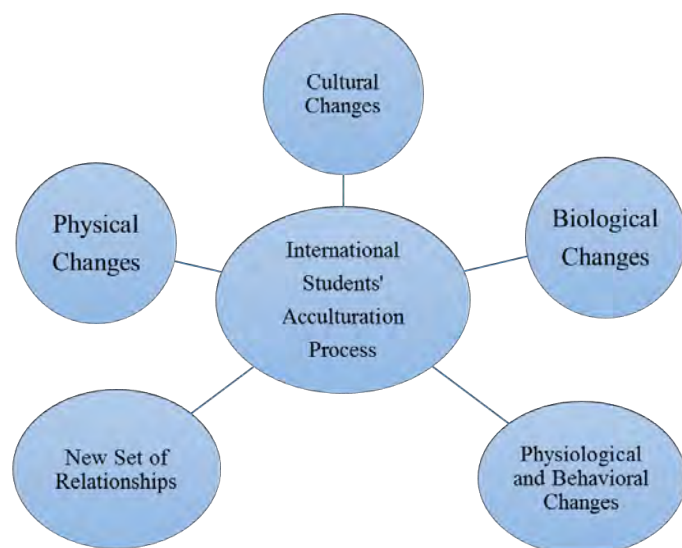
Teske and Nelson (1974) proposed the first psychological model of acculturation. The authors suggested that acculturation includes changes in patterns of behavior, personal characteristics, customs, institutional changes, and specifically, values. Nonetheless, the authors did not discuss how the process occurs (Padilla & Perez, 2003). Berry et al.’s (1987, p. 492) theory of acculturation describes the following five stages of acculturation:

1. Physical changes (a new place to live, a new type of housing, increased population density, more pollution, etc. are all common with acculturation).
2. Biological changes (new nutritional status, new diseases often devastating in force, interbreeding yielding mixed [metis, mestizo, etc.] populations are all common).
3. Cultural changes (original, political, economic, technical, linguistic, religious, and social institutions become altered, or new ones take their place).
4. New set of relationships (including in-group/outgroup and dominance patterns may become established).
5. Physiological and behavioral changes (behavioral changes and an alteration in mental health status almost always occur as individuals attempt to adapt to their new milieu).

The notion of acculturative stress denotes the stressors that are produced during the acculturation process. Furthermore, there are specific stress behaviors exhibited during the process of acculturation that include diminished mental health status producing symptoms of anxiety, depression, and confusion. Common experiences include ostracism, estrangement and isolation, identity confusion, and increased psychosomatic symptoms. Hence, acculturative stress is a decline in the health of individuals, which could include physical, social, and psychological features as they undergo the acculturation process (Berry et al., 1987).

### ***Resiliency Theory.***

This theory was defined by Morales and Trotman (2004) as the “ability or process of remaining in-tact in the midst of potentially and often destructive environmental factors” (p. vii). The authors identified 3 main components as “obstacles, stress, and conflict” (p. 7). Moreover, they explain that the persons who become most resilient are part of a high-risk group that predisposes them to failure; experiencing unsurmountable obstacles, learning to deal with the

**Figure 4***Model of International Students' Acculturation Process*

*Note.* Source: Berry et al., 1987

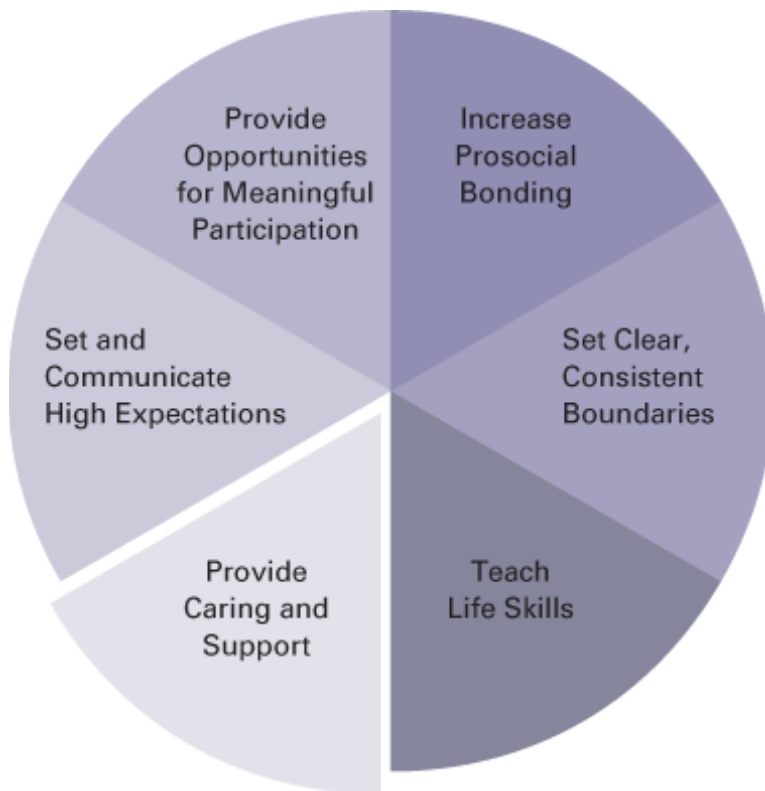
stressors that cause the obstacles, and obtaining conflict-resolution by self-directed means. The theory also focuses on competence, empowerment, and self-efficacy (Henderson & Milstein, 2003). Henderson (2007) explained how the theory helps us to understand why some high-risk students succeed while experiencing critical stressors, including trauma, while others fail.

Henderson and Milstein (2003) created the “Resiliency Wheel” model (as shown in Figure 5) and Henderson (2012) suggested that

The Resiliency Wheel is a visual synthesis of resiliency-building conditions documented in the body of resilience research, “Caring and Support” is highlighted because it is the single most powerful environmental protective factor. All the other conditions are actions that grow out of providing genuine caring and support. (p.16)

**Figure 5**

*Resilience Wheel Presented by Henderson and Milstein (2003)*



The model depicted in Figure 6 helps to explain how the resilience theory evolved from risks to resilience, from problem-solving to positive development, from pathology to a wellness approach, from reactive to proactive, from deficiency to competency, from competition to collaboration, from people as problems to people as resources, from authoritarian to democratic, and from remedial to empowerment (Henderson & Milstein, 2003). This emphasis has persisted for the past 20 years. This paradigm shift, adapted from Henderson (2007), is shown in Table 3.

**Figure 6***The Resilience Wheel Explained*

*Note.* Wheel/Headings Source: Henderson & Milstein (2003). Descriptive Text Source: Henderson et al. (2000).

### **Internal and External Protective Factors**

Several studies showed that individuals use protective factors to overcome barriers, resolve conflict, and cope with stress (Benard, 2004; Morales & Trotman, 2004). In her research of more than 20 years, which included surveys, Benard (2004) identified the following, as protective factors: autonomy, social connectedness, ability to problem-solve, and sense of purpose. Other protective factors include receiving care and support, participation in academic and social activities, and setting high expectations. Henderson (2012) posited that “a student's resilience is fostered when his or her internal and environmental protective factors are

strengthened” (p. 16). Henderson identified several internal protective factors, and Henderson and Milstein (2003, p. 18) identified various external protective factors as outlined in Table 4.

**Table 3**

*Resilience Theory Shifting Paradigms*

From	To
1. Risk	Resilience
2. Problem Solving	Positive Development
3. Pathology	Wellness
4. Reactive	Proactive
5. Deficiency	Competency
6. Competition	Collaboration
7. People as Problems	People as Resources
8. Authoritarian	Democratic

*Note.* Adapted from Henderson (2007).

**Internal and External Protective Factors**

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**Table 4**

*Internal (Henderson, 2012) and External Protective Factors (Henderson & Milstein, 2003)*

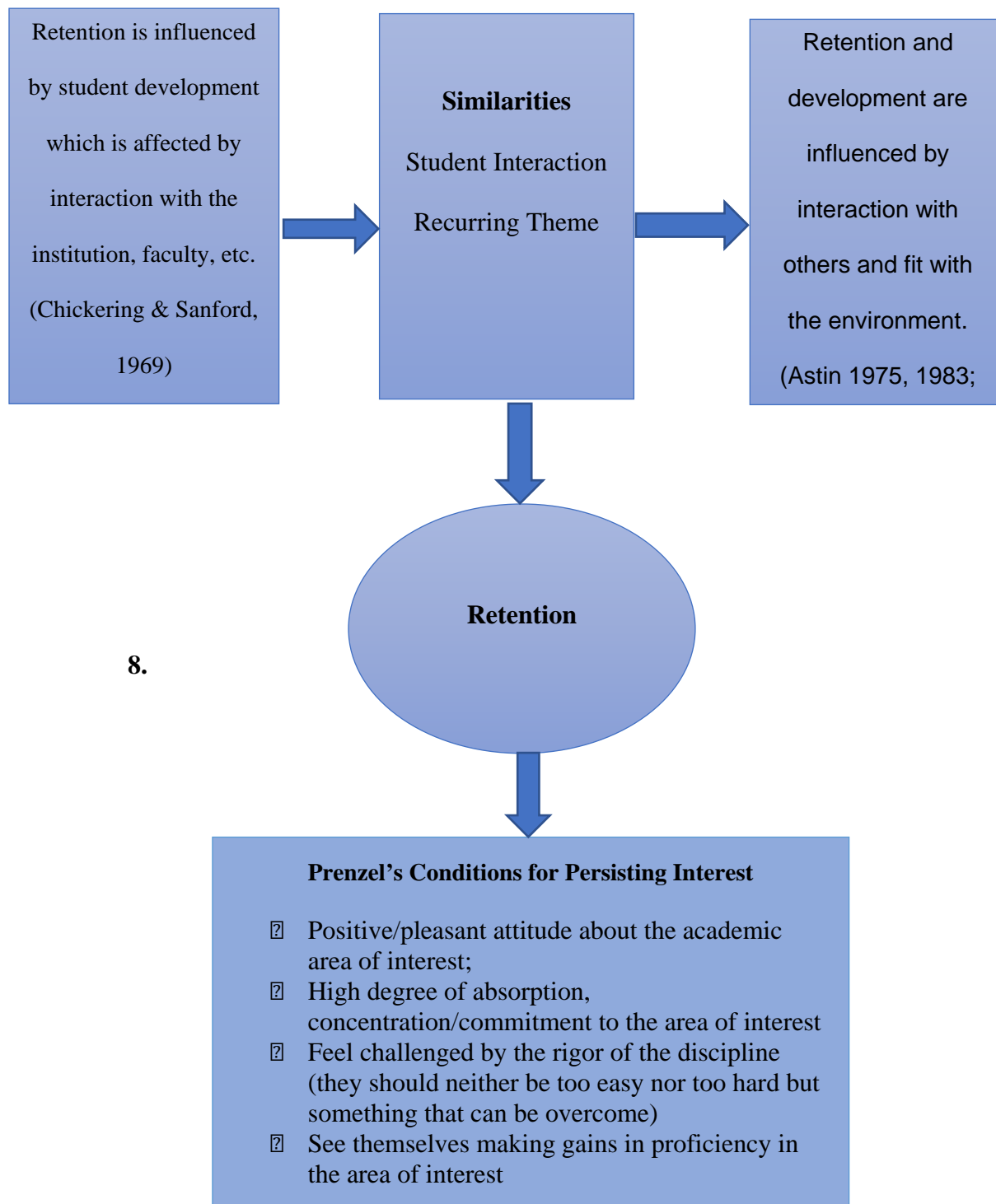
Internal	External
Relationships. Is sociable; able to be a friend; able to form positive relationships	Promotes close bonds, encourages supportive relationships with many caring others
Service/Helpfulness. Gives of self in service to others or a cause	Service to others, "required helpfulness",
Life Skills. Uses life skills, including good decision making, assertiveness, and impulse control.	Sets and enforces clear boundaries (rules, norms, laws)
Humor. Has a good sense of humor, can laugh at difficult situations.	Uses high-warmth, low-criticism style of interaction,
Inner Direction. (Internal Locus of Control).	Provides leadership, decision making,
Bases choices and decisions on internal evaluation.	Encourages pro-social development of values and life skills. Appreciates the unique talents of each individual.
Perceptiveness. Has insightful understanding of people and situations.	Promotes sharing of responsibilities
Independence. Can distance himself or herself from unhealthy people and situations. Has autonomy, can go his/her own way.	Expresses high and realistic expectations for success
Positive View of Personal Future. Is optimistic; expects a positive future.	Values and encourages education
Flexibility. Can adjust to change; can bend as necessary to positively cope with situations.	Encourages goal setting and mastery.
Love of Learning. Shows capacity for and connection to learning.	Encourages pro-social development of values and life skills.
Self-motivation. Has internal initiative and positive motivation from within.	Provides access to resources for meeting basic needs of housing, employment, health care, and recreation
Competence. Is good at something; has personal competence.	Provides other opportunities for meaningful, participation.
Self-Worth. Has feelings of self-worth and self-confidence.	
Spirituality. Has personal faith in something greater.	
Perseverance. Keeps on despite difficulty; does not give up.	
Creativity. Demonstrates expressiveness through artistic endeavor and/or by using imagination and creative thinking or other processes.	

### *The Persistence Theory*

This theory was developed by White and Massiha (2016), and is based on Prenzel's (1988, 1992) model of persistent interest in the field of science. It is also based on Kuh and Love's (2000) cultural model (as cited in White & Massima, 2016), which explains why cultural, and society's prejudices are the cause for lower retention rates of underrepresented population. Furthermore, the theory includes Astin's (1993) theory of student engagement and the importance of students' interaction with the faculty. White and Massiha arrived at their conceptual framework from several retention theories to include Chickering's (1969) 7 vectors of development (competence, emotional management, autonomy, interpersonal relationships, identity, clarification of purpose, and personal integrity) and Sanford's (1967) integration differentiation theory.

By contrast, Astin's (1975; 1993) student involvement, Tinto's student engagement (1975, 1993), and Bronfenbrenner's (1979) campus ecological model provide an environmental lens for attrition and its opposite, retention. These environmental theories focus on students and their relationships with the institution, the specific academic science field chosen, and classmates. Student attitudes, and the quality of interaction between students and faculty, play a critical role in the persistence toward remaining in a doctoral degree program in general or graduating with a degree in a specific STEM field of study (White & Massiha, 2016). Prenzel's (1988, 1992) persistence of academic interest in the field of science model was grounded on 4 basic principles, as depicted in Figure 7 that has been.



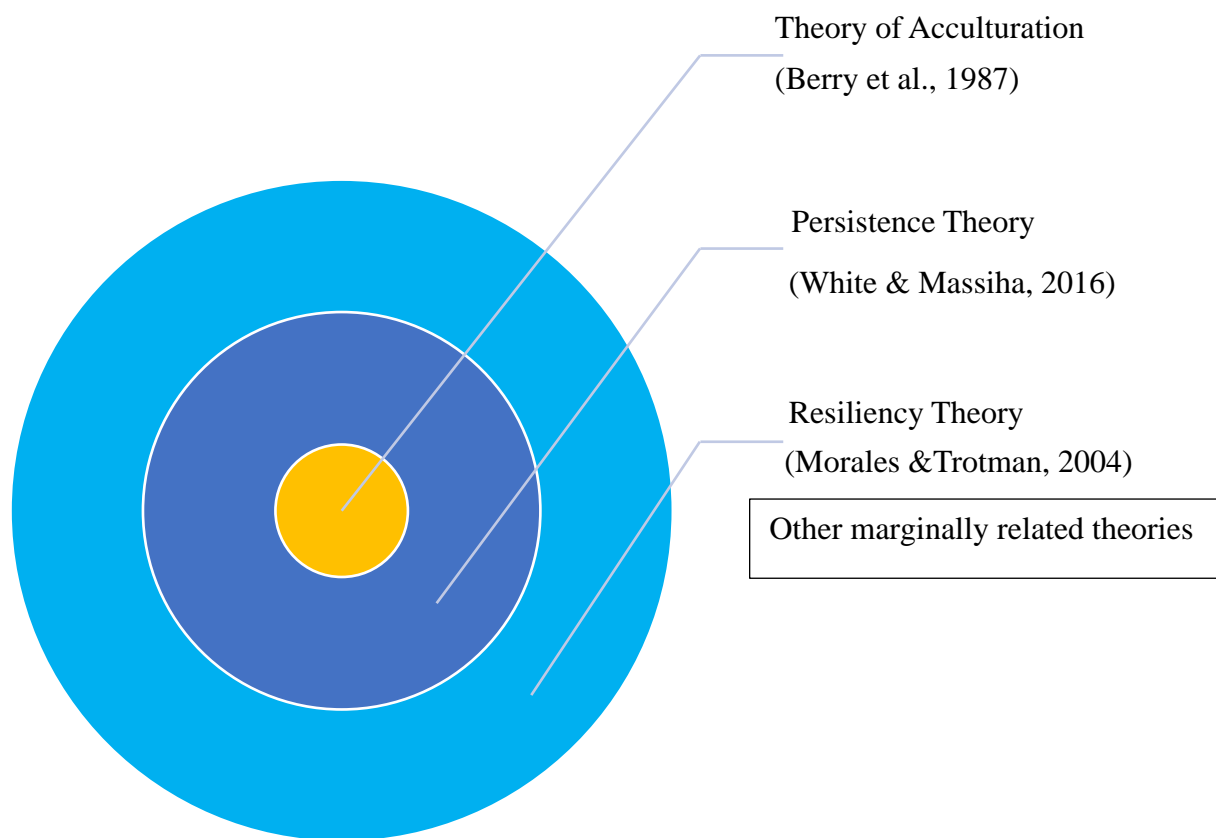
**Figure 7***Persistence Conceptual Model*

*Note.* Adapted from White & Massiha (2016)

Figure 8 depicts a summary of the theoretical review related to overcoming the problem.

## Figure 8

### *Main Theories to Overcome the Problem*



## Conceptual Framework

The conceptual framework for this study is based on the prior research and theories discussed above. International female doctoral students must overcome main stressors to achieve acculturation to include gender, age, racial, and/or disability discrimination; low proficiency in the English language; overcoming cultural shock; academic deficiencies (specifically, in math, technology, and the sciences); lack of financial resources; living conditions; socio-economic

status; overcoming loneliness; isolation and homesickness; adapting to new environments; and socialization skills. To become resilient and succeed in doctoral programs in the sciences, the international female students need to: develop a sense of community in their host country by establishing social systems of support; become persistent or persevere by having clearly defined goals; strengthen their educational backgrounds taking pre-requisite courses, have a strong work ethic and regular study habits; participate in group projects and study groups; and, draw inner strength from their specific faith, religion and spirituality.

These students also need to develop strong peer connections and make new friends with domestic students, while maintaining strong bonds and constant communication with family and friends left in country of origin. Additionally, they should foster friendly and respectful professional relationships with faculty, administrators, and academic advisors, and become assertive if needed and be a self-advocate. Students need to learn about university policies and be familiar with immigration, state, and host country laws. They also need to find mentors and work as a teaching or research assistant and participate in conferences and submit papers for publication.

Furthermore, students need to search and apply for additional scholarships or sources of financial aid or part-time work at the host university, as well as identifying and utilizing resources such as International Student Services, Library, Media Center, Tutoring Centers, Writing Centers, Labs, English language Centers, Health Clinic or Hospital, Counseling Center, Student Disability Services, Student Affairs, Research Centers. It is also important for students to balance study, work, and family responsibilities, as well as trying to have a healthy and safe lifestyle and finding ways to relax, exercise, and energize. The final conceptual framework after

data analyses, synthesis and interpretation is included in the chapter on Data Analysis, Synthesis, and Interpretation.

## Methodology

The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international female doctoral students who succeeded in their doctoral programs in the United States in Science, Technology, Engineering or Mathematics (STEM) or completed a dual PhD and/or professional program in the health sciences. Within phenomenology philosophy, there are two important traditions or schools that have been identified and differentiated: transcendental, and hermeneutic interpretive. Each tradition has been related to prominent phenomenological scholars (Given, 2008).

Transcendental phenomenology is linked to Edmund Husserl. For Husserl, phenomenology is an arduous and demanding human science field, which studies all possible transcendental phenomena. It explains the formation of knowledge in consciousness, specifying the suppositions upon which all human comprehensions are based. Main terms include intentionality, eidetic reduction, and constitution of meaning (Given, 2008).

Hermeneutic interpretive phenomenology is associated with Paul Ricoeur and Hans-Georg Gadamer. Phenomenology transforms to hermeneutical when its method is interpretive (as opposed to purely descriptive as in transcendental phenomenology). Basic terms of hermeneutic phenomenology include interpretation, textual meaning, dialogue, preunderstanding, and tradition (Given, 2008).

Connelly (2010) explained that hermeneutic or interpretive phenomenologists strongly feel that researchers cannot bracket or put aside their biases and they are an essential component of their personalities. This had been previously noted by Crist and Tanner (2003) who stated that hermeneutic or interpretive phenomenologists are not obliged to bracket their preconceptions during their research studies.

Creswell (2013) posited that interpretive phenomenology not only provides a description but also an interpretation conducted by the researcher of the meanings of participants' lived experiences. Furthermore, McCance and Mcilpatrick (2008), as cited in Tuohy et al. (2013) and corroborated by Creswell (2013), affirm an important component of interpretive phenomenology; that the researcher forms an integrated part of the assumptions of the phenomena studied. Hence, the researcher's assumptions must be acknowledged and incorporated into the findings. Flood (2010) added that in interpretive phenomenology, the meanings of the lived experiences are a combination of the researcher's and the participants' meanings.

### **Arts-Based Research**

Arts-based research (ABR) is a form of qualitative research that utilizes the properties, processes, and philosophies of the arts. It is described by the incidence of aesthetic features (or design characteristics) within both the research text and the inquiry process (Given, 2008). In the field of education utilizing art during research and practice, it is usually referred to as arts-based research (Osei-Kofi, 2013). From the disciplines of psychology and psychiatry, in the practice of creative arts therapies within the qualitative research methods, a new form of research emerged: arts-based research (Andrews, 2009). Shawn McNiff (2007), a creative arts therapist, posited that "creative arts therapies ... promoted themselves as ways of expressing what cannot be conveyed in conventional language" (p. 11). From the arts therapy, researchers started to apply the same principles to qualitative research (Andrews, 2009; McNiff, 2007). Arts therapists began to wonder "whether or not we [were] ready to use our unique methods of artistic inquiry to shape a new vision of research" (McNiff, 2007, p. 11).

With the help of 25 researchers and under the sponsorship of the American Educational Research Association (AERA), ABR originated with Elliot Eisner at Stanford University in 1993 (Osei-Kofi, 2013). She led a team to debate “research guided by aesthetic features” (Barone & Eisner, 2012, p. xi). In 1997, Eliot Eisner and his graduate student Tom Barone coined the term “arts-based educational research” as a chapter in the book *Complementary Methods for Research in Education*, published by AERA. Barone had written a dissertation in the form of creative nonfiction under the direction of Eisner (Andrews, 2009). Their chapter “focused largely on contributions of the literary arts in educational research ... and laid out a theoretical framework for arts-based research, describing the qualities of arts-based texts” (Cahnmann-Taylor & Siegesmund, 2008, p. 8). Andrews (2009) affirms that written text is a basic data form in qualitative research. Hence, most of the early works ABR concentrated on “the use and analysis of literary art forms in the human sciences with nods to music and the visual arts” (Cahnmann-Taylor & Siegesmund, 2008, p. 6).

Original scholars from various fields are incorporating the arts in their social research. The arts can teach, inform, motivate, enlighten, defy, convince, and cure; thus, the rise of a new research model, arts-based research. ABR procedures became apparent due to the natural attraction and like-mindedness between artistic practice and social practice (Leavy, 2015). The author defined ABR practices as, “A set of methodological tools used by researchers across the disciplines during all phases of social research, including data generation, analysis, interpretation and representation” (Leavy, 2015, Preface p. IX). These evolving tools address social research questions in holistic and involved manners by means of the creative arts in which practice and theory are interconnected. ABR practices employ music, dance, performance, visual art, literary writing, film, and other arts. Representative forms include but are not restricted to: paintings,

drawings, sculpture, 3-D art, collages, quilts, needlework, short stories, novels, experimental writing forms, poems, parables, graphic novels, comics, script writing, theatrical performances, dances, films, and songs and musical scores (Leavy, 2015, Preface p. X).

Barone and Eisner (2012) posited:

Arts-based research represents an effort to explore the potentialities of an approach to representation that is rooted in aesthetic considerations and that, when it is at its best, culminates in the creation of something close to a work of art. (p. 1)

In the *Arts-Based Research* chapter of the *Handbook of the Arts in Qualitative Research*, Shawn McNiff defined ABR as the:

systematic use of the artistic process, the actual making of artistic expressions in all of the different forms of the arts, as a primary way of understanding and examining experience by both researchers and the people that they involve in their studies. (p. 29)

Cahnmann-Taylor and Siegesmund (2008) explained what arts-based researchers do:

Arts-based researchers do more than help us see an external reality that heretofore has gone unnoticed by reading images. They actively form a new visual reality by creating images. The visual is not just a tool for recording, analyzing, or interpreting data; it has become a tool for creating data. The visual has reached a new dimension. It has become generative. (p. 99)

Knowles and Cole (2008) see arts-based research from a different lens, as “a mode and form of qualitative research ... that is influenced by, but not based on, the arts broadly conceived” (p. 59). Barone (2008) reinforces the concept that ABR is not a replacement for other forms of qualitative or quantitative research methods but is one more tool to expand the researchers’ approach to perceiving and producing knowledge. Finley (2005) also classified ABR within qualitative research methodology and promoted its use in political activism, social justice issues, and inclusion. Osei-Kofi (2013) is another author who strongly supports the use of ABR in social justice issues: “To engage in anti-oppressive work, to challenge the norms of what



it means to know and how we come to know, imagination is essential” (p. 139). The author concurred with Greene (2007) who advocated for

a centrality of imagination because of its power to enable persons to reach toward alternatives, to reach beyond ... [to] open windows in experience, provide moments of freedom and presence, [and] enable us to break with terrible moments of apathy and numbness. (p. 2)

ABR affords us a new chance to “move . . . into new cultural spaces of understanding, resistance and hope” (Bagley & Castro-Salazar, as cited by Osei-Kofi, 2013 p. 148).

### **Research Question**

The following research question guided my study:

What are the lived experiences of successful female scientists who earned a PhD as international doctoral students in Science, Technology, Engineering or Mathematics (STEM) or completed a dual PhD and/or Professional program in Health Sciences in the United States?

In reviewing transcendental phenomenology, Moustakas (1994) outlines what phenomenologists must consider when drafting the research question:

The research question that is the focus of and guides an investigation must be carefully constructed, every word deliberately chosen and ordered in such a way that the primary words appear immediately, capture my attention, and guide and direct me in the phenomenological process of seeing, reflecting, and knowing. (p. 59)

Following Moustakas (1994), I carefully constructed my research question. In addition to an overall question, I decided to create sub-questions after a thorough review of current related literature on international female doctoral students in STEM and Health Sciences, the suggestions of my dissertation chair and dissertation committee members, and casual discussions with international female doctoral students at the University where I study.

In writing my sub-questions, the assumptions as stated in the first chapter (assuming that there were barriers and assuming that there were factors and attributes previously unknown to me that helped my participants to navigate those barriers), guided the development of my sub-questions.

The following sub-questions guided my study:

- 1) What factors do participants perceive enabled them to complete their program of studies?
- 2) What barriers did the successful international doctoral female students experience while completing a STEM PhD or a dual PhD and/or Professional program in Health Sciences?
- 3) How did the successful international doctoral female students in STEM fields or in a dual PhD and/or Professional program in Health Sciences in the United States navigate these barriers?
- 4) What attributes contributed to the success of international doctoral female students who completed a STEM PhD, dual PhD, and/or Professional program in Health Sciences in the United States and graduated in a timely manner?

### **Research Approach**

The plans and processes for research from broad suppositions to specific methods of data collection constitute the research approach. It comprises the researcher's philosophical views, research designs, and methods (Creswell, 2013). The main components of research are ontology, epistemology, axiology, methodology, and methods. Each component influences how a research question is articulated, how the conceptual framework for the research project is obtained, and

how the research project is designed. Hence, ontological, and epistemological stances guide the methodological and methods options (Hesse-Biber & Leavy, 2006).

***Ontological Assumption—Constructivist Worldview***

“An ontology is a philosophical belief system about the nature of social reality—what can be known and how” (Hesse-Biber & Leavy, 2006, p. 4). Crotty (1998) defined ontology as “the study of being” (p. 10). Ontology addresses the question of “what constitutes reality and how can we understand existence?” (Radoon, 2016). It answers the question, *what is?* In this study, I assumed a constructivist worldview or paradigm that Guba (1990) defined as a “basic set of beliefs that guide action” (p. 17). Constructivists believe that individuals strive to comprehend their current world where they exist and function. Participants develop subjective meanings from their experiences and the role of the researcher is to interpret these meanings from the participant’s point of view. Instead of starting with a theory (as in post-positivism), the inquirer inductively arrives at a theory or specific patterns of meaning (Creswell 2013).

According to Crotty (as cited in Merriam, 2002), meaning “is not discovered but constructed. Meaning does not inhere in the object, merely waiting for someone to come upon it ... Meanings are constructed by human beings as they engage with the world they are interpreting” (p. 37). There are multiple and complex meanings as the researcher seeks to avoid strict and narrow ideas, basing his/her research in the views and experiences of the participants. These meanings are constructed through relationships with others. Hence, these relationships explain the term of *social* constructivism (Creswell, 2007).

As a constructivist, I assumed there is no complete or fixed reality. The objects of the inquiry, international doctoral female scientists who successfully completed their PhD’s in the United States, have formed their own perceptions of reality by their personal experiences and

express it from their own point of view (Guba & Lincoln, 1994). Thus, following the above stated authors, I tried to capture the essence of the participants' realities as they have been experienced within their specific context from their abstract construction of their realities.

### ***Epistemological Assumptions***

“An epistemology is a philosophical belief system about who can be a knower” (Guba & Lincoln, 1998; Harding, 1987; Hesse-Biber & Leavy, 2016). Hesse-Biber and Leavy (2016) explained that, “An epistemology includes how the relationship between the researcher and research participant(s) is understood” (p. 13). Epistemology addresses the question: what constitutes valid knowledge and how can we obtain it (Radoon, 2016)? Constructivists posit that “knowledge is symbolically constructed and not objective; the understandings of the world are made of conventions; the truth is in fact what we agree it is” (Hatch, 1985, p. 161). In this study, the international female doctoral scientists and I joined efforts in constructing the subjective reality under investigation (Bloomberg & Volpe 2016) following Hatch's constructivist principles (Hatch, 2002).

My ontological and epistemological constructivist's beliefs constitute the philosophical foundations for this qualitative phenomenological research. From this philosophical standpoint, I make assumptions about what is knowledge (ontology), how I know it (epistemology), what values are applied to it (axiology), how I write about it (rhetoric), and the processes for conducting the study of it (methodology) (Creswell, 1998). In the following section, I will describe the methodology I used in this study, state the decisions I made in the specific steps in my methodology, and explain why I made such decisions grounding them in the literature.

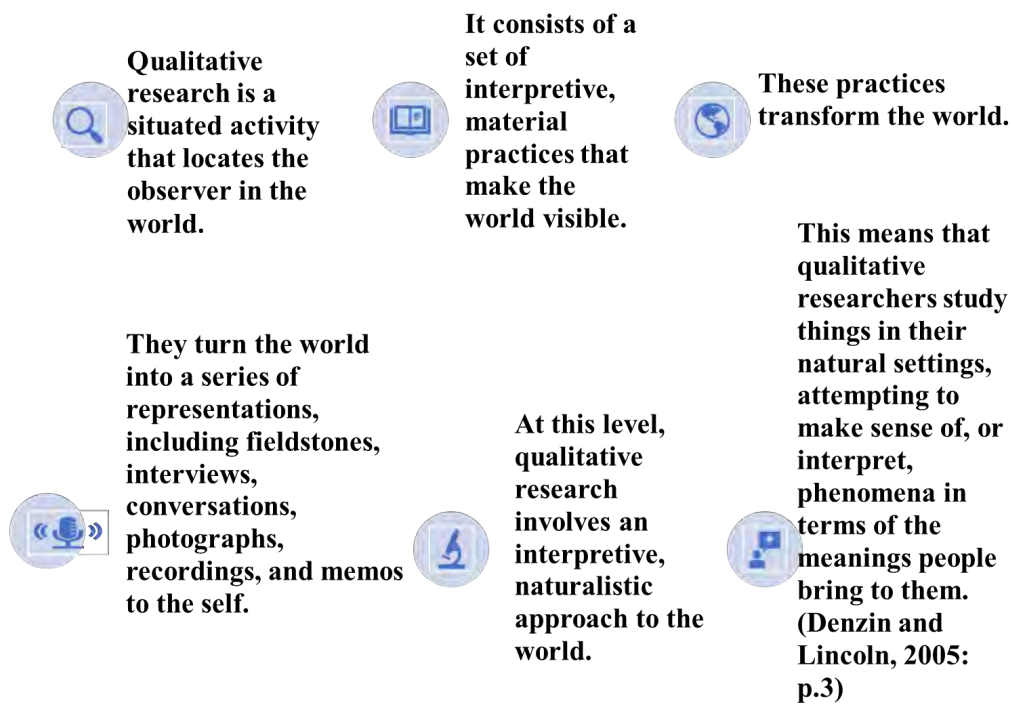
## Research Design

For this qualitative research design, I utilized a transcendental descriptive phenomenology tradition or genre based on the initial conceptual framework obtained from the Literature Review. However, my conceptual framework will be updated after the data analysis. I used qualitative inquiry in the study. Qualitative research paradigm has an extensive history in anthropology and sociology although it is used in all the social sciences (Merriam, 2002). In describing the nature of qualitative research, this author posited that the key to understanding qualitative research lies with the idea that meaning is socially constructed by individuals in interaction with their world.

The world, or reality, is not the fixed, single agreed upon or measurable phenomenon that is assumed to be in a positivist, quantitative research. Instead, there are multiple constructions and interpretations of reality that are in flux and that change over time. (Merriam, 2002, pp. 3–4)

Furthermore, Creswell (2014) stated: “Qualitative Research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem” (p. 4).

Qualitative inquiry helps us to understand a central phenomenon. To learn about it the researcher asks participants broad questions, collects their detailed views in words or images and analyzes the data for specific themes in a descriptive manner. The researcher draws from other previous work done by various researchers and his/her own personal reflections to interpret the meaning of the data. The final report is flexible, and it includes the researcher’s biases and ideas (Creswell, 2012). Figure 9 visually summarizes the rationale for qualitative research design.

**Figure 9***Rationale for Qualitative Research Design*

*Note.* Figure Design: Dr. Alfredo Ortiz-Aragon. Data Source: (Denzin and Lincoln, 2005, p. 3).

From my standpoint as the researcher, the essential characteristics and postulations of a qualitative research method fit well with this study and produced rich, thick data necessary to answer the research question (Bloomberg & Volpe 2016). I chose a qualitative research design because it contained the main 8 characteristic elements of a qualitative study specified by several authors such as Creswell (2014), Hatch (2002), and Marshall and Rossman (2011):

1. The study occurred in a natural setting.
2. The researcher is the main instrument.
3. Multiple sources of data are collected.
4. An inductive data analysis is used to establish the themes then a deductive analysis of the data is made beginning from the themes to obtain further information.

5. The researcher focuses mainly on the participants' meanings.
6. The research process is an emergent design.
7. The researcher utilizes great reflexivity.
8. A holistic account of the phenomenon is presented.

Creswell (2007) explained the main five approaches of qualitative research design: narrative research, phenomenology, grounded theory, ethnography, and case studies. Within the constructivist worldview, I chose phenomenology from all the different traditions of qualitative research design.

### **Rationale for Phenomenology**

As a methodological approach, phenomenology was chosen because I wanted to study the essence of the lived experiences of these international female doctoral science students in the United States. I also wanted to understand their perceptions of barriers they encountered and how they constructed meaning from these barriers and overcame these barriers to successfully complete their program of studies. Given (2008) defines phenomenological research as, “the study of lived or experiential meaning and attempts to describe and interpret these meanings in the ways that they emerge and are shaped by consciousness, language, our cognitive and non-cognitive sensibilities, and by our preunderstandings and presuppositions” (Given, 2008, p. 614).

Phenomenology is the reflective study of lived experiences. The main trait of the phenomenological tradition is that it is the study of the lifeworld as it is first experienced without any pre-reflections, theories, concepts, and classifications (Given, 2008). What this meant for me is that I had to approach my study by first disclosing my background (stated in the *Role of the Researcher*). Second, I constantly engaged in reflection by keeping a journal and writing memos to be aware of possible biases that may surface. I avoided these biases during data collection and

data analysis. Third, although I truly reviewed the theories and current literature, discrepant findings (findings that did not conform to any of the pre-existing theories) are discussed in the following chapter.

I also tried to understand and describe the perceptions of my participants as a way to understand what their lived experiences were. Oiler-Boyd (2001) posited that phenomenology arises from perception.

Perception is original awareness of the appearance of phenomena in experience. It is defined as access to truth, the foundation of all knowledge. Perception gives one access to experience of the world as it is given prior to any analysis of it. Phenomenology recognizes that meanings are given in perception and modified in analysis... (pp. 96-97)

During discussion, *testimonies*, and conclusions, I explain how the lived experiences changed, affected, and shaped the participants for the better. Farina (2014) explained that, “Phenomenology involves a change in the ‘sense of the world’: everything acquires its sense and value only when it becomes the content of the lived experience of the subject correlated to his intentional acts” (p. 50).

### **Rationale for Using Transcendental Phenomenology**

From the different phenomenological traditions or schools, I chose the traditional Eidetic (from the word *essence*) or transcendental phenomenology, because “it analyzes the essences perceived by consciousness with regard to individual experiences” (Padilla-Diaz, 2015 p. 103). My decision to choose transcendental phenomenology as a qualitative research tradition was made after immersing myself in the readings of the work of Husserl (1962, 1996, 1970) and Moustakas (1994). This decision was further supported by other authors such as Klein, (1940), Luft, (2002), McConnell-Henry et al., (2009), Rapport and Wainwright (2006), and Phillips-Pula et al. (2011).



Transcendental phenomenology concentrates on finding the essential meaning of the individual experiences (Phillips-Pula et al., 2011). In this study, I was trying to find the essence of the experience of being an international female student in a Doctoral Program in the Science fields in the United States. Transcendental phenomenology is based on the studies of Edmund Husserl (1859-1938), who is also considered the father of contemporary phenomenology and one of the most prominent philosophers of the 20<sup>th</sup> century (Moran, 2000, Phillips-Pula et al., 2011; Zahavi, 2003).

Husserl contended that our investigations must be critical and undogmatic, which required putting aside scientific and metaphysical biases. The question then arose: How should we proceed as researchers without allowing our biases to influence the findings in advance?

Husserl answered:

Our investigation should turn its attention toward the *givenness* or *appearance* of reality, that is, it should focus on the way in which reality is given to us in experience. We should, in other words, not let preconceived theories form our experience, but let our experience determine our theories (Zahavi, 2003 p. 45).

Zahavi (2003) published *Husserl's Phenomenology* (originally published in Danish in 1997) and translated it to the English language. Zahavi explains that in §24 of *Ideen I*, Husserl describes the phenomenological *principle of principles* in the following manner: “We should let the original giving intuition be the source of all knowledge, a source that no authority (not even modern science) should be allowed to question” (p. 45). Hence, to investigate the phenomenon, we need to “suspend” or bracket our natural realistic inclinations to avoid presuppositions or naiveté in a process known as “*epoche*” (p. 45). In the words of other authors, *epoche* is “the identification and acknowledgement of both conscious and unconscious beliefs *a priori*” (Phillips-Pula et al., 2011, p. 67). Following Husserl’s teachings in the *Role of the Researcher*, I

provided a full disclosure of my personal and educational background, identifying and putting aside (bracketing) any possible biases prior to conducting the research.

Husserl felt that the acceptance of descriptions of the experience provided by the participants in what he termed *imaginative variation* will help researchers to capture the essence of their experiences. Further, Husserl believed that the action of being present in a situation, which he called intentionality, incorporate s perception or *noema* and meaning or *noesis* (Husserl, 1970; Moustakas, 1994; Phillips-Pula et l., 2011).

In this research design, I utilized transcendental descriptive phenomenology and not hermeneutical or interpretive phenomenology, because I wanted to describe the experiences of the participants as opposed to interpreting such experiences. Wojnar and Swanson (2007) explained that these are the two main approaches in research design in phenomenology. According to the authors, Husserl developed transcendental descriptive phenomenology and one of his students, Heidegger, modified Husserl's research design, developing hermeneutic or interpretive phenomenology.

According to Creswell (2013), descriptive transcendental phenomenology focuses on the “*what*” and “*how*” the participants had these experiences. Moustakas (1994) posited: “The core processes that facilitate derivation of knowledge are: Epoche, Transcendental-Phenomenological Reduction, and Imaginative Variation” (p. 33). I fully accept the participants’ descriptions of their lived experiences without any prejudices as narrated to me; to understand their perceptions and construct meaning with the goal of capturing the essence of their experiences.

Moustakas (1994) described the purpose of methods in transcendental phenomenology: “Every method relates back to the question, is developed solely to illuminate the question, and provides a portrayal of the phenomenon that is vital, rich, and layered in its textures and meanings” (p.

59). I will now describe the specific components of the transcendental descriptive phenomenology methodology used in the study and the decisions I made as I followed this methodology.

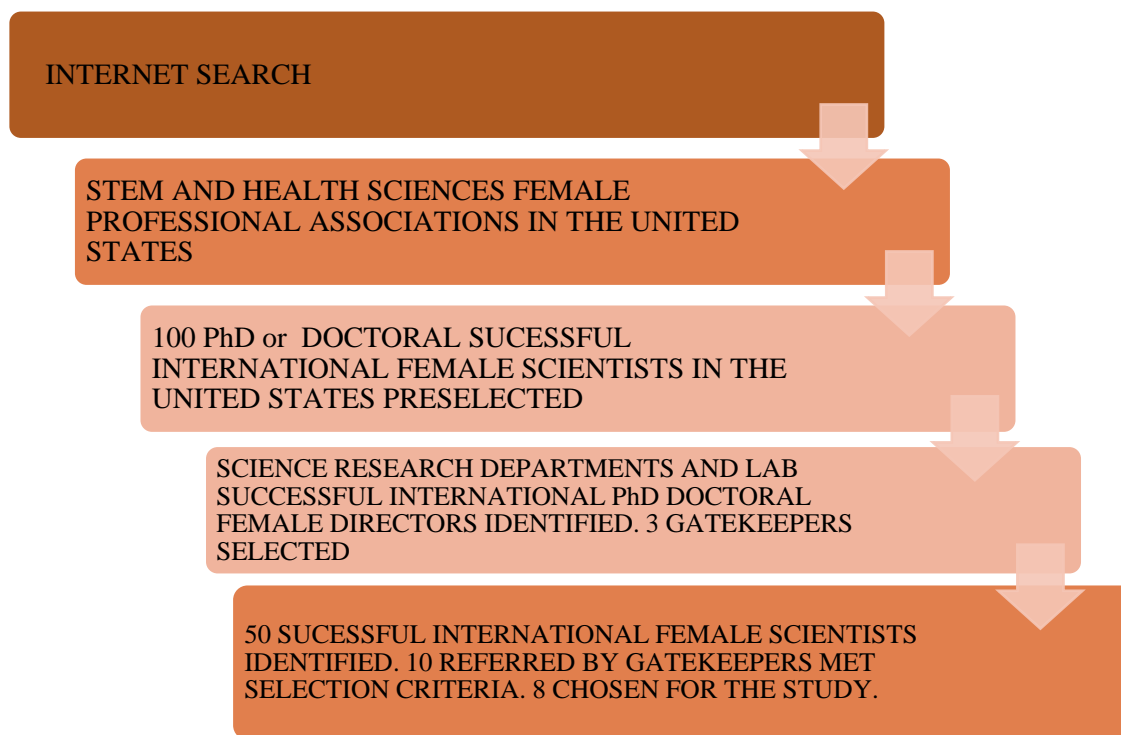
### **The Research Population**

The target population consisted of international female scientists who successfully completed their Doctorate in the STEM fields or in a dual PhD and/or professional program in the health sciences in the United States.

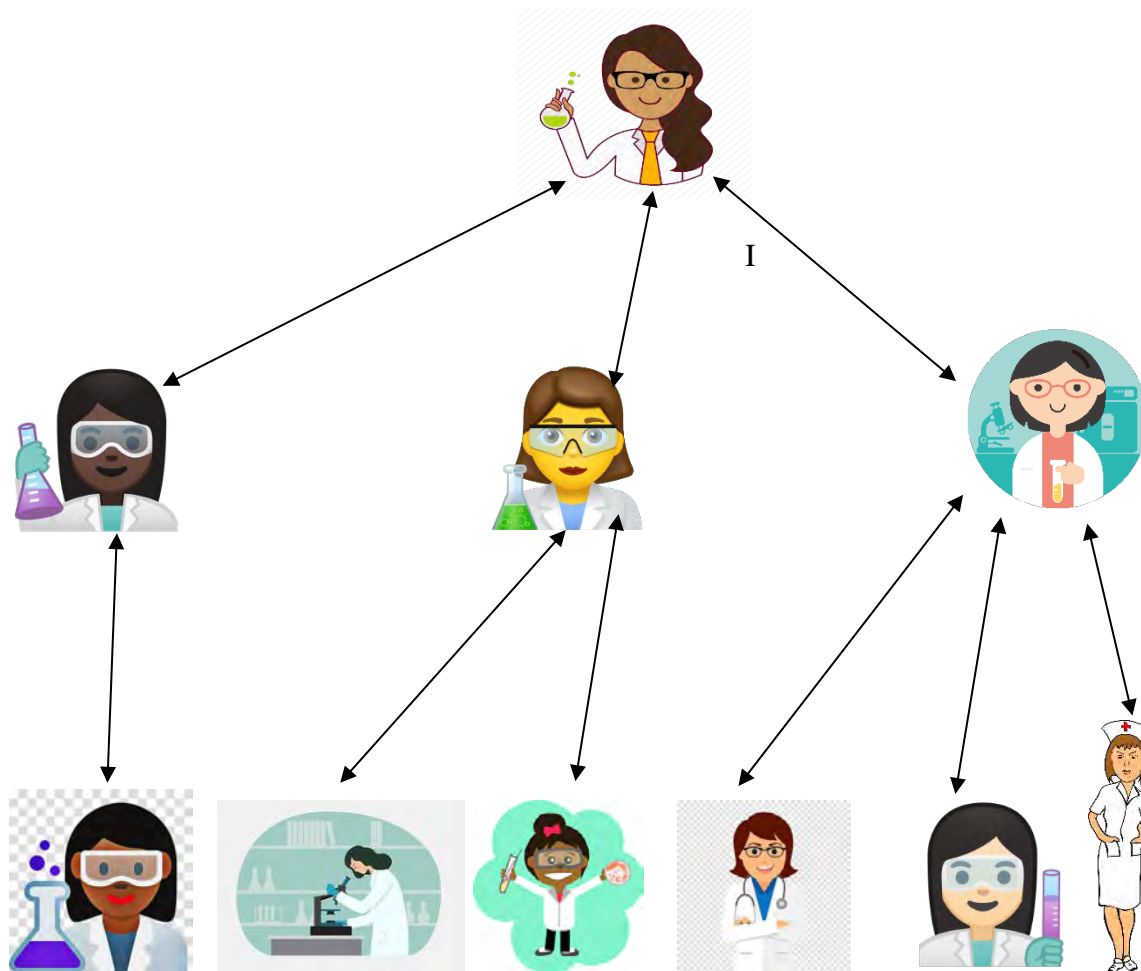
### ***The Research Sample***

I selected a purposeful sampling for my study. Creswell (2012) explains that “in purposeful sampling, researchers intentionally select individuals and sites to learn or understand the central phenomenon” (p. 206). Furthermore, Patton (1990) recommends choosing individuals and sites that are “information rich” (p. 169). “This method is in contrast to the random sampling procedures that characterize quantitative research, which is based on statistical probability theory” (Bloomberg & Volpe, 2016, p. 148).

Creswell (2012) posited: “In homogeneous sampling the researcher purposefully samples individuals or sites based on membership in a subgroup that has defining characteristics” (Glossary, p. 208). Therefore, my sample was homogeneous. All participants were members of a specific subgroup: Female International Scientists who successfully obtained their PhDs in the Sciences in the United States. I purposefully identified the characteristics of participants and found them in specific sites where they now work, as illustrated in Figure 10.

**Figure 10***Purposeful Sampling*

Further, I also used the snowball sampling technique, which is illustrated in Figure 11. The name reflects an analogy to a snowball increasing in size as it rolls downhill (Given, 2008, p. 815). Snowball sampling is a practical form to achieve the objectives of purposive sampling in cases where there are no common listings or other resources for obtaining members of the population who meet the specific criteria for the study. It obliges that the participants know others with similar traits who qualify to participate in the research (Given, 2008). I also needed to find additional participants because I lost one who chose to withdraw from the study and there were several who failed to meet the specific criteria to participate in the study.

**Figure 11***Snowball Sampling*

Snowball sampling uses a small pool of initial informants to nominate other participants who meet the eligibility criteria for a study (Given, 2008). This sampling also involved using networks. I started with a few individuals in local university research centers and STEM or Science labs who gained employment as international female scientists after they completed their doctoral studies in STEM and/or a Doctoral Professional program in health sciences in the United States. They worked either as faculty or researchers. I attempted to collect needed information and asked them to identify similar participants who met the selection criteria for this

study and refer them to me. These referred individuals were contacted and asked to participate in the study, becoming part of the sample. The process continued until I reached the point of saturation in terms of data collected (Kumar, 2014). Figure 11 provides an illustration of the sampling used.

Furthermore, I made sure all my participants met the criteria of a history of *academic success* in their STEM PhD or Health Science Doctoral Programs. For purposes of this study, *academic success* refers to the completion of a doctoral and or professional degree within the time deadlines prescribed by the specific university each participant attended and subsequent graduation.

The sample size “is the number of data sources that are actually selected from the total population” (Denzin & Lincoln, 2005, p. 798). The authors explain that the purpose of most qualitative research studies is to obtain a profound comprehension of a phenomenon within a very specific context and this purpose is well-matched with small sample sizes. Hays and Singh (2012) state that in purposeful sampling, the sample size depends on the research goals and qualitative tradition. As a result, it is very challenging to determine the appropriate number of participants.

Dukes (1984) posited that from a theoretical perspective, a sample size consisting of only one participant will be enough in phenomenology because it would reveal the structural invariants of their lived experience. The experience of a phenomenon will be the same despite specific traits of each case. The experience of a phenomenon is not bound by time nor restricted to a specific culture. Nevertheless, the author warns us about *seeing what we want to see*, for this reason, Dukes (1984) advised of having a sample size of 3 to 10 participants for phenomenology. Giorgi (2009) advises the use of three participants as a minimum in phenomenological studies.

Polkinghorne (1988) recommends an average of 5 to 25 participants who have experienced the phenomenon under study. Additionally, Creswell (2013) posits that the sample size depends on the type of qualitative design tradition used. Glaser (2001) argued that small size does not necessarily yield a small number of incidents because participants can provide a lengthy talk during the interview and participants can always be interviewed more times as needed.

After much consideration, based on the rationales cited above, I selected eight of the 10 participants recruited for the study. These participants produced rich-based data, which informed a profound comprehension of the phenomenon of the successful completion of the PhD or Doctoral Program by international females who had migrated to the United States to study STEM and/or professional health science fields (the purpose of my phenomenological study within a very specific context). I firmly believed that the sample size was adequate to explore the phenomenon of this inquiry and it properly addressed the purpose of the study.

### **Criteria for Selection of Participants**

In his book *Phenomenological Research Methods*, under “Methods and Procedures,” Moustakas (1994) stated that:

There are no in-advance criteria for locating and selecting the research participant. General considerations include age, race, religion, ethnic and cultural factors, gender, and political and economic factors. Essential criteria include: the research participant has experienced the phenomenon, is intensely interested in understanding its nature and meanings, is willing to participate in a lengthy interview and (perhaps a follow-up interview), grants the investigator the right to tape-record, possibly videotape the interview, and publish the data in a dissertation and other publications. (p. 107)

The criteria for participants’ selection included:

- 1) To have been a *true* international student in the United States. “*True*” international students are defined as those who come from foreign countries but are neither legal residents nor American citizens by naturalization.

- 2) To be female.
- 3) To have learned English as a second language.
- 4) To have graduated in a Science, Technology, Engineering or Mathematics (STEM) doctoral program or a dual PhD and/or professional program in health sciences in the United States within the last 20 years.
- 5) To have experienced the phenomenon of migrating to the United States from a foreign country to obtain a PhD research degree in STEM or a dual PhD and/or professional program in health sciences in the United States.
- 6) To be willing to share their experiences and perspectives related to the research inquiry.

### ***Gaining Access***

In this part, I describe further the methods I used to gain access to research sites and participants. I list the characteristics of the organizations that I contacted to gain access to the persons who met the criteria to participate in this phenomenological study. I also describe the methods I used for recruitment and selection of the participants. I contacted specific professional scientific research organizations [listed under Participants' Identification Strategies].

I used my *insider* position as alumna of some of these universities and research centers where I conducted clinical rotations as a graduate student to gain access to the research sites. Creswell (2012) posited: "To obtain access to a field site, locate a gatekeeper on the 'inside' who can provide needed permissions and access to people and places" (p. 234). I identified gatekeepers in these universities and research centers who not only gave me access to the sites but who became participants themselves and referred me to other possible participants.



The participants and I agreed to meet face-to face in their private faculty offices or labs where they conducted research. For 2 participants, I reserved a private study room in the library of the private faith-based university where I studied to conduct the interviews, and in a conference room in the research center of the institution where the other participant worked. One out of state participant and a participant who commuted from a different city were interviewed by phone.

### **Participants' Identification Strategies**

My goal was to identify at least 10 initial participants who met the above-mentioned criteria. Further, the number of participants follows Creswell's (2013) and Polkinghorne's (1989) endorsement of using 5-25 participants in phenomenological studies. I used various strategies to identify participants for the study. I conducted internet webpage searches in doctoral STEM departments in local public and private universities, searching specifically, for international females with PhD's in STEM fields or a dual PhD and/or professional program in the health sciences who completed their studies in the United States. I checked online for their Curriculum Vitae (C. V's); type of research interests; and STEM or health science research articles published; and awards. I also checked specific STEM research centers; the Association for Women in Science (AWIS); Professional Associations in various STEM fields; the American Association of University Women (AAUW); Million Women Mentors (MWM); the Organization for Women in Science in the Developing World (OWSD); Scientista; and Women in Science Association. I went through listings of international associations such as the Fulbright Commission and specific associations of citizens from other countries living in the United States and in my local city and state. I further searched in the Research Gate website. I visited in person many of the doctoral STEM departments in public state universities and research centers in my

area and nearby cities. Some of these agencies and institutions or gatekeepers referred me to other potential participants, per my request. I then contacted individuals by phone and e-mailed the referred potential participants obtained by word of mouth through the use the snowball sampling technique.

I collected their e-mails and other contact information from the webpages of their place of work, STEM and or professional/health science Doctoral departments where they work as faculty and researchers in universities and/or research centers and from other lists in scientific professional associations. After passing my proposal defense and obtaining IRB approval, I contacted the prospective participants by e-mail, phone, or in person and requested a face-to-face meeting.

Individuals were then sent a personal invitation letter (see Appendix C). Each participant received specific instructions, the purpose of the study, the IRB approval notification, and a participant's consent form (see Appendix D). I explained the study in detail and informed them of the benefits of their contribution to future female international students who aspire to come to the United States to obtain their PhDs in STEM fields. I waited two weeks for their response and followed-up with additional e-mails or calls, if necessary, for those who did not respond. I then asked for a first face-to-face meeting or pre-interview (Moustakas, 1994). I explained again the specifics of the study and I answered any questions they had. My goal was to create a connection, build trust and establish a good professional relationship (Walford, 2008). I obtained their cooperation and asked that they sign the informed consent form prior to the interview if they had not already done so. This first face-to face meeting helped me determine if the participants met the specific criteria for the study and if they agreed to participate in the study.

## **Participants' Selection**

Utilizing the above stated strategies for identification, I asked the participants if they could provide me with a copy of their Curriculum Vitae (CV) by e-mail. I relied on the assumption that if they work as faculty and/or scientists and researchers in the United States, the institutions that hired them verified their credentials since most scientific work in the United States requires specific pre-screening for security reasons. Their CVs and published research articles helped determine if they were eligible to participate in the study.

The participants and I then met and decided together their eligibility for the study. If they were eligible, I sent them a survey by email to collect their demographic information. To answer the research questions, I used 3 instruments. The first involved me as the researcher and the investigator observing and collecting data from the participants and all the other methods used as well (Creswell, 2014). The second instrument (Appendix F) was a questionnaire designed for the semi-structured interviews, as suggested by Bloomberg and Volpe (2016). The third instrument involved artistic artifacts (Leavy, 2015).

## **Participant Profiles**

Bloomberg and Volpe (2016) posited that demographics are part of the participants' profiles because they describe who the participants are and their background: personal information such as gender, age, ethnicity, level of education, et cetera. I used demographics because they allow the general audience to assess how the participants met the selection criteria for the study and to whom the findings apply. Demographics also helped me to conduct cross-case analysis, a requirement of qualitative dissertations. Demographic data were collected through surveys. The Sample Survey of Demographic Data can be found in Appendix E (Bloomberg & Volpe, 2016). Participants' demographics are presented in Table 5 and Table 6 as

well as the participants' profiles. In the appendices, I provide a Textural Description, a Structural Description, and a Textural-Structural Description for each participant following Moustakas' (1994) data analysis and presentation of findings.

**Table 5**

*Participant Demographics (A)*

Participants	Gender	SEC	Continent of Origin	Year of First Entry to the United States	Education Level on Admission Of Doctoral Program	First Language	Number of years in ESL
Luisa 07312017	Female	Lower Class	South America	2004*	Bachelors	Spanish	3
Akilah 09132017	Female	Upper Class	Asia	2005	2 Masters	Malayalam/ Hindi	10
Mira 09182017	Female	Upper Middle Class	Asia	1992	Master's	Hindi	11
Pilar 12072017	Female	Upper Middle Class	South America	1995*	Master's	Spanish	3
April 12132017	Female	Lower Class	South America	1997	Bachelors	Spanish	3
Rose 03212018	Female	Lower Middle Class	Euro-Asia	2004*	Bachelors	Turkish/ Pomakca	9
Ana 02032018	Female	Upper Middle Class	South America	2010	Masters	Spanish	1
Tanvi 04162018	Female	Upper Class	Asia	1994	Master's	Hindi/ Punjabi English/ Russia	n/a

*Note.* Asterisk (\*) indicates there were periods in which the participant returned to country of origin.

**Table 6***Participant Demographics (B)*

Participants	Age Range	Race/ Ethnicity	Religion	Years in Doctoral Program	Program of Study or Concentration	Married	Children
Luisa 07312017	23-30	White/ Hispanic- Latina	Catholic	6	Neurobiology Cellular & Molecular Biology (Science)	YES	1 *After PhD
Akilah 09132017	31-40	Asian	Hindu	5	Physics (Science)	YES	2 *1 During PhD
Mira 09182017	41-50	Asian	Hindu	7	Medicinal Chemistry (Science)	YES	1 *After PhD
Pilar 12072017	41-50	White/ Hispanic- Latina	Catholic	8	Public Health/ Epidemiology (Science)	NO	0 During PhD
April 12132017	31-40	White/ Hispanic- Latina	Catholic	5	Microbiology/ Immunology (Science)	YES	2 1 *After PhD
Ana 02032018	23-30	White/ Hispanic- Latina	Christian	5	Civil Engineering	NO	0
Rose 03212018	23-30	White	Muslim	5	Mathematics And Technology	YES	2
Tanvi 04162018	31-40	Asian	Hindu	5	Nutrition and Technology (Science and Technology)	YES	0

Narrative profiles are an extremely important part of descriptive transcendental phenomenology, following Moustakas (1994). They provide a general introduction and background of the participants. I present earlier experiences directly related to the problem of this study. The narrative profiles help understand the findings of this dissertation, which will be discussed in the following chapter and help answer the main research question and sub-questions. The profile narratives present the individual personal attributes that best contribute to the participants successfully graduating with a PhD in STEM. The personal attribute was evidenced from their direct answers during two interviews [valued coded] to the specific question of: what specific personal attribute do you think contributed to your success and graduating with a STEM PhD?

### **Data Collection and Procedures**

In a qualitative study, using multiple methods to collect data and employing triangulation is very important to be able to obtain an in-depth comprehension of the phenomenon. Maxwell (2013) defines triangulation as “collecting information from a diverse range of individuals and settings, using a variety of methods” (p. 128). Denzin (as cited by Given, 2008) provided a general definition of triangulation “as a combination of methods used to study the interrelated phenomena from multiple and different angles or perspectives” (p. 892).

The tactic of using multiple methods and triangulation produces strong supporting evidence of the data obtained while adding depth, rigor, and extensive coverage (Bloomberg & Volpe 2016; Creswell, 2013; Denzin & Lincoln, 2011). Hence, this study utilized multiple methods of data collection that included: a survey, interviews document review, art-based research, and *Testimonios* (Bloomberg & Volpe 2016). I used triangulation of methods across different periods of time and in different places to collect data about this phenomenon from

multiple perspectives and in different contexts. Further, I used triangulation of different data sources [a survey, interviews, document review, art-based research artifacts, and *testimonios*] to increase the credibility of my research findings (Denzin, 1989). Each type of data yielded different evidence that led to different understandings and awareness of the phenomenon (Given, 2008) of the successful completion of the PhD or Doctorate by international females who had come to the United States to study STEM /and or professional health science fields.

### *Survey*

A survey was sent to all research participants by e-mail or delivered in person to those who requested it to be hand-delivered. The survey's goal was to obtain participant demographic data to establish the profiles. Bloomberg and Volpe (2016) posited that demographics are part of the participants' profiles because the information describes who the participants are and their background, as well as personal information such as gender, age, ethnicity, level of education, et cetera. This pertinent information is instrumental in defining similarities and differences between participants and explaining an individual's perception.

A specific datum (e.g., socio-economic status) may help to explain specific findings of the study. Locke et al. (2010) emphasize the need for authors to stipulate the demographic traits (e. g., gender, race, age, ethnicity, civil status, religion, et cetera) of their participants that directly relates to the research problem. I also asked participants a few open-ended questions to explore their personal experiences and tried to link them to their perceptions (Bloomberg & Volpe 2016). For sample questions, refer to Appendix F.

The benefit of survey methodology in qualitative studies is that is easy to conduct while not intrusive. Its limitation is that it cannot elucidate multifaceted relationships or complicated interactions (Bloomberg & Volpe 2016; Fink, 2013; Fowler, 2014). In this study, the survey

served as complementary to other methods of data collection. I used an adapted Sample Survey of Demographic Data created by Bloomberg & Volpe 2016 (see Appendix E).

Each participant was given the opportunity to select a pseudonym; for those who did not select one, a numerical code and/or a name pseudonym were assigned. A separate document was created that contained the pseudonyms or numerical codes, the real names, and all contact information of each participant [e-mail address; phone number; place of work; position held]. This document will be kept secure in a file cabinet under lock and key in the researcher's home up to 5 years and shredded later. Each participant was informed of this procedure (see Appendix G, Participant Identification Information Form).

### *Interviews*

In qualitative research, the interview is an essential tool (Bloomberg & Volpe 2016; Brinkman & Kvale 2015; Seidman, 2012). Moustakas (1994) posited: "Typically in the phenomenological investigation the long interview is the method through which data is collected on the topic and question. The phenomenological interview involves an informal, interactive process and utilizes open-ended comments and questions" (p. 114). In this research the semi-structured interview with open ended questions was the main method of data collection.

I conducted and recorded face-to-face interviews and two phone interviews for out of city and out of state participants. The interviews focused on a bracketed topic and question. Furthermore, three follow-up interviews were conducted by phone, to clarify statements and answers and/or seek specific data. (Moustakas 1994). Interviews were used because they produced thick and rich descriptions. Several researchers assert that in-depth interviews are the method of choice to elicit the participants' perspectives of their experiences and specific incidents in their lives (Bloomberg & Volpe 2016; Creswell, 2013; Denzin & Lincoln, 2011;



Marshall & Rossman, 2015). Brenner (2006) describes open-ended interviews as “interviews in which the intent is to understand informants on their own terms and how they make meaning of their own lives, experiences and cognitive processes” (p. 367). Rapley (2001) posited that interviews are essentially social encounters dependent on interaction contingencies between interviewers and interviewees. Furthermore, Brinkmann & Kvale (2014) stated:

The research interview is based on the conversations of daily life and is a professional conversation: it is an interview, where knowledge is constructed in the inter-action between the interviewer and the interviewee. An interview is literally an inter-change of views between two persons conversing about a theme of mutual interest. (p. 4)

We interview others to find from them things we did not observe. It is impossible for one person to observe everything. We cannot observe people’s behaviors from a different place and/or point in time. We cannot observe what is on their minds, their feelings, and their thoughts. To see how people construct meaning of their world, we need to ask questions. The objective of conducting interviews is to obtain other people’s perspectives (Patton, 2002). My reason for using this method of data collection is that in qualitative research, the primary way to obtain data is by interacting with participants in their own context (Bloomberg & Volpe 2016; Fontana & Frey, 2003; Rubin & Rubin, 2012; Seiman, 2012).

**Interview Protocol.** Under supervision of my faculty dissertation committee chair and members, I utilized the research question and sub-questions as a framework to develop the interview questions. I constructed matrices to show any connection between the research question and the interview questions. I asked 3 faculty members to review the interview protocol and make related suggestions to the researcher. I corrected the interview questions to incorporate changes. Upon approval of the faculty, I conducted face-to-face interviews. The final interview protocol can be found in Appendix F

**Interview Processes.** I conducted the semi-structured interviews during two semesters, the fall of 2017 and the spring of 2018. I then conducted three follow-up interviews in the spring and summer of 2018. The initial interviews lasted approximately 1 to 1.5 hours each. I conducted follow-up interviews by phone, which lasted an average of 40 mins to 1 hour. I continued with the interviews until the point of saturation or when no additional information was obtained.

Creswell (2103) asserts that the point of saturation is reached when the interviewees no longer have anything new to say. I conducted at least one recorded interview with each participant. My goal for the first interview was to obtain a rich description of the participants' experiences. My goal for the second or follow-up interview was to clarify any answers that were not clear; obtain additional information; ask additional questions that arose after initial findings; and to improve my assessment of the findings' accuracy. Additionally, I asked the participants if they were willing to participate in member-checking via e-mail. This gave participants the opportunity to revise the transcriptions of their interviews and I was able to verify if the transcriptions accurately stated what the participants were trying to convey during their interviews. This strengthened the credibility of the study and validated the accuracy of the interviews and transcription.

**Interview Observations.** I made observations and took brief notes during the interview on body language, reactions, and "non-verbal cues" when participants narrated their lived experiences. I upheld ethical values such as mutual interchange and uprightness to protect the participants' rights, including their right to privacy. I ensured the sustainability of this phenomenological research mixing strong ethical values while taking notes of the participants' perceptions of their simple real-life day to day experiences during their doctoral studies (Given, 2008).

Observation has been defined as “the fundamental base of all research methods” in the behavioral and social sciences (Adler & Adler, 1994, p. 389). Given (2008) described observations as:

[A] tool used to help describe and understand a group or culture. It is guided by practical activity, judgment, interpretation, and description ... fieldwork requires systematic observation, interpretation of observed behavior, and a plan of action to follow up on observations. (p. 347)

I relied on observations during the interviews as an unobtrusive tool to interpret events, clothing, language, and dialogue as indicators of the participants’ social status, power, roles, and attitudes. I also used Audacity Software© installed on my laptop as a recording device; a digital tape-recorder and my I-phone were used as back-ups. The audio recordings were placed in Drop-Box Plus© and the audio wave files were encrypted by Sookasa© immediately after the interview and sent securely to the professional transcriber.

### **The Transcription Process**

I used a professional transcriber who is very experienced with transcriptions of qualitative research audio recordings collected from participants’ interviews during research projects and dissertations. The transcriber signed a confidentiality agreement prior to the transcriptions (see Appendix H). Transcribing interviews from oral to written form organizes the interviews to prepare it for analysis. Transcribing from audio recording form to text form involves systemic technical and interpretation procedures especially regarding verbatim oral as opposed to written forms [there are no specific rules; rather, decisions that need to be made]. The only general rule is to describe exactly in the report how the transcriptions are done (Brinkmann & Kvale 2015).

I checked the validity of the interviews by listening to every recorded interview several times while reading the transcriptions line by line to ensure they were accurate. This procedure

helped me abstract non-verbal cues, the context of the interviews, and the tone of the participant's voice. This process of reading and rereading each participant's transcription while listening to their audio recordings several times, not only helped me verify the validity of the transcriptions it also gave me a general understanding of the participants' experience and perceptions of the phenomenon under investigation and constituted the first analysis. As I sorted through the transcriptions, I took notes, highlighted significant statements, reflected on the memos and observations I took while conducting the interview, journaled new ideas, and started conducting the first stages of phenomenological horizontalization reduction of the data per Moustakas (1994). I listened to the participants' interviews and read their transcripts many times (Creswell, 2014; Moustakas 1994). These processes were consistent in all transcriptions to ensure that each transcription was reviewed with similar focus and attention to detail. For practical purposes, both the transcriber and I numbered each line of text in every transcription. I conducted data input in Microsoft Data Table Documents to organize, code, and classify all the raw data.

### **Document Review**

In qualitative research, the word *document* is an umbrella term that covers a wide variety of visual and archival data, written records, and artifacts. Most documents are created separately from the research study, although some may be produced at the researcher's request. Hence, they offer an impartial and helpful resource for corroborating discernments obtained from other data collection methods (Bloomberg & Volpe 2016).

The general method of document analysis depends mainly on what they comprise. Documents contain important messages that can be in written form but also in different formats such as films, videos, photographs, maps, and models (Given, 2008; Prior, 2003; Prior, 2004). I

reviewed the following documents [hardcopies and/or online versions] to inform which services and facilities were available to female international students in STEM : university webpages, degree plans, graduate and/or doctoral catalogues, library and computer service webpages or brochures, English language Centers or institutes' webpages or brochures, tutoring services, financial aid or research/teaching assistantships Information, faith-based services, and curriculum vitae from participants. The review of these documents helped me understand and describe the settings and context in which the participants were educated. Additionally, the CVs from the participants helped specify the participants' profiles, demographics, achievements, and life stories.

### **Utilizing the Field of Art-Based Research**

Utilizing the field of ABR, I asked the successful international female doctoral STEM and/or health science professionals on a volunteer basis to provide any art sample (in various forms) that they used as a method to motivate them or relieve stress while in the science doctoral program or that they think connects to or represents their experience. ABR is a form of qualitative research in the human studies that employs the premises, procedures, and principles of the arts. It is defined by the presence of aesthetic qualities (or design elements) within both the inquiry process and the research text (Given, 2008). Representational forms include songs, photography, drawings, pictures, poems, prayers, passages and scriptures in religious books, parables, comics, and handcrafts of the participants' choice (Leavy, 2015).

The use of ABR in phenomenology has been extensively documented by many researchers (Garoian, 2013; Grosz, 1994; Snowber, 2012; Stinson, 2004). The participants in my study presented me with songs in their native languages (Turkish and Spanish), as well as poems, prayers, inspirational writings, comics, photographs, collages, drawings, and handcrafts. One

participant presented me with an entire wall of visual arts. “Human experiences cannot be understood separately from the environments in which they occur. It is well accepted that we live in a visual world with a historically specific multitude of visual stimuli in our daily environments” (Leavy, 2015, p. 230).

### **Testimonios**

I decided to incorporate *testimonios* to my methodology at the suggestion of one of my committee members. This seemed like a great idea to me. Some of my participants expressed candidly their perceptions of oppressive environments in the labs where they conducted research. These included perceptions of sexual harassment by their research supervisors; perceptions of feeling discriminated against by their research supervisors as international students compared to treatment given to domestic doctoral students; perceptions of unsafe working conditions in the lab; perceptions of negative competition by senior research females in their labs; and uncooperative peers during group work. Others narrated feeling unsafe as female international doctoral students in the community where they lived due to a lack of reliable transportation and having to work and study long hours at night and/or early hours in the morning. Some reported perceptions of being stalked at public places, such as supermarkets.

Participants who were pregnant and/or took care of newborn babies and/or toddlers during their PhD studies had perceptions of difficult and rigid work and study schedules during pregnancy and the first year(s) of motherhood. Hence, I wanted to create a safe place for them to have their voices heard. *Testimonios* provided this place for their voices to be heard. [For specifics of *Testimonios* as a methodological tool please refer to the *Testimonios* chapter].

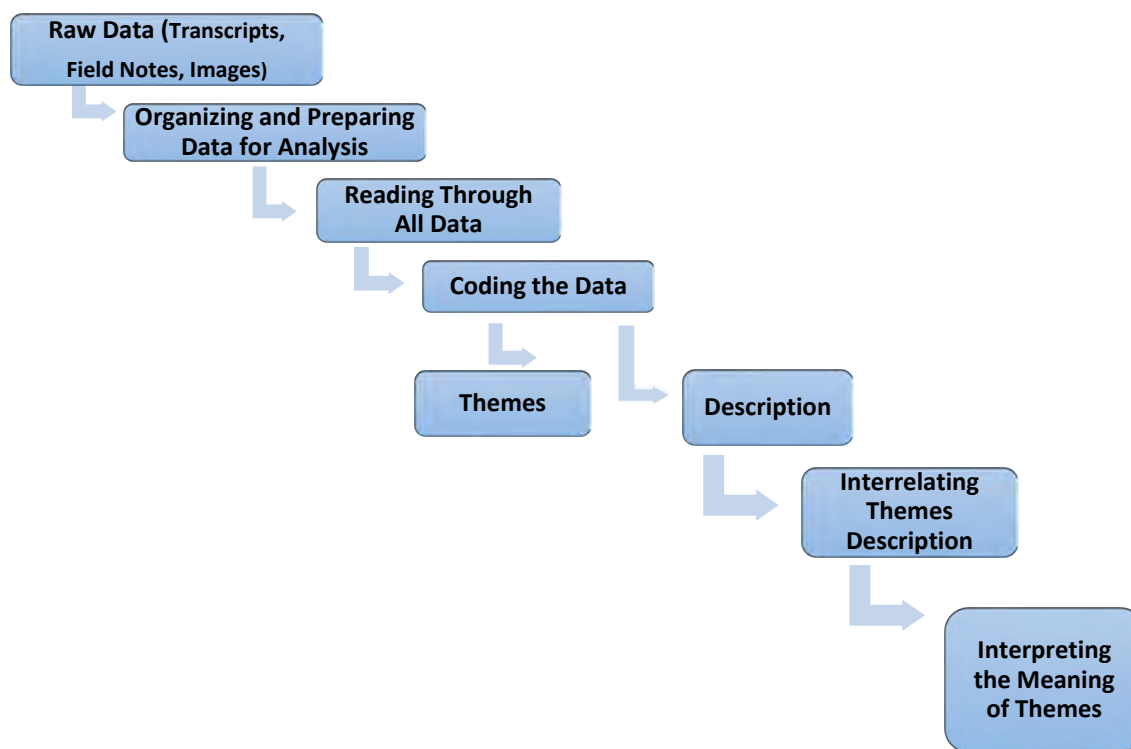
### **Data Analysis**

Following Creswell (2014), data analysis in this study proceeded on 3 levels:

- 1) The general procedure in analyzing qualitative data by Creswell (2014).
- 2) The analysis steps embedded in transcendental phenomenology following Moustakas (1994).
- 3) Moustakas (1994) modification of Van Kaam's method of analysis.

### Figure 12

*General Data Analysis in Qualitative Research Adapted from Creswell (2014)*



*Note.* Adapted from Creswell, 2014.

The general procedure in analyzing qualitative data:

1. Organize and prepare the data for analysis. I started by having the interview audio files professionally transcribed. I visually glanced over all the data, typing memos and

recording interview observations in my journal, classifying all the visual documents and artwork, and categorizing all the data per information source.

2. Read or look at all the data. I started reflecting all the messages the participants were trying to convey regarding their lived experiences. I expanded by writing analytical memos and writing marginal notes in transcripts and interview notes; general thoughts and ideas regarding the data were recorded in my journal. I begin sketching the visual data, including specific ideas.

3. Start coding all the data. Coding is defined by Rossman and Rallis (as cited in Creswell, 2014) “as the process of organizing the data by grouping chunks (or text or image segments) and writing a word representing a category in the margins” (p. 197). Saldaña (2016) posited that “a code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language based or visual data” (p. 4).

In my coding, I included all text data, pictures, documents, and art pieces gathered during data collection, fragmenting sentences (or paragraphs) or images into groupings or classifications and labeling those groups with a term; a specific term derived from the actual language of the participant [referred as an *in vivo* term]. I coded all my data manually. “There is something about manipulating qualitative data on paper and writing codes in pencil that gives you more control over and ownership of the work” (Saldaña, 2016, p. 29). Saldaña posited that qualitative researchers must reflect which coding methods will produce the kind of answers they need to address their research questions. The research tradition will determine the type of coding selected. *In Vivo*, *emotion*, *values*, and *themeing* the data are coding methods recommended for phenomenology (Saldaña, 2013). I used these four coding methods in my phenomenological study.



### *In Vivo Coding*

This method uses words or short phrases from the participant's own language in the data record as codes. It is appropriate for studies that prioritize and honor the participant's voice. (Saldaña, 2016, Appendix A pp. 294-295). I first coded all the data using mostly this method; coding as a “*splitter*” where the data were split into smaller codable moments (Bernard, 2011). I split the data in smaller sections, which resulted in more codes, providing a more detailed data analysis (Saldaña, 2016). I then used the “*lumper*” code, which “is applied to capture and represent the essence of an entire excerpt – a broad brush-stroke representation called Holistic Coding” (Saldaña, 2016, p. 23). The latter resulted in just one *In Vivo* code applied to a large segment. An example of an *In Vivo* code that I used with one of my participants Luisa (a pseudonym) is: “<sup>1</sup> Sister encouraged motivated & inspired Luisa to apply to graduate school in the United States in science.”

### *Emotion Coding*

Emotion coding labels the emotions recalled and/or experienced by the participant or inferred by the researcher about the participant. This method is appropriate for virtually all qualitative studies, but particularly for those that explore intrapersonal and interpersonal participant experiences and actions. This method also provides insight into the participants' perspectives, worldviews, and life conditions. Examples: “tearing me apart”; mild surprise; relief (Saldaña, 2016, Appendix A, p. 293). An example of an *emotion* code that I used with participant Pilar (a pseudonym) is: <sup>1</sup> **It was for me amazing.**

### *Values Coding*

This method involves the application of codes to qualitative data that reflect a participant's values, attitudes, and beliefs, representing his or her perspectives or worldview. A value (V) is the importance we attribute to oneself, another person, thing, or idea. An attitude (A) is the way we think and feel about ourselves, another person, thing, or idea. A belief (B) is part of a system that includes values and attitudes, plus personal knowledge, experiences, opinions, prejudices, morals, and other interpretive perceptions of the social world. This method is appropriate for virtually all qualitative studies, but particularly for those that explore cultural values, identity, intrapersonal and interpersonal participant experiences and actions in case studies, appreciative inquiry, oral history, and critical ethnography. Examples: V: respect; A: dislikes "lame excuses"; B: the ideal is possible (Saldaña, 2016, Appendix A Glossary of Coding Methods, p. 298).

Some examples of *Value Codes* are noted for Luisa, as she was coping with her research supervisor's inappropriate behavior:

<sup>1-2</sup>"Yeah, it was sort of difficult. It was sort of difficult because, you know, my first intuition which I had in the first conversation that I had with him the next day was about, okay, am I going - this idea—"do I need to leave?" **Belief Codes**=<sup>1-2</sup>B= DO I NEED TO LEAVE? <sup>3</sup>*Because certainly I was not interested in having anything with him. Value Codes*=<sup>3</sup>V= "Certainly i was not interested in having anything to do with him."

<sup>3</sup>He\_Misunderstood everything that has happened, or he created that. I don't know, a fantasy I believe. A= **Attitude Codes**. <sup>3</sup>A= "He misunderstood everything that has happened."  
<sup>3</sup>A= "or he created that. I don't know a fantasy I believe."

### *Memoing*

Strauss (1987) introduced the notion of “memoing,” which includes writing and keeping a journal or record of specific incidents that are crucial to the investigation. Given (2008) defined memoing as “the act of recording reflective notes about what the researcher (fieldworker, data coder, and/or analyst) is learning from the data” (p. 505). Memos are instruments to compile a group of written insights, ideas, and observations. They describe a concept and its relationships. Each memo contains one idea and should be dated and referenced. Memos evolve with time as the study proceeds, and each may be different in style. We tend to forget too quickly what has been experienced or observed. Remembering specific details are a critical aspect of qualitative research and its credibility. Thus, to overcome forgetfulness and add to the credibility of a study, memoing was created. It allows researchers total creative freedom as there are no set rules for style, writing, or grammar. Memos keep researchers involved in the empirical reality of their study while contributing to its trustworthiness (Given, 2008).

I used memoing (making written notes to myself) of what I believed was happening in the researcher’s journal throughout the research (Given, 2008). I also used memoing during data analysis to identify specific descriptors or eliminate them if they did not appear in the coding and writings. As such, the memos became the basis of the coding scheme chart, interpretation, and analytical charts. Additionally, these charts became important components of the audit trail, an indispensable part of the phenomenological research’s trustworthiness and credibility (Bloomberg & Volpe 2016).

Memo-writing is the pivotal intermediate step between data collection and writing drafts of papers. When you write memos, you stop and analyze your ideas about the codes in any – and every – way that occurs to you during the moment. Writing successive memos throughout the

research process keeps you involved in the analysis and helps you to increase the level of abstraction of your ideas. Certain codes stand out and take form as theoretical categories as you write successive memos (Charmaz, 2014 p. 163). “Memos are sites of conversation with ourselves about our data” (Clarke, 2005, p. 202). They are “roughly equivalent to a lab notebook in experimental research” (Vogt et al., 2014, p. 394). Saldaña (2016) refers to memos as analytic memos. They “are somewhat comparable to the researcher journal entries or blogs – a place to “dump your brain” about the participants, phenomenon, or process under investigation by thinking and thus writing and thus thinking even more about them” (p. 4a4).

I utilized analytic memos to help me select the appropriate codes for my study; during the coding process: to extract the main themes and as a way to document my main ideas. An example of an analytic memo was used in the data analysis of participant Mira Gypta (a pseudonym); further detail of this is provided in the following chapter. Additionally, a fourth approach involved the use of the coding process to generate a description of the setting or people as well as categories or themes for analysis. I used some of my codes to describe the sites I visited and to generate *Participant Profiles* listed in the first part of the following chapter.

The three different types of codes enabled me in the formation of categories and themes. A category as been defined as “a label in the form of a word or phrase applied to a grouped pattern of comparable codes and coded data” (Saldaña, 2016, Appendix A Glossary of Coding Methods, p. 298). Themes are explained below.

After using 3 different codes (In Vivo, Emotion and Values) for all my transcripts and categorizing them, I engaged in reflexivity to write the analytical memos. The themes emerged from the analytical memos. Saldaña (2016) explains that “a theme is an *outcome* of coding, categorization, and analytic reflection, not something that is, in itself, coded” (p. 199). Unlike a

code, a theme is an extended phrase or sentence that identifies what a unit of data is about and/or what it means. A theme may be identified at the manifest level (directly observable in the information) or at the latent level (underlying the phenomenon). Themes can consist of such ideas as descriptions of behavior within a culture; explanations for why something happens; iconic statements; and morals from participant stories.

The analytic goals are to develop an overarching theme from the data corpus, or an integrative theme that weaves various themes together into a coherent narrative. This is appropriate for virtually all qualitative studies, especially for phenomenology and those exploring a participant's psychological world of beliefs, constructs, identity development, and emotional experiences. Examples: For a study exploring what it means "to belong": belonging is knowing the details of the culture; belonging means feeling "grounded"; you can belong somewhere without actually being there (Saldaña, 2016, Appendix A Glossary of Coding Methods, p. 298).

I generated specific codes for this description of the phenomenon under study. Creswell (2014) defines description as a process that "involves a detailed rendering of information about people, places, or events in a setting" (p. 199). In data analysis, it is recommended that the researcher winnow the data, reducing it to small themes to incorporate in the final narrative (Creswell 2014; Guest et al., 2012). I used these codes to produce a small number of themes [5-7]. These themes surfaced under major headings as findings of the research, as noted in the following chapter. They convey various perspectives from the participants and are supported by the participants' quotes.

4. Advance how the description and themes will be represented in the qualitative narrative. I first revised each data unit of the transcripts and carefully reviewed the participants' main or salient words and my comments at the same time to obtain the final description. The salient words spoken by the participants and my main comments and observations became part of the data corpus. I used a narrative passage to represent the findings of the analysis. Further, I used visuals, figures, and tables to illustrate and support the discussion.
5. Making an interpretation in qualitative research of the findings or results. After I completed all the data analysis and reported the findings, I asked the question, "what were the lessons learned?" to capture the essence of the participants' lived experiences (Lincoln & Guba, 1985). Lastly, at the end, I also compared the findings with information derived from the literature and/or theories. This suggested that the findings corroborate prior research or differ from it. I also suggested new questions that need to be asked for future research based on the findings of the study.

This general qualitative data analysis, per Creswell (2014), was conducted simultaneously with other sections of the study, specifically the data collection section and the writing of the findings. For example, while interviews are being conducted, I was analyzing other interviews previously recorded; summarizing analytical memos to include in the final chapter or constructing a table to display the organization of the findings section. In data analysis, I winnowed the data (Creswell 2014; Guest et al., 2012), using some parts of the data and discarding others.

## Coding

I designed 3 tables for three different types of codes [in-vivo, emotion, and values] for each participant. Additionally, I coded for *testimonios*. This involved a total of 32 tables which ranged from 60-100 pages each with an average of 1,700 words each. There was an average of 120 codes per table with a total of approximate 3,808 codes. Oftentimes, a code can be classified as different types of codes simultaneously. For instance, an *in-vivo* code can be coded as an emotional code, a value code, or a *testimonio*. These codes were grouped into 80 initial themes. The themes were reduced and condensed to the same 12 themes listed under emergent themes.

### Analysis Steps Embedded in Transcendental Phenomenology (Following Moustakas, 1994)

- A. Organize and analyze the data. I started organizing and analyzing the data immediately after the first interview was transcribed. Moustakas (1994) explains how to organize and analyze the data: “Organization of data begins when the primary researcher places the transcribed interviews before him or her and studies the material through the methods and procedures of phenomenal analysis” (p. 118).
- B. Époché. Before I started this research, as the main researcher, I suspended or bracketed through the “époché” all memories positive and negative I experienced as an international student in a graduate program in STEM in the United States. I explained candidly my education, background, and professional experiences in the *Role of the Researcher* section in the first chapter. To eliminate any pre-conceived biases I may have had, I went through self-reflection many times in the past years. I attempted to put aside recent memories and memories that happened many years ago. I purposely did not allow my country of origin, culture, upbringing, beliefs, religion, nationality, age, gender, socio-economic status or any other personal attribute to

influence my research. I obtained closure. This allowed me to move forward with receptiveness to listen and focus only on the participant's perceptions and lived experiences (Moerer-Urdahl & Creswell, 2004).

### C. Phenomenological Reduction

- a. Bracketing the topic or question. I selected my topic because I felt passionate about it. My personal history as an international female student in a STEM graduate program in the United States and my previous research on international students in the United States helped me define the concrete problem of the study. I drafted my main research question with great interest, and I approached my research based on my passion about the topic and my curiosity. Moustakas (1994) explained that, "In phenomenological research, the question grows out of an intense interest in a particular problem or topic. The researcher's excitement and curiosity inspire the search. Personal history brings the core of the problem into focus" (p. 104). Nonetheless, I temporarily "bracketed" all my presuppositions, biases and views and focused only on the views of the participants (Creswell, 2013).

9. Transcendental phenomenology compels the researcher to leave behind biases and preconceptions through bracketing by analyzing data in a systematic form. Leaving behind preconceptions is called "époché," from the Greek meaning to refrain from judgment. Hence, the researcher sees the phenomenon from a fresh new beginning or horizon and is receptive to the experience (Simon & Goes, 2013). Époché is considered the first step in the phenomenological reduction process. It is a conscientious effort made at the



beginning of the study by the researchers who put aside their beliefs and interpretations of the “*époché*” phenomenon to focus on the beliefs and interpretations of the participants (Moerer-Urdahl & Creswell, 2004; Moustakas, 1994). Moustakas (1994) explains that: “In the *Epoche*, no position whatsoever is taken; every quality has equal value. Only what enters freshly into consciousness, only what appears as appearance, has any validity at all in contacting truth and reality. Nothing is determined in advance” (p. 87). Further, Moustakas explained the difficulty in achieving “*époché*”:

The challenge is to silence the directing voices and sounds, internally and externally, to remove from myself manipulating or predisposing influences and to become completely and solely attuned to just what appears, to encounter the phenomenon, as such, with a pure state of mind. (p. 88)

- b. **Horizontalization.** Horizontalization is the first step in the data analysis, in which specific statements that provide information relevant to the participants are extracted from the transcripts. The specific statements are gathered from the transcripts and presented in a table to enable the readers to detect various perspectives related to the phenomenon (Moerer-Urdahl & Creswell, 2004; Moustakas 1994).

I identified specific statements from the transcriptions that described the participants’ experiences (Moerer-Urdahl & Creswell, 2004). I obtained the significant statements as provided verbatim in the transcripts by the participants. Notice that this step is very similar to *in vivo* coding (Moerer-Urdahl & Creswell, 2004; Saldaña, 2016) as described above. *In vivo* coding was done concurrently. I displayed the significant statements obtained from the transcriptions in a table to allow the readers to observe the different

perspectives of the phenomenon (Moustakas, 1994). These statements constitute non-repetitive, non-overlapping significant statements. This step gave all the meaning units equal value in the first stage of analysis. It receives the name of *horizontalization* from the word *horizon* because it is a process of unlimited inquiry and discovery that never ends (Moustakas 1994).

- D. Meaning Units, Horizons. I enumerated and grouped the meaning units, or horizons, following Moussakas' (1994) system of organizing the data: "The procedures include horizontalizing the data and regarding every horizon or statement relevant to the topic and question as having equal value" (p. 118). Every significant statement relevant to the topic is originally treated as possessing equal value.
- E. Clustering Horizons into Themes. Moustakas, 1994 recommends that "from the *horizontalized* statements, the meaning or meaning units are listed. These are clustered into common categories or themes, removing overlapping and repetitive statements" (p. 118). In this step, I deleted those statements irrelevant to the topic and those statements that repeated or overlapped. I displayed these themes in a table providing the evidence or record in the transcript from the participants' statements. Coding was done simultaneously to be able to triangulate both methods.
- F. Organize Themes into Textural and Structural Descriptions. I completed this step by synthesizing the themes into a description of the participants' experiences. From the thematic analysis, I provided a description of "what" was experienced in textural descriptions, and "how" it was experienced in structural descriptions. Textural descriptions were evaluated, and supplementary meanings were searched for from different viewpoints, functions, and positions (Moerer-Urdahl & Creswell, 2004;

Moustakas, 1994). Moustakas (1994) summarizes the components and purpose of phenomenological reduction: “The pre-reflective and reflective components of Phenomenological Reduction enable an uncovering of the nature and meaning of experience, bringing the experiencing person to a self-knowledge and a knowledge of the phenomenon” (p. 96).

### **Imaginative Variation**

Once the phenomenological reduction was completed, I followed the next step in Moustakas (1994) research process: imaginative variation. This led to the structural textures resulting in the vital constructions of the phenomenon. I described what the participants experienced [textural description] and in what contexts did they experience it [structural description] (Moerer-Urdahl & Creswell, 2004; Moustakas, 1994). According to Moustakas (1994), imaginative variation enables the researcher to derive structural themes from the textural descriptions that have been obtained through phenomenological reduction. We imagine possible structures of time, space, materiality, causality, and relationship to self and to others. These are universal structural groundings connected with textural figures (p. 99). Therefore, imaginative variation allowed me to analyze the data corpus from different perspectives of the participants and I fulfilled its goal of creating the structural meaning of their experiences.

The task of imaginative variation is to seek possible meanings through the utilization of imagination, varying the frames of reference, employing polarities and reversals, and approaching the phenomenon from divergent perspectives, different positions, roles, or functions. The aim is to arrive at structural descriptions of an experience and the underlying and precipitating factors that account for what is being experienced; in other words, the “*how*” that

speaks to conditions that illuminate the “*what*” of experience. How did the experience of the phenomenon come to be what it is? (Moustakas, 1994 p. 98).

### **The Essence of the Experience (Textural Structural Synthesis)**

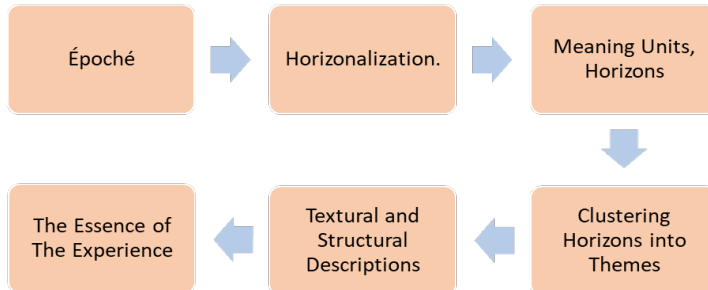
I conducted a true reflective and imaginative study of the phenomenon of the successful completion of the PhD or Doctorate by international females who had come to the United States to study STEM/ and or professional health science fields. Following this step, I arrived at the fundamental textural-structural synthesis which represented the essences at a particular time and place from my perspective as a phenomenological researcher. This is the final step: the synthesis of meanings and essences. Essence is the indispensable feature without which a thing could not exist: it is the ultimate and final truth. “From the textural descriptions, structural descriptions and an integration of textures and structures into the meanings the essences of the phenomenon are constructed” (Moustakas, 1994, pp. 118-119). The textural and structural descriptions of the experiences are thus synthesized into a combined description of the phenomenon through the research process referred to by Moustakas as “intuitive integration” (p. 100). This description became the vital, invariable structure, capturing the true meaning, the ultimate “essence” of the experience. Figure 13 represents this process, inspired by Moustakas (1994).

I used Moustakas’, modification of van Kaam's method of analysis, represented in Figure 14, as described below (1994, pp-120-121), using the complete transcription of each research participant:

1. Listing and Preliminary Grouping. List every expression relevant to the experience (horizontalization). For each participant, I listed the entire transcript verbatim stating every expression they stated as relevant to their experience. This process is what Moustakas called horizontalization.

**Figure 13**

*Data Analysis Transcendental Phenomenology Flowchart Following Moustakas (1994)*

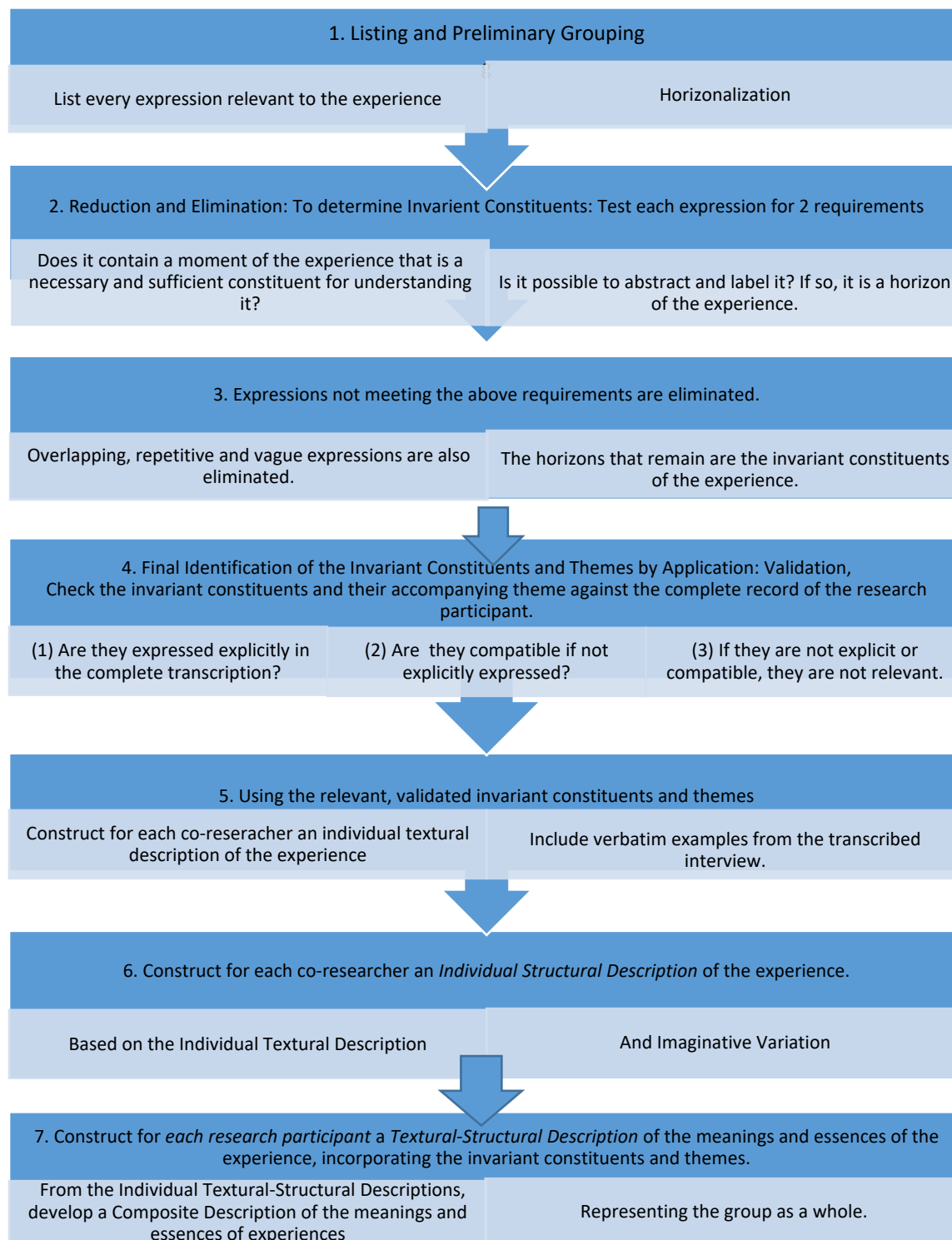


2. Reduction and Elimination. To determine the invariant constituents. I tested each expression for two requirements:
  - a. Does it contain a moment of the experience that is a necessary and sufficient constituent for understanding it?
  - b. Is it possible to abstract and label it?

If so, it was a horizon of the experience. I eliminated expressions not meeting the above criteria. I also eliminated overlapping, repetitive, and vague expressions. The horizons that remained are the *invariant constituents* of the experience. According to Moustakas (1994), “The *invariant horizons* [also called *invariant constituents*] point to the unique qualities of an experience, those that stand out” (p. 128). Hence, the invariant constituents were the most important or salient qualities of my participants’ experiences. Examples of these are provide in the Appendices.

3. Clustering and Thematizing the Invariant Constituents. I clustered the invariant constituents of the experience that were related into a thematic label. The clustered and labeled constituents constituted the core themes of the experience.

4. Final Identification of the Invariant Constituents and Themes by Application: Validation. I checked the invariant constituents and their accompanying theme against the complete record of the research participant. I addressed the following questions: (a) Are they expressed explicitly in the complete transcription? (b) Are they compatible if not explicitly expressed? (c) Based on the answers to the previous two questions, I deleted the invariant constituents and respective themes that were not stated explicitly or were not compatible with the complete transcript of the participant because they were not relevant to the participant's experience and should be deleted. Using the relevant, validated invariant constituents and themes, construct for each co-researcher as an *Individual Textural Description* of the experience. I incorporated verbatim examples from the transcripts of the participants' interviews.
5. I constructed for each co-researcher an *Individual Structural Description* of their experience by utilizing specific and validated invariant constituents and their respective themes based on the individual *textural description* and *imaginative variation*.
6. I constructed for each research participant a Textural-Structural Description of the meanings and essences of the experience, incorporating the invariant constituents and themes. From the individual Textural-Structural Descriptions, I developed a composite description of the meanings and *essences* of the experience, representing the group. (Represented in Figure 14). Refer to the Appendices for examples of Analysis Steps Embedded in Transcendental Phenomenology (Moustakas, 1994).

**Figure 14***Moustakas' Modification of Van Kaam's Method of Analysis*

Note. Source: Moustakas (1994, pp-120-121)

## Document Analysis

The documents analyzed provided the context, demographics, profiles, and achievements of the participants. The participants' achievements include scholarships, research, grants, and publications that were summarized from their CVs. Specific details of their research, grants, and work have been deleted for confidentiality. Participant *vitae*s are not included to protect participants' and institutions' anonymity.

Reflexivity: Creswell (2014) defined the process of reflexivity and the role of the researchers in this process:

In qualitative research, the inquirer reflects about how their role in the study and their personal background, culture, and experiences hold potential for shaping their interpretations, such as the themes they advance and the meaning they ascribe to the data. This aspect of the methods is more than merely advancing biases and values in the study, but how the background of the researchers may shape the direction of the study. (p. 186)

To overcome forgetfulness, keep track of ideas, and established relationships, I kept a journal and used analytical memoing (Given, (2008).

Journaling: I kept a journal, as recommended by Yin (2011). The author defined a personal journal as “a diary-like record of a researcher’s methodological choices, dilemmas, and discretionary judgments used in the course of a research study. Especially includes notes about reflexivity conditions and their likely influence on a study’s findings” (Glossary, p. 311).

Furthermore, Yin recommended qualitative researchers keep a personal journal:

There is one other writing activity that parallels the data collection (and other) processes in a research study. The activity involves keeping a personal journal or diary, capturing your own feelings and reflections on your research work ... In qualitative research, such a journal can play more than a private role. Because you the researcher are likely to be the main research instrument, any introspections and insights into your own reactions or feelings about ongoing fieldwork (or the study as a whole) may later reveal unwanted biases. (p. 175)



Keeping a journal made me aware of my own personal and methodological tendencies during the research. It helped me during data analysis, specifically the coding process. The final chapter includes my reflexivity and I relied on the personal journal as a source of information during the final reports (Yin, 2011).

### **Ensuring Trustworthiness**

Trustworthiness in qualitative research refers to attempts made by researchers to deal with the traditional quantitative topics of validity [the degree to which something ensures what it is supposed to measure] and reliability [the consistency with which it is measured over a period of time] (Bloomberg & Volpe 2016). In this qualitative phenomenological study, I assessed trustworthiness of the findings through credibility, dependability, confirmability, and transferability (Lincoln & Guba, 2000).

**Credibility:** This credibility criterion implies that the findings are accurate and convincing from the viewpoint of the participants, the readers, and the researcher. Without a doubt, the credibility criterion is one of the most important elements of the research design (Bloomberg & Volpe 2016; Creswell, 2014; Marshall & Rossman, 2015; Maxwell, 2013; Merriam, 1998, 2009; Miles & Huberman, 1994). I validated the accuracy of the interviews and transcription through member checking. I used a strategy by which “you ask the participants to comment on your interpretation of the data” (Merriam, 2002, p. 26) by taking parts of the major findings and the themes to the participants during the last or follow-up interview and asking for their feed-back, as suggested by Creswell (2014). I also used it to corroborate whether the participants identified their experience in the researcher’s interpretation and to obtain their suggestions to better understand their perspectives as proposed by Merriam (2002).

Maxwell (2013) defines triangulation as “collecting information from a diverse range of individuals and settings, using a variety of methods” (p. 128); triangulation was first introduced by Foreman (1948) who suggested the use of independent investigators to “establish validity of pooled judgment” (p. 413). Creswell (2014) further endorses it as a source of trustworthiness and credibility in a qualitative study: “If themes are established based on converging several sources of data or perspectives from participants, then this process can be claimed as adding to the validity of the study” (p. 101). I used triangulation by obtaining information from diverse individuals through a variety of methods using multiple sources of data to ensure the participants voices, and meanings have collaborating evidence as recommended by Bloomberg and Volpe (2016). To improve the methodological validity of the study, I use triangulation of data sources and data methods. Through multiple methods and multiple sources, I gathered data which provides a rich description of the phenomenon investigated (Bloomberg & Volpe 2016).

Reflexivity: “The process of reflecting critically of the self as a researcher, the human as *Instrument*” (Lincoln and Guba, 2000, p. 183). Hence, understanding that my previous experiences and perceptions could influence my research I stated the reasons behind all my decisions and processes up-front and kept records in a personal journal, digital memos, and recordings. These tools helped bracket any pre-conceived biases and helped me guide the analysis. These processes helped me at times when the participant’s beliefs and statements made during the interviews opposed my own beliefs and opinions (Ying, 2011).

### **Dependability**

In qualitative research, traditional reliability, or the degree in which research findings can be replicated by other similar studies, is not feasible. But instead, as posited by Lincoln and Guba (2000), a more relevant issue is whether the findings are dependable and consistent with

the collected data. Hence, researchers need to be vigilant and keep a record of discrepancies. I relied on Inter-coder agreement or cross checking, a qualitative reliability strategy endorsed by authors such as Creswell (2014); and Guest et al. (2012). I asked two committee members to review their codes as evidence that there were consistent results, both in coding the data and in extracting *Testimonios*. Creswell (2014) clearly explains that:

Such an agreement might be based on whether two or more coders agree on codes used for the same passages in the text. It is not that they code the same passage of text but whether another coder would code it with the same or a similar code. (p. 103)

Further, I kept an audit trail (Lincoln & Guba, 1985) registering an account of all thinking processes, keeping record of all decisions made during the research process. This trail depicted by Merriam (1998) as a *method of transparency* consists of keeping a journal and all the memos, which included specific descriptions of data analysis and interpretation (Bloomberg & Volpe 2016).

### **Confirmability**

The concept of confirmability was introduced by Guba (1981) and corresponds to the concept of objectivity in quantitative research. Shenton (2004) suggested that the findings should be the result of the research rather than the product of the researcher's subjectivity and biases. I followed Miles et al. (2014) to achieve this goal. First, I described the research methodology in detail, including the data collection and analysis for other researchers to follow. Second, by means of journaling and memoing, keeping good records of interview notes and transcripts, I complied with the audit trail (Lincoln and Guba, 2000), allowing me to put aside my personal biases while providing readers the chance to evaluate the study's findings (Bloomberg & Volpe 2016).

## **Transferability**

Generalizability was not an objective in this study; what I concentrated on is *transferability* (Lincoln and Guba, 2000), or the way other researchers and readers can decide and to what degree if this phenomenon in this specific context can be transferred to another unique context (Bloomberg & Volpe, 2016; Lichtman, 2013). To obtain this objective I, as the inquirer, ensured transferability by providing a rich, thick description of the participants and their specific context. Rich, detailed descriptions discussed in depth constitute the grounds in which a qualitative study can have application in broader contexts (Bloomberg & Volpe 2016; Schram, 2003).

## **Ethical Considerations and Protection of Human Subjects**

All research studies require the ethical considerations that relate to the protection of human subjects (Bloomberg & Volpe, 2016; Marshall & Rossman, 2015; Merriam, 1998, 2009; Pring, 2000; Scram, 2003). I was responsible for both protecting and informing the participants (Bloomberg & Volpe 2016). I worked under the supervision and guidance of the doctoral faculty in the Dreeben School of Education and in the Ila Faye Miller School of Nursing and Health Professions at the University of the Incarnate Word (UIW) to ensure the stages of collection, evaluation, and assessment of data in the study were conducted in an ethical way. In preparation for this study, I took the Collaborative Institutional Training Initiative (CITI) test, obtaining a certificate that was valid for 3 years, and renewed, as necessary. Upon receipt of the CITI certificate, I wrote the dissertation proposal. After defending the proposal, I applied for approval from the Institutional Review Board (IRB) of the University of the Incarnate Word where I am a doctoral candidate. All participants were informed of the purpose of the study.

I designed and obtained an informed consent form (Appendix D) from the participants. The informed consent includes the following guarantees: (a) all information is strictly confidential; (b) participation is voluntary; (c) the participants can withdraw from the study at any time without any penalties; (d) the study poses minimum risks to participants.

### **Ensuring Confidentiality**

The participants' rights and interests have priority in decisions regarding the report and dissemination of data (Bloomberg & Volpe 2016). I kept the names and other identifiable information of the participants and their organizations confidential. Pseudonyms and numeric codes were used to ensure the participants remained anonymous.

### **Data Protection and Discarding of Records**

I took strict measures to protect the storage of the study's data and records that remained in my possession only. I protected digital files and interviews with passcodes and encrypted them by using *Sookasa*© encryption services. I then secured hardcopies of audio files, forms, and transcripts with lock and key in a file cabinet in my home. After the data analysis was completed, I saved all transcribed data in an off-line external drive until the research is complete. Subsequently, I will permanently erase data and discard all records from the hard drive after 5 years.

### **Summary**

This chapter provided a detailed description of the methodology that I used in a qualitative transcendental descriptive phenomenological research design. It addressed the purposeful sampling and the criteria for the selection of the participants. The chapter introduced the eight participants by providing the Participants' Demographics. Six different methods of data collection were discussed: a survey, interviews, interview observations, document analysis, arts-

based research, and *Testimonios*. Data analysis occurred at 3 levels simultaneously: the steps in general data analysis following Creswell (2014); the analysis steps embedded in transcendental phenomenology following Moustakas (1994); and Moustakas' (1994, pp-120-121) modification of Van Kaam's method. The chapter culminated in discussing ensuring trustworthiness, credibility, and ethical considerations. In the next chapter, findings of the study are presented with attendant discussion.

## Findings

I start this chapter with the participants' profiles, which are supported by direct quotations from the eight participants.

### Narrative Profiles

#### *Luisa (07312017)*

Luisa was born in a country in South America to a Catholic family of modest means. She is the youngest of three siblings. Her age range is 23 to 30 years. Her first language is Spanish. Her Religion is Catholic. Luisa's most important personal attribute is forgiveness. This attribute best contributed to her academic success during her PhD STEM studies as she managed to graduate and obtain her PhD in Neurobiology despite experiencing sexual harassment from her direct supervisor, who later refused to allow her to publish her dissertation.

Why did I stay in that place for such a long time? 'Why did I spend so much time in there? Why did I let him do this? Why didn't I do this?' So, I was trying to forgive him and forgive myself. I felt I needed some space and time alone. I was still working on completing some of the figures for my future paper. I thought on sending him an email, but because I did not have my work email yet, I did not want him to have my personal email, and I also thought it would be good to give him some time and space, but I was wrong. (Luisa)

Luisa's external source of motivation came from her father; "I do remember that my dad always said, you need to study. That's what's going to make it easier. It's going to help you to have a good future." Luisa's father instilled the love for education to all children since an early age and provided the resources for a family library. When Luisa was 11 years old, she experienced the death of her father due to cancer. After the death of her father, the family went through financial hardships. Luisa's mother struggled as a widow, without many skills in a developing country (with a paternalistic society) characterized with political and economic instability, to provide financially for herself and her three children.

Luisa was inspired and supported emotionally, academically, and financially by her older sister who left her country and family to pursue a STEM PhD in the United States, when Luisa was a student in the 10<sup>th</sup> grade in high school. Hence, the main external source of motivation came from her sister who was already finishing her PhD in the United States: “But whereas before I was in college, I started taking English classes because my sister was here to let you know, you should learn English”. “Maybe, so maybe, you will have the opportunity to come to the United States and pursue further studies [was told so by her older sister]. So, I was studying English as well.”

My sister asked her post-doctoral advisor, to consider the possibility of sponsoring a visa for me to come and help her during that year, for a year. So, I got a visa as an exchange student, a J1 is what it's called, I think?

Luisa is married to her high school sweetheart; both are now permanent residents in the United States. They are the parents of one American citizen by birth; a son who was born after Luisa completed her STEM PhD.

***Akilah (09132017)***

Akilah was born in Asia to a Hindu family. Her age range is between 31 to 40 years old. She has one sibling who holds a master's degree. Akilah's religion is Hindi. Her family belongs to the Brahmins (priests) in the Caste system, which is the social hierarchy of her country of origin. The Brahmins hold the most power in Hindu society; they are priests, also known as the spiritual and intellectual leaders of the society. The word Brahmin translates to “Supreme Self” or the first of the gods, and constitute 4.3% of the total Indian population. Only some members are priests; other members have held professions as educators, law makers, scholars, doctors, writers, poets, landowners, and politicians.



<https://scholarblogs.emory.edu/reli100hinduism/2015/11/25/the-caste-system-brahmin-and-kshatriya/>).

Akilah's family were mostly musicians, artists, and writers. Her first language is Malayalam; she then learned Hindi and British English. Her external source of motivation to pursue a STEM PhD in the United States originated from her peers, co-workers, and friends:

And after my degree, after my MPHIL degree I got an opportunity to work as a research and development assistant at the really popular laboratory in [Country of origin deleted for confidentiality purposes]. It's called [Name of Research Institute deleted to preserve institutional anonymity] \_\_\_\_\_ Research Institute. And I worked there. Initially I did a project there with one of the advisors, scientists. And then following that, I got an opportunity to work there as the research and development assistant at the same.

During her PhD studies, Akilah experienced the death of her beloved paternal grandmother with whom she was very close. Despite these barriers, she never gave up on her dream of obtaining her PhD in physics. Her most important personal attribute is perseverance. This attribute helped her persevere and to find ways to prepare for and plan on how to obtain her PhD in the United States:

And then thinking more and more, I started talking to more visiting professors coming to that laboratory for talks and everything. And then I found the ways and to take exams like TOEFL, GRE and I get an idea about doing those things, and I started preparing. I didn't tell anybody about this because it was kind of so embarrassing that people will laugh at me cause it's never gonna happen.

Akilah is married to an engineer. She and her husband are now permanent residents of the United States. They are the parents of two American-born children, one of whom she gave birth to shortly after her graduation ceremony for a PhD in physics. Akilah was pregnant while writing her dissertation.

### ***Mira (09182017)***

Mira was born to a very progressive upper middle-class family in a country in Asia. Mira's father was first a school principal who became a University Professor in an institute that

directed the education policies of their country. Her mother was not educated, studying only until the fourth grade. At that time, women in her country of origin were not encouraged to finish school. Mira's mother was determined not to allow this to happen to her children. Hence, her mother's passion for education combined with her father's professional capabilities and passion in the field of education provided a strong foundation for all the children in their home. Mira's self-determination derived from her parents:

And my father was a professor in mathematics. And so, you know, the culture of education was very prominent in our household. And, you know, my mom made sure that what happened to her [not be allowed to pursue her education because she was a female] would not happen to her daughters. And so, I mean, with that kind of atmosphere at home, the sky is the limit.

Mira's extrinsic source of motivation came from her parents:

My parents were totally committed to our education. So, you know, so combine—I think those two things together, my mother's passion for education and then my father's for just his passion and capability and educator kind of shaped all of us.

Mira's siblings include three sisters and one brother. All her siblings are well-educated professionals. Mira's most important personal attribute is believing in her own potential and abilities: "And frankly, you know, I did not have any doubt that I cannot do this, you know? So, I did not have any doubt on my capability."

Mira's age range is from 41 to 50 years old. She is married to a pharmacist. She and her husband are permanent residents in the United States. During her PhD studies, Mira longed to get pregnant but it did not happen, which allowed her to focus completely on her PhD. After the completion of her PhD, however, her son was born in the United States. Mira relied on her Hindu faith during her PhD studies. Her faith has been very strong since her childhood and continues to this present day. Mira now teaches her Hindu faith to her son. Her first language is Hindi.

***Pilar (12072017)***

Pilar was born to a Catholic, upper middle-class family in a country in South America. She is the youngest of five siblings, all of whom are professionals. Her older sister was the first to obtain a STEM PhD and travelled abroad, which inspired Pilar to do the same. Her other sister is a social worker. Her two brothers are engineers. Pilar's most important personal attribute is determination:

And my mother was very strong and determined. So, we have that character that we are determined. We're focused. Challenges are not deterrents for us. Challenges are just motivators. I mean, it's just like so I was determined to accomplish it and I was going to do it.

Pilar's parents always encouraged all their children to get an education. Her father died when Pilar was 12 years old, and she feels he became one of her guardian angels. After becoming a widow and having to provide for five young children, in a paternalistic developing country with scarce economic resources, her mother, who was fortunate to have a college degree, became very strong and determined. Hence, Pilar inherited a strong character and determination from her mother and became very focused at an early age. Her first language is Spanish.

Pilar's extrinsic sources of motivation came from her parents and her older sister: "But my parents, I think that was one of the things that maybe made me pursue my doctoral degree when I was growing up is that education was very important". "My oldest sister is also PhD, and she has doctoral degrees, and she has studied overseas". "I saw my sister getting all that ... I mean, pursuing her academic goals. And for me it was that I wanted to do that also."

Pilar's source of external motivation came from her parents and other family members. "And my parents and my family always promoted that and supported us in doing that [Education]." Pilar's age range is from 41 to 50 years of age. She is single and has no biological children of her own. She chose not to be in a relationship during her PhD studies. She now lives

with her partner, an American well-known scientist; they co-parent three children from his previous marriage.

*April (12132017)*

April was born in a country in South America to a Catholic family of low socioeconomic status. April's external motivation came from her father:

My dad died when he was very young, and I was in my first year of college when he passed. And so that was definitely, I have to say, my strength because, you know, I feel like I didn't want to disappoint him. Even though he was not there, I really wanted to do well because he couldn't go to college. And there I was in my first year in college, so I felt like, you know, I think I need to do this for myself and for all of us. So, he has been a big driver of everything that is happening in my life. And just seeing what he did at his job, the way that he interacted with people, the effort that he put in everything he did, to me that was basically a really good example to have.

Moreover, both parents contributed toward April's external motivation:

So, they both struggled a lot. And neither of them was actually able to complete a college degree. But that was not a limitation for them to do the best they could to actually make sure that we had a better education than what they had.

“So that kind of became my motivation to do well and to perform to the best of my abilities, knowing all the sacrifices, you know, that my mom or my dad had to do.” April was also motivated by a research organization in her home country, which she joined during her second year of college:

And I became very interested in research in my second year in college. With those experiences, there was very limited resources in [country of origin withheld for confidentiality] to do research. But I was actually able to connect with a group. Outside the University is a private research institution.

And they actually supported these national programs in trying to look for talented students that will have kind of a profile to do research. And so, I ended up being selected to be part of that group. And that was basically the door that opened basically so many different opportunities for me to actually be here now.

Her age range is between 31 and 40 years. She has two siblings; an older brother who lives in their country of origin and a younger sister who also obtained a STEM PhD in the United

States and remained in this country. April inspired, motivated, and financially supported her younger sister's STEM PhD in the United States. Her first language is Spanish.

April's most important personal attribute is resilience:

So, growing up, basically something that it was kind of like emerged in home, at home in my family was kind of like the resiliency that my mom and my dad had, you know, to make sure that we had an education. I learned to be resilient since childhood.

Neither of April's parents had a college degree, but this did not impede them to motivate their children to pursue an education. April's father was self-educated, and he became an avid writer and a poet. The family struggled financially a lot, but her parents made sure all children had the school supplies they needed and provided them with an education. When April was in her first year of college in her country of origin, her father died. April's mother, then a widow, became the main bread winner, with no college degree in a paternalistic developing country. She struggled financially to provide for her three children. April's mother would have as her priority to ensure she gave her older daughter the funds for photocopies when she could not afford her textbooks and provided lots of encouragement and emotional support with academic challenges and encouraged her to study the English language.

April is married to an engineer from her country of origin whom she married during her STEM PhD studies in the United States. Both are now permanent residents in the United States. They are the parents of two children; a son who was born during the time April was writing her dissertation and a daughter who was born after her PhD graduation while she was completing her post-doctoral studies.

***Rose (03212018)***

Rose was born to a lower middle-class traditional Muslim family in a rural area of Euro-Asia. Her father completed some years in high school. Her mother did not complete elementary

school. She has 3 siblings. One older sister has a college degree. Two others are high school graduates. She was the first female in her family and city to complete a PhD degree. Her first language is Turkish. The family also spoke Pomakca, which is like Bulgarian. Her race is white.

Rose's sources of external motivation include her father and mother who are self-educated and her older sister who was the first in her family to graduate from college:

For instance, my mom and my dad. My mom, actually, I think she didn't even complete elementary school and my dad, I think he just got his middle school degree, but he was a very open-minded person. He was like a director of one company in the town that I was living. And my mom, she was reading a lot of books and things like that. She was all the time trying to encourage me.

"And I can say that, you know, in terms of the family I got a lot of encouragement as well." Rose's older sister: "Well, I actually had a sister who is two-and-a-half years older than me. So, she went to college." "Yeah, it was something like that. It really wasn't very common." Rose's elementary teacher, who taught the female students they could achieve just like the boys: "And I got a lot of positive encouragement from my teacher. He never told us that, you know, well, if you are a girl, you cannot do this."

But I think this kind of vision I got from my elementary school teacher I think is so important. And I was all the times I think I can do it in terms of solving the problems, especially solving word problems.

Additionally, other teachers also affected Rose.

And even middle school, you know. Some of my teachers for my thing [motivation], he was the physics teacher. Whenever he gives us exam if I don't get 100, he was telling me, "Oh, you didn't study well." So, my target was not actually passing the course, but my target was getting the score of 100, so kind of getting the full score types like that.

A university preparation facility where she studied in STEM would not interfere with her Muslim faith: "I can say that there were some university preparation facilities, like, better than the schools. So, there were a lot of female teachers. I can say advisors." "I met a lot of nice people who were encouraging me because while in [country of origin deleted for confidentiality

purposes] it's kind of a little bit religious and cultural thing [to just get married, bear and raise children].”

But yeah, like, these people as I mentioned from the University Preparation facilities, there were also some, like, religious people. But they didn't really believe like that. I mean, they said that, I mean, even if you are religious or non-religious, I mean, you really need to get an education. It's not just, like, the science is not about—so you don't really need to say negative things about God if you do science. It's something parallel to the religion, so there shouldn't be any conflict. Does that make sense?

Rose's friends from college inspired her and motivated her to come to the United States for graduate studies:

But during that time, all the friends that I was with together—almost all of them after the graduation they came here to the United States. Some of them they got their PhD like me or some of them they got their master's degree. So, I had these type of groups. They were all, you know, thinking about education, you know, how we can get our education better. Yeah, things like that.

Rose's age range is 23 to 30 years old. She is the youngest of the participants. She married very young while still in college. At the time, her husband was pursuing his second master's degree in the United States. Her husband also obtained his PhD in math while in the United States. They now teach in the same state university in the United States, and both are now permanent residents. They are the parents of two children; both were born while Rose was an international STEM PhD student. Rose felt torn between her PhD studies and raising her two babies.

Her most important personal attribute is feeling passionate towards her field, this passion helped her to overcome barriers and challenges:

I'm actually all the time I'm kind of passionate. I'm passionate to do things. If someone tells me, “Oh, you cannot really do this,” I become even more passionate towards to that, you know? So, I think, yeah. This is all the time, my dad also tells me that, “Oh, if you decide to do something, dear, you are going to do it. I know that if you put something in your head, you really are going to do it.” This is my personality thing. So, if there is a challenge, I'm very...how do you say? I just concentrate on the end. Like, I was all the time dreaming about the day that I am graduating, the day that I'm getting my PhD. So, I

was thinking a lot about the pathway. This is my target, so hopefully I'm going to go there. So, whatever the situation is, I will hopefully go there. This is kind of my personality, so I'm very passionate about things.

**Ana (020320180)**

Ana was born to an upper middle-class Catholic family in a developing country in South America. Her age range is 23 to 30 years of age. Her father is an electrical engineer, and her mother is an economist who obtained a master's degree in management. Ana has one sister who holds a bachelor's degree. Ana obtained her STEM PhD one year ago. She is single and does not have any children. Her first language is Spanish.

Ana's external sources of motivation to pursue a PhD in civil engineering came from 3 sources. Her parents allowed her to play games [traditionally meant for boys], which helped her build things and promoted discovery. "My dad, he's an electrical engineer. Of course, I think he played a major factor because having a scientist as a relative, usually relative will probably influence kind of those positions."

But it also allowed me to have a different sense of games growing up. So, I know I really enjoyed playing with Legos and doing things that would challenge me, like astrology set or games that would, like, ask you questions. I really enjoyed the games that challenged me to look at things in different perspectives. So, I think that contributed to my interest in STEM degrees and my sense of discovery I think was something that—the games that I was exposed to through that.

The culture and economy of her country of origin:

When I was in college, I started pursuing chemical engineering because petroleum engineering was really big in my country. But that's the only degree that kind of gave you money. So, you know, if you wanted to make money in my country, then petroleum engineering was the big thing.

But I guess it was a different situation, right? Like, any field here can get you money and back home it's not the case. Like, you have to be an engineer if you want to get money. So, I guess that's just the different society event that made it kind of, like, if you want to make money, you pursue an engineering degree. And I guess in the U.S. you pursue a health degree.



It is a different culture. Back home in my country having a medical degree is almost like a voluntary thing. Because health is free, so you can get a heart open surgery for free if you wanted to you can get a cancer treatment for free. It's completely different cultures, but what happens is that the government pays the doctors, which means there are a lot of times that they don't get paid. So, it's almost like you're doing it because you really care for the well-being of the people, not because you took money really.

If you want to go be a doctor and study all this time, it's because you really care about the profession. And eventually you could have money if you had a private profession, but I know a lot of doctors who just couldn't get paid and who couldn't work because they really care for the society.

Another source of external motivation was her strong female role models:

And my mom works, my dad works so that—I mean, you never know how those little things influence you. But just having the non-traditional, I guess, role in the family really made me see that I guess, that was my normal, right? Like, women have to work. There are no questions about it.

Women in STEM were also a source of external motivation:

And I guess in my culture women in STEM was also very common, too, so it was not unusual for a woman to be in STEM. It was very common. So, for me growing up there wasn't as big of a...like, it was very common. Like, women pursued STEM. It was very common. Like, never crossed my mind. But when it came to the U.S. I recognized that there were not that many women in STEM like that.

Ana's most important personal attribute is responsiveness to feedback; a quality she developed during competitive training as an athlete that she then transferred to her PhD:

Well, I was an athlete. So, I think that definitely developed a lot of skills that I used for being in my PhD work. Because I'm used to having a coach pointing out faults in my technique or something like that, right? Like, I'm used to improving because we're working for the big leagues, right? So, I'm used to having that Constructive criticism constantly because I know that it's going to be eventually for good. So, I know that that's definitely something that I think translates directly to my PhD work.

Ana was first recruited to the United States as an athlete to play and compete as a student player (specific sport deleted for confidentiality). She was offered a scholarship to obtain her bachelor's degree and she chose civil engineering. Her priority, however, was to develop a professional career as an athlete, and she was highly competitive.

To build her professional identity, Ana had a smooth transition from her master's degree to her PhD in civil engineering by means of a fellowship in research and a teaching assistantship (TA) position:

I think when I was trying to transition between master's and PhD, I was really looking forward, you know, getting a little money, that kind of thing. Because I'd had internship experience, I thought there were some companies who really wanted me to work for them. So that really attracted anyone, right?

I was going to do my, you know, get my Master's, get my P.E., get my degree [M.S. degree] and just go to work. But I realized that I enjoyed research and because I was on a fellowship that was all I was doing, right? I was just doing research and just research and studying, right? So, my funding ran out, so it was only for one year, and for the next year I had the opportunity to renew my fellowship or go into a TA position.

And at that time, I was like, "Well, I'm going to do my internship experience and get the practical exposure." And for my last year of my master's, I'm gonna try out being a TA just to see if I like being in the classroom, right? So, I really wanted to get those two experiences—to be on the field and to do that TA to see if I liked that academic environment as a teacher because a PhD in my mind I thought, you know, if you get a PhD that means you're going to academia. You know, so I just didn't know if I liked being a professor or not or grading. That seemed just, like, what a PhD person did. So, I did my TA and in the Department of Engineering Education and just---and I think that's particularly different from other TA experiences because they do focus on education of engineers.

During her PhD studies Ana had to overcome many barriers including academic challenges in her very difficult field to become the first female with a PhD in civil engineering from her institution in 40 years. Other barriers include being separated from her family, overcoming gender stereotypes, and financial difficulties.

Ana is now a permanent resident in the United States. She teaches at a state university. Her country of origin is still under the control of a dictator. Ana's parents and sister remain in her native country, and she cannot visit her family. Ana remains a strong advocate for social justice and political freedom of her country of origin.

*Tanvi (04162018)*

Tanvi was born to an upper-class Hindu family in a country in Asia. Her age range is 31 to 40 years old. Her father was an air force officer turned foreign diplomat in what once was the Soviet Union and her mother an English professor. Her mother was highly educated and had a PhD in English. Tanvi attended from pre-school to high school in Russia during the cold war. Her mother took her then 3 daughters every summer to England to master the English language.

Tanvi's external sources of motivation included her mother, and extended family members.

My mother is a professor in English. So, we tag all the environments at home. And our large [country of origin withheld to ensure participant's confidentiality] community, or family I should say where we had the expectation in that sense that education is something—our human capital is the biggest aspect we have. So, there was always a push towards human capital.

And for example, within our family are my cousins, brothers, and sisters - we had 58 positions in our family, including surgeons in every specialty. So, all my cousins are doctors. And many specialists among the doctors. It's a very [country of origin deleted for confidentiality] thing to go in sciences and engineering and acquire human capital in those disciplines.

We saw everybody in our intimidate environment going for higher education. So, this was not a change. Even my grandmother was educated. My mom had a doctoral. She has a PhD. So, it wasn't nothing out of norm.

But at home they gave me this focus or in our bigger pathway we had this focus knowing all the other siblings and cousins, everyone is focused towards acquiring human capital in either sciences and math or engineering. That was a very norm for our family. It was nothing out of norm. So, we grew up seeing other siblings or cousins doing the same thing too. So, we were going in a similar manner, like, this is what you have to do. You have to get this. You have to get this. You have to get this.

Since she was a teenager, Tanvi has spoken Hindi, Punjabi, Russian, and English; she later learned Bangla, the language of Bangladesh. Her religion is Hindi. During her PhD studies, Tanvi experienced two very difficult personal crisis. One was ending a relationship with

someone she loved, which culminated in her having a nervous breakdown. The second was the tragic death of her younger sister in a car accident.

Tanvi's doctoral research took her to technology as a minor as she developed an artificial intelligence system for food aid distribution. Her goal was to integrate technology in the field of nutrition. For her dissertation she worked with a U.S. professor working with NASA software programs.

Tanvi's most important personal attribute is that she was able to identify and believe in her innate gifts and abilities. This great inner set of intellectual abilities and emotional intelligence is part of her "genetic code" and is prevalent in most members of her extended family and in citizens from her country of origin.

My mother's professor in English. So, we tag all the environments at home. And our large [Country of Origin in Asia] community, or family I should say where we had the expectation in that sense that education is something—our human capital is the biggest aspect we have. So, there was always a push towards human capital.

What exemplifies Tanvi is that she strongly believes in teaching beyond the classroom walls. "So interesting journey in terms of diversity. I've always had opportunities to be with my fellow students pretty much all over the world." Tanvi's teaching philosophy includes not only bringing the world to the classroom but to take the classroom to the world. Tanvi travels extensively to many developing and marginalized countries in the world trying to combat world hunger.

Tanvi is now married and commutes to her job from a nearby city. She has no children. She is now an American citizen by naturalization. During her PhD studies, she experienced the tragic accidental death of one of her sisters. She is very close to her other sister who is an engineer. She visits her parents often, who are now retired in their country of origin.

## Themes

This chapter also introduces the most salient themes that emerged from my study. These themes emerged from the analytical memos and codes. According to Saldaña (2016), “a theme is an *outcome* of coding, categorization, and analytic reflection, not something that is, in itself, coded” (p. 199). “Typically, reoccurrence is a prime means of analyzing data for themes” (Given, 2008, p. 868).

Saldaña (2016), further stated:

The analytic goals are to develop an overarching theme from the data corpus, or an integrative theme that weaves various themes together into a coherent narrative. Appropriate for virtually all qualitative studies, especially for phenomenology and those exploring a participant’s psychological world of beliefs, constructs, identity development, and emotional experiences (Saldaña, 2016, Appendix A Glossary of Coding Methods, p. 298).

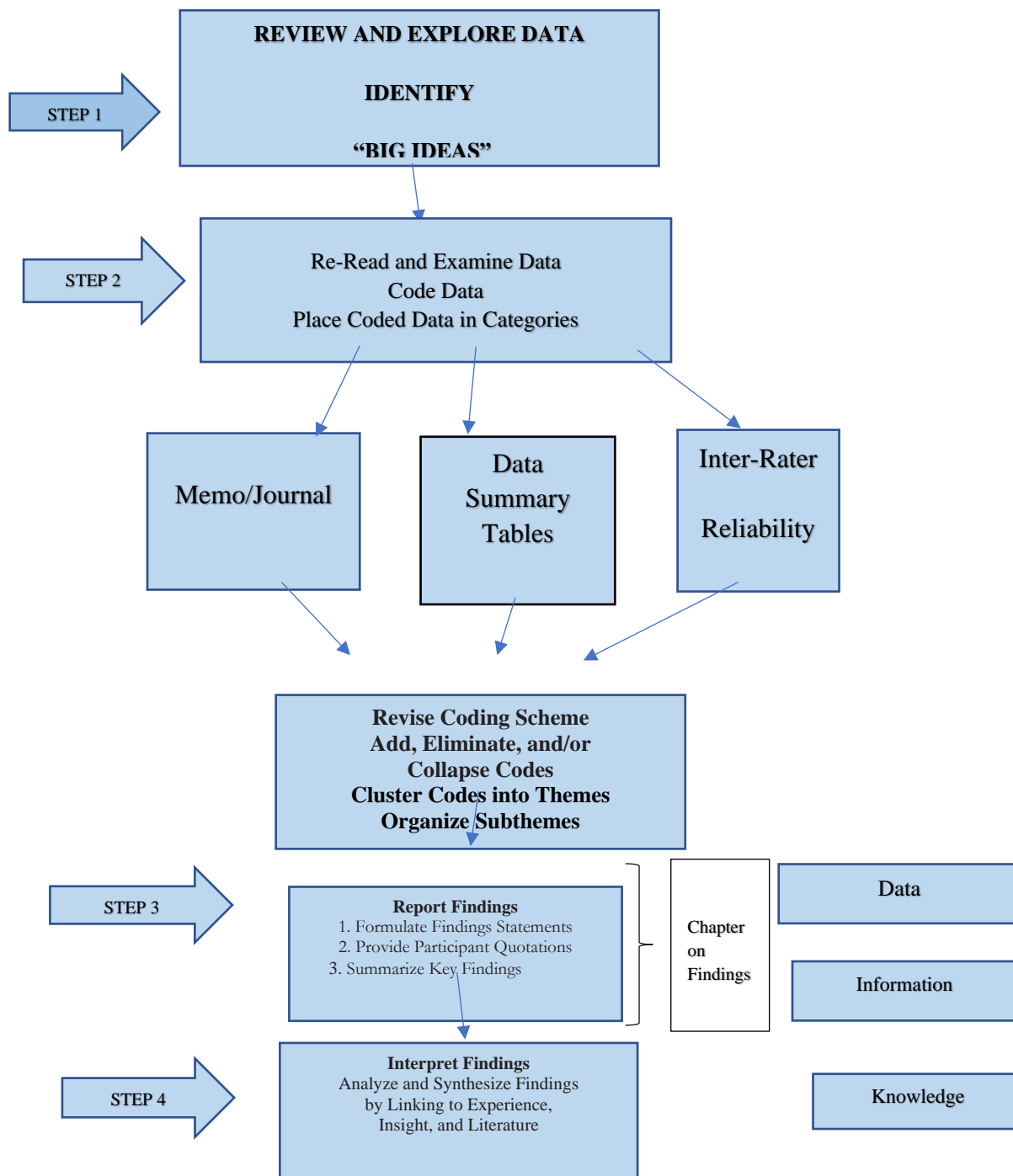
My interpretations of all the data collected became the research findings of this study. “Qualitative research findings are typically defined as the researchers’ interpretations of the data they collected or generated in the course of their studies” (Given, 2008, p. 350). A major task was to transform all the raw data into meaningful findings (Bloomberg & Volpe, 2016).

Phenomenological research makes use of significant statements, the generation of meaning units, and the development of an “essence” description (Moustakas, 1994). “As such, the focus is on attitude and the response to the phenomenon under study. The aim is to achieve an analytic description of the phenomena not affected by prior assumptions” (Bloomberg & Volpe, 2016, p. 192).

Thus, this chapter displays the key findings acquired from 8 participants, 8 open-ended in-depth interviews, 3 follow-up interviews, document analysis, and arts-based research artifacts. The chapter culminates with a summary of the findings. Figure 15 provides a road map explaining the process.

Figure 15

*Road Map for the Process of Qualitative Descriptive Phenomenology Data Analyses, Synthesis, Findings, and Interpretation*



Note. Adapted from Bloomberg, L.D. (2007)

## **Participants' Context**

All eight participants completed their required courses, passed their qualifying exams, conducted research, wrote, and defended their dissertations and graduated with a STEM PhD and/or a doctoral professional degree in the health sciences. All now work as professors and researchers in PhD and doctoral programs in STEM or the health sciences and have been granted permanent resident visa status in the United States. In short, all were and continue to be successful in their respective fields, even as they reported experiencing challenges during their doctoral studies.

The challenges were not just about learning English as a second language, overcoming cultural shock and acculturation, or experiencing financial barriers in the United States. Their challenges included academic challenges; grieving the death of close and beloved family members; being separated for 1 to 3 years from husbands, fiancées, or boyfriends; and experiencing emotional breakdowns as a result of a broken personal romantic relationship and putting their personal and romantic life on hold. Other barriers including trying to get pregnant after several years of marriage, pregnancies, childbirth and or raising small children while completing their demanding doctoral programs. All participants narrated how these experiences shaped and affected their educational lives.

## **Emergent Themes and Subthemes**

I utilized Moustakas' (1994) Van Kaam method of data analysis in this transcendental descriptive phenomenology study, reducing the total number of original themes to the 11 listed below. Not every participant experienced that which is described in each specific theme. Hence, if the participant is not listed under the specific theme, it is because the participant did not report perceptions of experiencing the theme's topic.

Specific codes and themes may relate to different participants. Moreover, a specific code can be associated with more than two themes (Wiggins Nadeau, 2011). For instance, the code for receiving support from a mentor can be best associated with overcoming academic challenges but it can also be associated with building systems of support and with receiving emotional support in terms of a personal crisis.

Eleven themes emerged from my study, with sub-themes listed under the “umbrella” of a theme:

1. Family encouragement
2. Finding hope and strength in religion/faith/spirituality
3. Overcoming academic barriers
4. Learning English as a second language effectively
5. Overcoming acculturation barriers
  - a. Building systems of support
  - b. Overcoming critical personal incidents
    - 1) Learning to grieve a family member’s death.
    - 2) Finding safe environments.
    - 3) Being close yet so far from loved ones.
  - c. Finding alternative transportation
  - d. Obtaining financial support
6. Support from academic advisors, research supervisors, faculty, and mentors
7. Balance
8. Self-Determination
9. Resilience



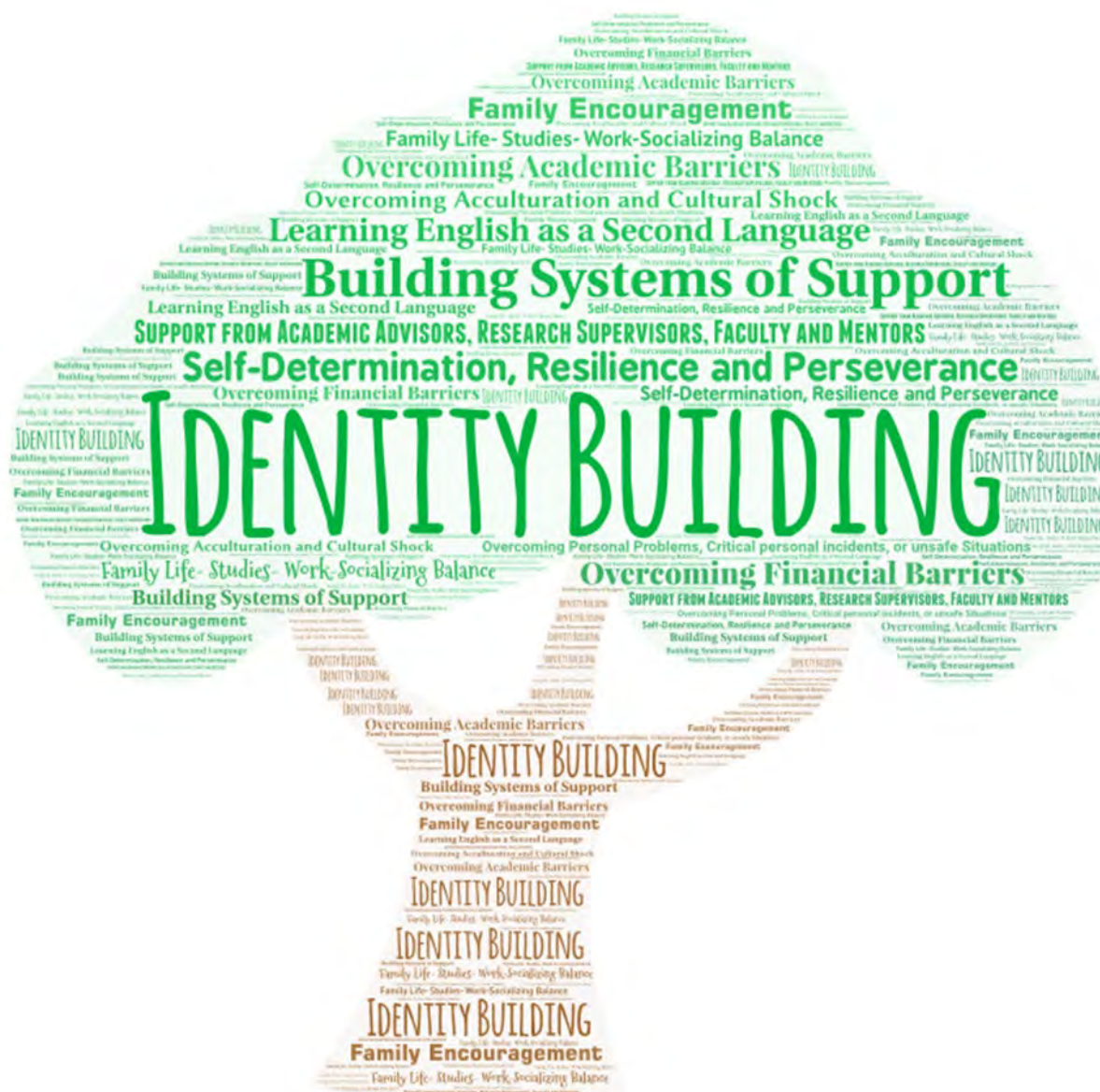
10. Persistence

11. Identity building

The 11 themes are illustrated in Figure 16.

**Figure 16**

*Tree of Main Themes for International Doctoral Female Science Students in the United States*



## **Arts-Based Research**

I asked all eight participants to submit a piece of art that they felt motivated and encouraged them during their STEM PhD or doctoral studies in the health sciences. I received numerous and various art pieces (songs; pictures or photographs; handcrafts, poems; comics, even religious hymns; and prayers). These data were analyzed and coded according to Saldaña (2009) and Saldaña and Omasta (2018). Examples of ABR coding can be found in the appendices. I displayed the specific arts-based research data provided by each participant in the themes they informed.

Following are the themes, illustrated with the ABR artifacts the female participants provided of their lived experiences during their STEM PhD/doctoral studies in the health sciences in the United States.

### **Theme 1: Family Encouragement**

A common theme among all participants was the encouragement from family members since an early age. All eight participants strongly felt they enrolled and graduated in science doctoral programs due to their family's encouragement. Fathers, mothers, and grandparents (especially grandmothers) were a source of inspiration and support. Equally important for some participants was the role of siblings; in particular, older sisters who had attended college or travelled overseas to obtain graduate degrees and PhDs. For one participant (12.5%), it felt like "it was in their genetic code," with many extended family members achieving in fields like medicine and engineering. For four participants, it was the norm in their country of origin. Three of the participants were the first to become scientists in their families. Additionally, three participants wanted to follow their older sister's science career path. But what they all had in

common was early nurturing, unconditional love, and receiving the passion for education from their families.

Some family members played a significant role even years after their deaths. One participant referred to her deceased father as “her guardian angel.” Four participants felt the need to pursue and complete their PhD to honor their memories and carry their deceased family members’ wishes for them to achieve their academic goals. (\*See Tables for Theme One: Family Encouragement and Theme One: Family Encouragement Descriptors)

**Table 7**

*Data Summary for Theme 1: Family Encouragement Descriptors*

Participants	PREDISPOSITION TO SCIENCE OR STEM DESCRIPTOR			OTHER DESCRIPTORS	
	Science was in “Genetic Code” (A)	Science was Norm in Country of Origin (A)	Wanted to Follow Older Sister Science Path (A)	Wanted to Honor Deceased Family Member (B)	First Scientists in their Family (C)
Luisa/07312017			X	X	X
Akilah/09132017		X		X	X
Mira/09182017		X			
Pilar/12072017			X	X	
April/12132017				X	X
Rose/03212018			X		
Ana/02032018		X			
Tanvi/04162018	X	X			
<i>N = X</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>N=8</i>	<i>1=12.5%</i>	<i>4=50%</i>	<i>3=37.5%</i>	<i>4=50%</i>	<i>3=37.5%</i>

### *Science or STEM Predisposition*

All eight participants had a predisposition for science since a very early age. Three participants became the first scientists in their extended families. Four participants stated science was the major chosen field of studies in their country of origins; three participants were first inspired by their older sister and wanted to follow their career path; and 1 participant strongly believes science was even ingrained in her “genetic code.”

Half of the participants (four) felt that science was one of the chosen fields of study in their country of origin. As two participants stated: “Science was the norm in my country of origin,”

And I guess in my culture women in STEM was also very common, too, so it was not unusual for a woman to be in STEM. It was very common. So, for me growing up there wasn't as big of a...like, it was very common. Like, women pursued STEM. It was very common. Like, never crossed my mind. But when it came to the U.S. I recognized that there were not that many women in STEM like that. (Ana)

But at home they gave me this focus or in our bigger pathway we had this focus knowing all the other siblings and cousins, everyone is focused towards acquiring human capital in either sciences and math or engineering. That was a very norm for our family. It was nothing out of norm. So, we grew up seeing other siblings or cousins doing the same thing too. So, we were going in a similar manner, like, this is what you have to do. You have to get this. You have to get this. You have to get this. (Tanvi)

Three participants followed their older sister's path. Two of the participants shared the following:

She [older sister], has also studied biology, and then a Master's in microbiology and then it was a post-graduate degree in Chile. And from there she went to Germany and got the doctoral degree and then a post-doctoral degree. I think it was in Switzerland ... So, I was exposed to that part of going overseas for me was something that I really wanted to do, especially when I was in high school. It was like, oh my God. I would love to travel and go and meet all these places and all those dreams that you have when you are a teenager. (Pilar)

I started taking English classes because my sister was here [in the United States] to let you know, you should learn English. Maybe, so maybe, you will have opportunity to come to the United States and pursue further studies [in biology]. (Luisa)

One of the participants believed science was engrained in her genetic code:

And for example, within our family are my cousins, brothers, and sisters - we had 58 positions in our family, including surgeons in every specialty. So, all my cousins are doctors. And many specialists among the doctors. It's a very common thing in my [nationality] to go in sciences and engineering and acquire human capital in those disciplines. (Tanvi)

### ***Other Reasons Participants Chose Science as a Field of Study***

**First Scientists in Their Family.** Only a small number (three participants) became the first scientists in their families. Two stated:

And I became very interested in research in my second year in college. With those experiences, there was very limited resources in [country of origin withheld for confidentiality] to do research. But I was actually able to connect with a group. Outside the University is a private research institution. (April)

And my grandfather was a musician. And so, everybody was so into music, arts and things like that. And I really enjoyed it, and I didn't have any other world than music and arts. So, my passion was either to, you know, focus my study in music or in literature ... I didn't tell anybody about this [getting a PhD in Physics in the United States] because it was kind of so embarrassing that people will laugh at me cause it's never gonna happen (Akilah)

**Wanted to Honor Deceased Family Member.** Four of the participants wanted to honor deceased family members or felt encouraged, or protected by them, or wanted to be strong for the surviving family members.

But my dad passed away when ... he was very young, and I was only 11 years old. He developed cancer and he passed away very fast. But the only thing that I remember, most of the things that I remembered about him telling us, like, 'You need to be good, and you need to study. You need to study. You need to study.' (Luisa)

Some family members played a significant role even years after their deaths. For example, Pilar's father died when she was 12 years of age; she saw her deceased father as "her guardian angel": "So, I said—That's my angel. My guardian angel. I have very good angels over there because they guide me to the right path." As Luisa also noted (see quote above), Akilah's

grandmother remains alive as an inner voice that she turns to in difficult moments. “Even now when I run into problems, and I miss her because there is nobody to say that it’s gonna be alright. But now I say it to myself, ‘Yes, it’s gonna be alright.’”

April simply wanted to be strong and to not disappoint and even fulfill her father’s unfulfilled dreams:

My dad died when he was very young, and I was in my first year of college when he passed. And so that was definitely, I have to say, my strength because, you know, I feel like I didn’t want to disappoint him. Even though he was not there, I really wanted to do well because he couldn’t go to college.

April presented me with a handcraft she learned to make in the United States trying to recreate or mimic the South American “Mochilas” or Arhuaca knapsack. Arhuaca’s Mochilas is a popular artisan bag made by the Sierra Nevada’s Arhuaco indigenous people. Although the whole Arhuaco community is involved in this artisan production, only Wati (The Arhuaco Women) can weave the bags together according to their indigenous traditions. Customarily, the women learn to weave from an early age by watching their mothers. The first mochila they weave is given to the priest for the rituals of the life cycle.

[https://en.wikipedia.org/wiki/Arhuaca\\_mochila](https://en.wikipedia.org/wiki/Arhuaca_mochila)

April visited the region as a young teenager during a family vacation, of which she still has vivid memories and treasures. Her father bought April her first Arhuacan Mochila as a souvenir. He died of cancer soon after that, and April decided to become a scientist and pursue a PhD in the United States to honor his memory, because he always encouraged his children to study. In the United States, April made this handcraft, while feeling homesick and missing her family. She honored the memory of her father by putting a picture in the knapsack. She chose a beige color, trying to recreate the colors with which the mochilas are woven [earth tones, ranging from brown and beige to black and gray]. April stored and carried in this knapsack her most

valued possessions, such as her passport, wallet, and other small valuables. She hoped to be able to raise more funds for her STEM PhD to put in her pouch. A digital picture of April's knapsack is provided below.

**Figure 17**

*April/12132017: Arts Craft "Mochila" [Pouch imitation Arhuaca knapsack]*



**Findings for April's ABR.** The pouch or handcraft contributed to the themes of family encouragement; overcoming acculturation and cultural shock (building systems of support); overcoming serious critical personal incidents; learning to grieve a family member's death; close yet so far from loved ones; obtaining financial support; balance; resilience; and persistence. The pouch provided by April contributed to the themes of self-determination, and internal and external sources of motivation; and findings, factors for success or factors that participants perceived enabled them to successfully complete their STEM PhD and graduate. Each of the

participants wanted to honor deceased family members or felt encouraged, or protected by them, or wanted to be strong for the surviving family members. Their ongoing dialogue acted as a conscience, a comfort, and fulfillment of family dreams. Four participants felt the need to pursue and complete their PhD to honor their memories and carry their deceased family members' wishes for them to achieve their academic goals.

## **Theme 2: Finding Hope and Strength in Religion/Faith/Spirituality**

Seven participants practiced different religions: Catholic, Protestants (Evangelical Christians), Muslim, and Hindu. One participant described herself as possessing a high level of spirituality although not necessarily too religious. (Table 8 provides a data summary of Theme 2.) Seven participants attended religious services or mass regularly, were members of specific congregations, parochial churches, mosques, temples and or religious groups. Seven participants practiced their faith in some way on a daily basis: Hindu religious rituals; reading the Bible and inspirational verses; saying prayers and rosaries, or reading the Koran. One participant practiced daily meditation. All of the participants celebrated their religious holidays and followed specific religious ordinances, rites, ceremonies and even diets.

Despite their different systems of beliefs, what was very common to all of the participants during their PhD studies and beyond was their strong faiths. They derived their strength in times of crisis or trouble, sought spiritual guidance or divine intervention, peace and hope, and protection in unsafe situations from their specific faiths. Their faiths helped them find comfort when family members died, and when romantic relationships were broken. Their faiths helped them cope being far away from their homes and loved ones. All eight participants believed in life after death in a spiritual form.



**Table 8**

*Data Summary for Theme 2: Finding Hope and Strength in Religion/Faith/Spirituality*

Participants	RELIGION/FAITH/ (RF); SPIRITUALITY (S); CELEBRATED RELIGIOUS HOLIDAYS, RITES, CEREMONIES (HRC); DIET (D)
Luisa/07312017	X(RF); X (HRC); X (D)
Akilah/09132017	X(RF); X (HRC); X (D)
Mira/09182017	X(RF); X (HRC); X (D)
Pilar/12072017	X(RF); X (HRC); X (D)
April/12132017	X(RF); X (HRC); X (D)
Rose/03212018	X(RF); X (HRC); X (D)
Ana/02032018	X(RF); X (HRC); X (D)
Tanvi/04162018	X (S); X (HRC); X (D)
	# = x %
N = X	RF= 7=87.5%
N=8	S=1=12.5%
8=100%	HRC=8= 100%
	D=8= 100%

Of interest is that, despite their different religions/faiths, all eight participants believed in angels and/or spirits. Several felt they somehow communicated with their loved ones who had died. Table 9 provides a summary of the data from Theme 2B related to a belief in angels.

**Table 9***Data Summary for Theme 2B: Believed in Angels*

Participants	Religion/Faith/Spirituality Believed in Angels	
Luisa/07312017	X	12.5%
Akilah/09132017	X	12.5%
Mira /09182017	X	12.5%
Pilar/ 12072017	X	12.5%
April/12132017	X	12.5%
Rose/03212018	X	12.5%
Ana/ 02032018	X	12.5%
Tanvi/04162018	8=100%	12.5%
<i>N = X</i>	<i># = x %</i>	<i># = x %</i>
N=8	8 = 100%	8= 100%

The participants' stories that follow best illustrate the theme represented in Table 10, a data summary of Theme 2C. The stories represent all the religions of the participants: Catholic, Hindu, Protestant (Evangelical Christian), and Muslim, as well as the spirituality of a participant who does not necessarily considers herself practicing religious but, within her faith, practices meditation and spirituality.

**Table 10***Data Summary for Theme 2C: Religion/ Faith/Spirituality Descriptors*

DESCRIPTORS					
Participants	Strength in times of crisis or trouble	Sought spiritual guidance	Divine intervention	Peace and hope	Protection in unsafe situations
Luisa/07312017	X			X	X
Akilah/09132017	X	X		X	
Mira/09182017	X	X	X	X	
Pilar/12072017	X	X		X	X
April/12132017	X	X	X	X	X
Rose/03212018	X	X	X	X	
Ana/ 02032018	X	X	X	X	X
Tanvi/04162018	X	X	X	X	
<i>N = X</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>N=8</i>	<i>8=100%</i>	<i>7=87.5%</i>	<i>5=62.5%</i>	<i>8=100%</i>	<i>4=50%</i>
<i>8=100%</i>					

***Strength in Times of Crisis or Trouble***

Akilah relied on the Holy Book of Hinduism, the Bhagavad Gita, for guidance during her PhD studies in physics in the United States. Akilah stated “And that was my faith, believing in myself and ask, pray God to make me courageous. Give you strength. I don’t know if that makes sense.” Akilah also stated,

So, start that, right now do things for yourself. Work for yourself rather than expecting a God to come to you and do things for you. God is not your servant, right? So, you be your servant. You be server for yourself and then you can be, you know, once you know it, once you are aware of what you are doing, when you look back you can always be proud of what you did.

Mira also looked for spiritual strength in the Bhagavad Gita. The religious faith, rituals and traditions are passed from generation to generation ensuring the continuation of her faith.

She practices Hinduism and continues to rely on the Bhagavad Gita, the Holy Book for Hinduism to this day.

And also, like, there is a very famous couplet in the Bhagavad Gita, which is one of the holy texts of Hindus, which really says that—and I have it over here because I was thinking of that’s kind of a Hindu philosophy if you will—. If you translate it, it says you have the right to work only, but never to its fruits. ‘Let not the fruits of action be your motive, nor let your attachment be to inaction.’ I don’t know—that may not be correctly translated. But basically, you know, it means that do the work or do the deed without thinking about the result. You know? Or without, you know, like it says, ‘Don’t think about the fruits of your labor,’ you know? Do the labor, you know? Do what is right and what needs to be done. And your actions will get you the results, you know? So that’s something that I’ve had always sort of in the forefront of my mind and that’s what I teach my son also.

**Mira’s ABR.** Mira presented me with an ABR artifact. The first portion was a prayer or hymn from the Bhagavad Gita. It is presented here to illustrate the theme of finding hope and strength in religion/faith/spirituality. Currently, the Bhagavad-Gita is translated into all the major modern languages of the world. The entire Mahabharata, including the Bhagavad-Gita, was originally written by the sage Vedavyasa in the *Sanskrit* language.

[\[www.quora.com > In-what-language-was-the-first-Bhagavad-Gita-written\]](http://www.quora.com/In-what-language-was-the-first-Bhagavad-Gita-written)

The ABR artifact, a prayer or hymn Bhagavad Gita, Chapter 2, Verse: 47, shown in Figure 18, informed theme 2 (Finding Hope and Strength in Religion/Faith/Spirituality); theme 3 (Overcoming Academic Barriers); theme 5 (Overcoming Acculturation Barriers); theme 6 (Support from academic advisors, research supervisors, faculty, and mentors); theme 7 (Balance); theme 8 (Self-Determination); theme 9 (Resilience); theme 10 (Persistence); and theme 11 (Identity Building). This prayer and hymn contributed to Self-Determination (theme 8), external sources of motivation, factors for success or factors that participants perceived enabled Mira to successfully complete her STEM PhD and graduate, and how she was able to navigate experienced barriers.

**Figure 18**

*Mira/09182017: Bhagavad Gita, Chapter 2, Verse: 47*



Note. Original in Sanskrit with English Translation. Source for figure [Wikimedia Commons](#).

Provided at <http://www.gitablog.com/2014/08/karmanyevadhikaraste-ma-phalesu-kadachana-ma-karma-phala-hetur-bhur-ma-te-sangos-tv-akarmani>, the  
verse is

कर्मण्येवाधिकारस्ते मा फलेषु कदाचन।  
मा कर्मफलहेतुर्भूर्मा ते सङ्गोऽस्त्वकर्मणि ॥ २-४७

A detailed meaning of this verse is provided below, as well as the English translation.

1. karmany evadhikaras te: कर्मण्ये वाधिकारस्ते: you have a right to work only
2. ma phalesu kadachana: मां फलेषु कदाचन: but have no right to the fruits thereof
3. ma karma-phala-hetur bhur: मां कर्मफलहेतुर्भूः let not the fruits be the motive of doing karmas
4. ma te sango 'stv akarmani: मांते संङ्गोस्त्वकर्मणि: let yourself not be attached to inaction.

**Ana/ 02032018**

Ana was raised in a Catholic family and her country of origin in South America is mostly Catholic. In the United States, Ana joined an evangelical Christian student organization. Her

Christian faith sustained her during her PhD in civil engineering in the United States: “Also, I guess my faith community was also very important to me.”

We all had that core belief, you know, being Christian and or Catholic, you know, we just kind of have that community. So that really helped me as well knowing that I have just with people who are going through it. So that also helped me keep my sanity, I guess.

### Figure 19

*Christian Pastels Drawing/Poster of Proverbs 16:3*



*Note.* This was made during Ana’s PhD in Engineering while a member of the Council for Christian Graduate Students.

**Findings for Ana’s ABR.** The poster/drawing made with pastel colors emphasizing the Christian biblical verse of Proverbs 16 informed the following themes: theme 2 (Finding Hope and Strength in Religion/Faith/Spirituality); theme 3 (Overcoming Academic Barriers); theme 5 (Overcoming Acculturation Barriers); theme 6 (Support from academic advisors, research supervisors, faculty and mentors); theme 7 (Balance); theme 8 (Self-Determination); theme 9 (Resilience); theme 10 (Persistence); and theme 11 (Identity Building).

April found a small Chapel in the university hospital where she studied and conducted research and every day, she would ask God to help her with her academics or fulfill her financial

needs, and it worked very well for her. Having a strong faith in God and a place to worship seemed to contribute to the success of this international female doctoral student in STEM:

And when things go well it's okay. But there are times where I don't know if I did good in my exam. I don't know if I'm going to have enough money for this. You know, like you doubt yourself sometimes you just want to be able to deliver to the expectations, right? And so, I used to go to the chapel and just, you know, put myself in God's hands and... And everything, you know, it kind of worked out.

April substantiated this subtheme with the following example:

And, you know, just like, "Oh, God. Help me through today." You know? Cause there were days that I felt so alone and so overwhelmed like, I don't know if I can do this for 3 more years, 4 more years that, you know, a PhD requires.

Seeking spiritual guidance, Akilah relied on the Holy Book of Hinduism, the Bhagavad Gita, during her PhD studies in Physics in the United States. The Bhagavad Gita provided Akilah with the most important basics of her faith and was a source of spiritual guidance:

It's the, what do you call it? The hymns. So, it has a lot of those things, but it's all written in Sanskrit. But one of those things that says that your body is the temple. And you, yourself, your soul when it merges the God. So, keep the temple clean, means keep your body healthy, clean, pure, free from the negative thoughts and everything. And then your God is going to be happy.

April grew up in the Catholic faith; both of her parents were faithful Catholics. When her father died of cancer, her mother relied on her faith to help her be strong as a young widow and provide for her 3 children. Her mother passed her strong Catholic faith to April. "I think my faith also helped me a lot." As a Catholic, April sought spiritual guidance and prayed daily in a chapel she found in the university's hospital. April shared the following:

So, you know, the combination of everything and also, I think my faith. You know, my mom and my dad, they're people of faith. I grew up with that in me and I remember there were days where I had to get up at four in the morning cause I had so much to do and study for my courses, do the work in the lab. I used to pass by the chapel from the university hospital. And I made basically a routine just to go there every morning just for a few minutes.

Rose was very fortunate to have strong Muslim mentors who taught her that studying science should pose no threat to her Muslim faith, and that it could even promote her to feel close to God:

Because I was able to, [reconcile my Muslim Faith with the study of science] yeah, I actually believe that if I do science, if I help people, if I educate girls, boys or whatever, it's a very blessing act. I mean, it's kind of as equal as you pray, you know, it makes me—it elevates me. It makes me close to God, I mean, the way that I believe.

Pilar shared the same feeling: “I mean, I met the right angels in my life and throughout my graduate and doctoral studies...and I only met good people. I said, “How lucky can I be?” Divine intervention. Mira, an international Hindu student from Asia, relied on her faith since childhood. She explained how her Hindu faith helped her:

Yeah. I mean, definitely it was very strong as we were growing up. And, you know, so we definitely, you know, performing our daily prayer rituals, you know, which I still do. It's just part of my daily activities. And definitely, you know, like, praying when things are not going right, you know, so praying for some divine intervention.

### ***Peace and Hope***

Tanvi explained that finding peace and hope from her faith after the tragic loss of her younger sister was a long process:

So, [grieving] it's not an exclusive gift for you. So that's the thing, that's a regular process. You get upset at God and you're angry, you know, at the person [who died] or higher power [for allowing a tragic and premature death to happen]. So, I kind of was upset with God. And I didn't go to any temple or any place of worship for a while. And then gradually I started back, and I find peace there. So yeah. I mean, I followed the regular process.

**Protection in Unsafe Situations.** Pilar has been a woman of faith since early childhood. She is a Catholic and strongly believes she has guardian angels who have guided her throughout her life and during her PhD. Pilar explained how her faith helped her find protection:

I mean, believe in Faith. I mean, I am a spiritual person ... Faith was important ... Yes, faith was also important ... I am Catholic, and I believe that I have angels ... I believe that I have angels ... I have angels that protect me.



Hence, religion, faith, and spirituality provided a strong refuge in times of crisis and a source of hope and peace that helped participants overcome what seemed, at times, an insurmountable climb up “mountains” and to overcome many obstacles.

Mira explained how her Hindu Faith helped her:

Yeah. I mean, definitely it was very strong as we were growing up. And, you know, so we definitely, you know, performing our daily prayer rituals, you know, which I still do. It’s just part of my daily activities. And definitely, you know, like, praying when things are not going right, you know, so praying for some divine intervention.

### **Theme 3: Overcoming Academic Barriers**

The overwhelming majority, seven participants, experienced minor to severe academic barriers. One participant did not experience any academic barriers, and even felt “unchallenged.” (Refer to Findings Three H. for specific academic barriers). This theme included the subthemes mentioned below. (See Table 11 for Theme 3, Overcoming Academic Barriers/Descriptors.) I will provide examples of two participants, Luisa and Akilah, both of whom successfully overcame their difficult academic barriers, one in her courses and the other in her research lab.

#### ***Confronting the Academic Barrier***

The first semester of her PhD in neurobiology was particularly very difficult in terms of academics for Luisa:

I remember my very first day of class, I had taken one of the most and so far, the most difficult class I’ve ever taken, but also, the one that has taught me a lot about not only science, but life itself. It was a neurosciences class; a high-level class and I did not understand the topic of the first class. I had no idea what they were talking about.

So, as I was sitting there, I was thinking, ‘What am I doing in this place? I don’t know what they’re talking about. I could understand some sentences, some words, but the topic, I had no idea.

For Akilah:

But then when I worked in the lab, no one was there to help me. And so, I had to figure it out, everything by myself, and my advisor at that time, cause he’s—I’m not blaming him. He’s so used to the senior people because they were there even before me. So, whatever

they tell him, he kind of believed it and so I had to prove it to him. It was a time-taking procedure. And with my data, my promising research to make him believe in it. And I was able to do that, but it was a really difficult time to conquer everything by myself.

**Akilah's ABR.** Akilah provided me with a famous poem and prayer by Rabindranath Tagore, a Bengali poet, screen writer, novelist, author, painter, and Nobel Prize winner for Literature in 1931 (<https://www.biography.com/writer/rabindranath-tagore>). This is shown in Figure 20, Rabindranath Tagore's Poem and Prayer: "The Grasp of Your Hands" (English Version). Tagore's Poem and Prayer informed theme 2 (Finding Hope and Strength in Religion/Faith/Spirituality); theme 3 (Overcoming Academic Barriers); theme 5 (Overcoming Acculturation Barriers); theme 6 (Support from academic advisors, research supervisors, faculty and mentors); theme 7 (Balance); theme 8 (Self-Determination); theme 9 (Resilience); and theme 10 (Persistence).

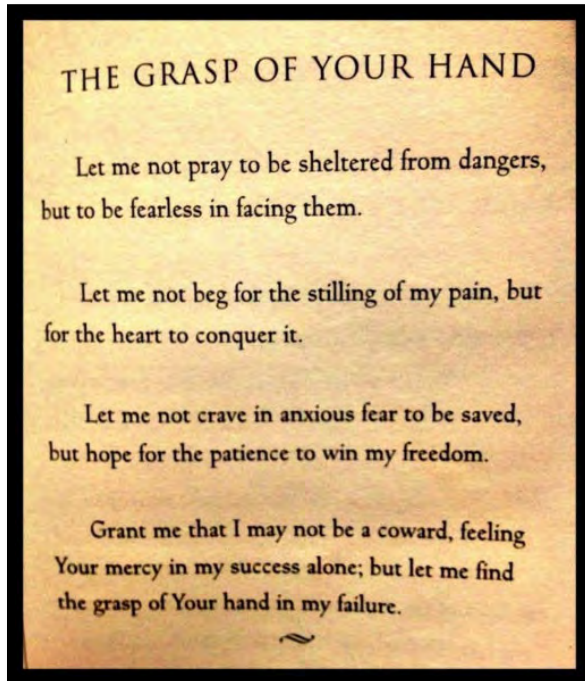
This poem contributed to Findings 1 under external sources of motivation; Findings 2, factors that participants perceived enabled them to successfully complete their STEM PhD and graduate; and Findings 3, experienced barriers and how she was able to navigate those barriers.

**Exhibiting an Emotional Reaction.** Two participants described their emotional reactions to course and lab research challenges respectively:

When I got home that day, I just cried. I kept thinking 'this is not happening. I'm not gonna to be able to do these. I didn't understand anything from that first class'. I called my sister. I was crying. I explained to her that I didn't think I could do this, that I didn't think I could make it through this first semester.' Because first of all, I didn't understand the topic of the class, and that made me pretty scared. But to make things worse I had to give a presentation for next Tuesday, and I didn't have a lot of time. I didn't have a computer at the time. (Luisa)

Figure 20

*Rabindranath Tagore's Poem and Prayer: "The Grasp of Your Hands" (English Version)*



Note. Source: <https://www.biography.com/writer/rabindranath-tagore>

It was tough because people who you work with, their perspectives could be different. And you will not be able to convince them always about your visions, your dreams, your insights. So, silence helped me a lot. Smile helped me a lot. Coffee helped me a lot. I don't know if I prayed, but I had the belief in my mind that things were gonna be okay, if not today for sure, for tomorrow. And I honestly, I even talked to—cause one of my friends in the teaching and learning scholarship program, he was doing his PhD in counseling. So, through him, I talked to the counselors and found out that there were a lot of resources that can help me, advise me to make things right. Sometimes it could be me. That way that I think could be not the way it's supposed to be. So, they helped me to kind of clear the fog I should say and forget about what happened but find a way how you're gonna live your life today. (Akilah)

**Seeking Academic Support.** Luisa asked for academic support from her older sister: “I had left home with what my advisor had said, but then my sister, helped a lot preparing the presentation and preparing me for it.” Akilah first gained the trust of male faculty researchers by

working hard for them as a research assistant. These male faculty became her mentors. Akilah shared the following:

They were actually collaborators in my advisor's research. And so, once I joined in the lab, they started giving me work. Like it was, you know, in the beginning it would be, like, could you make this Excel table for me? And then could you type this for me? Those were my jobs, but then I tried my best not to make a mistake. And the tables are actually with all the equations the scientific equations and everything. So that was the reason why. It took time, so that was the reason why they gave it to me, cause they don't have time to enter all the equations. But when I gave it back to them, they were impressed I think by the accuracy and effort. So, then they thought, 'Okay, they should include me as well in the research,' because it was like a test to make me understand what they are doing. So, when I got the background, they are like, 'Okay, now you are ready to get into the research.' So, they included me as well in the research.

**Taking Ownership of Their Learning.** Both Luisa and Akilah took ownership of their learning this way:

It turned out really nice. I got really nice compliments because it was an easy topic and I did a good job, explaining everything well. The professors asked a lot of questions, but as I was very well-prepared, I could answer to them, and this really was a good boost. As I finished the presentation, I thought that I could go through this class. (Luisa)

But it made me a stronger person, a better person. I learned everything by myself. And I still remember my last 3 years even though my PhD was in physics, half of the time, my research was in the chemistry lab because they had the hooded, you know, experimental area where you can safely use the chemicals and everything. So, it was just to prepare my nanoparticles. So, nanoparticles is of the size, you know, 10 to negative 9 meters. So, it's like extremely small. So, when you prepare it, there is a formula, but nobody knew the formula. So, I had to begin from scratch trying out different proportions and come up with the right thing. And it took several months. And each time when you prepare the sample, it'll take two days for it to come out. So then once you have the sample, you go to the microscopic lab to analyze, to view the particles, to see if that's the shape that I wanted. It could be a really small proportion change, end up with a big chunk of materials that we don't want. So, looking through the microscope, like, you know that. So, it took forever sometimes. (Akilah)

**Overcoming the Academic Barrier.** These same two participants described how they overcame their academic barriers:

I got all of my classes. Biostatics was very challenging. And also, the combination of the topic itself and the language. But I feel I made a 'B' on that one. So, I know I had to work very hard and extra hard because I was still learning the language. But I didn't, I never

felt like I was in trouble, that I was going to get in academic probation. And I know of a lot of friends that they're having a very difficult time. They would get a 'C' in the class and had to take it again. They ended up taking a little longer, so they'd have to go through a different route. But no, I always took all the classes that I needed to take. I made mostly A and some B in my classes. (Luisa)

So, my PhD is in physics, but I see a lot of chemical formula and math and everything. And once I get it, I have to kind of scatter those particles in a really uniform way for the laser to expose light into it. So, for that I have to find a way. So even though I have the right particles, I have to find the right way to scatter them uniformly. That was another challenge. I had to try out different methodology to do that. And then comes the real experiment with the laser. And that took several days as well. So, I mean, it was a difficult job. But, when you think about it, when you look back, even though it took time, but you did something. You achieved something. (Akilah)

I proved that they had a formula sheet with a glitch in it, but they were never able to figure out the mistake. So, they kept on keeping with the formula sheet. But I proved that their calculations are wrong, and that's why they're not able to get the result which they wanted to. And my advisor didn't believe me when I said that. Finally, when I got my particles, I told them that, 'Hey, I got it because my formula is correct.' And then he got a chance to look back and he found that I was right. So, I mean, I was actually helping myself and them. So, whoever came after me, they took my formula, and my professor got a lot of publications after that as well I believe. So, yeah. (Akilah)

**Relying on Their Own Values and Beliefs.** Luisa and Akilah relied on their own values and beliefs, with Akilah commenting:

And I always tell my students, this is what I did. And I was, cause in my lab, my fellow lab mates, my senior lab mates, their particles were 300 times bigger than my particles. So, they were not actually nanoparticles, but I made them synthesize the real nanoparticles.

So, I told my students, I tease them whenever I give exams and then I see a lot of students, you know, sitting there and I'm like, 'Excuse me. Are you ready for the exams?' And they are like, 'God will save us.' And I tell them, 'You know what? God is out for a conference today. He's not going to be helping you. So, it's all—you are on your own.' And that makes them nervous, afraid that there is no one to help them. But that is actually the fact, that it is actually you who has to be helping yourself. And that was my faith, believing in myself and ask, pray God to make me courageous. Give you strength. I don't know if that makes sense.

**Table 11***Theme 3: Overcoming Academic Barriers/Descriptors*

Participants	DESCRIPTORS					
	Confronting the Academic Barrier	Exhibiting an Emotional Reaction	Seeking Academic Support	Taking Ownership of their learning	Overcoming the Academic Barrier	Relying on their own values and beliefs
Luisa/07312017	X	X	X	X	X	X
Akilah/09132017	X	X	X	X	X	X
Mira/09182017	X	X	X	X	X	X
Pilar/12072017	X	X	X	X	X	X
April/12132017	X	X	X	X	X	X
Rose/03212018	X	X	X	X	X	X
Ana/02032018	X	X	X	X	X	X
N = X						# = x %
N=7	# = x %	# = x %	# = x %	# = x %	# = x %	7=87.5%
7=87.5%	7=87.5%	7=87.5%	7=87.5%	7=87.5%	7=87.5%	

To overcome their academic barriers, the overwhelming majority of participants directly confronted the barrier; exhibited an emotional reaction; sought academic support; and took ownership of their own learning. They relied on their own values and beliefs to overcome their STEM barriers during their PhD/Doctoral studies. Table 11 provides a summary of the descriptors.

**Theme 4: Learning English as a Second Language Proficiently**

All participants acknowledged the importance of learning and mastering the American English language to succeed in their STEM and/or professional degrees in the health sciences in the United States. (For their specific barriers, please refer to: Key Findings, Barriers: Learning English as a Second Language). Two participants were proficient in the English language before coming to the United States. One learned English over a period of more than 10 years prior to coming to the United States. The other participant is a polyglot who learned English and multiple

languages while living in various countries, including England, with her diplomat father and English Professor mother. The remaining 6 participants, or the majority, developed the following strategies to successfully master English as a second language as international doctoral STEM/health science students. (See Table 12, Data Summary for Theme 4: Learning English as a Second Language Proficiently).

### ***Confronting the English Language Barrier***

For most participants, it was a shock to learn that the many years they had spent learning the English language in their country of origin and/or even in Europe did not prepare them well to function in everyday life situations in the United States, let alone understand the difficult STEM PhD courses in the English language. Four participants shared how they were confronted with the English language barrier:

Despite the 3 years of English lessons, I took in [home country], my English was very poor, I felt all those years did nothing for me because the English that I was taught was so different to the English that people spoke here [in shock]. (Luisa)

And you know, I still remember my first semester here when I was a grad student. And the accent was different, cause in [Country of origin] we are so kind of liked to the UK English, so I'm so used to hearing those. (Akilah)

Ana recalled: “So, as an international student going from speaking Spanish to a school that is all English, in [name of university] that was something that was a complete shock.” Pilar expressed the same reaction: “And then when I came from London to the States, they didn't understand my Hispanic heavy accent mixed with the British English accent.”

**Table 12***Theme 4: Learning English as a Second Language Proficiently*

Participants	DESCRIPTORS					
	Confronting the English language barrier	Exhibiting an emotional reaction	Seeking English language support	Taking ownership of learning	Overcoming the English language barrier through goal setting, practice, and discipline	Relying on their own values and beliefs
Luisa/07312017	X	X	X	X	X	X
Akilah/09132017	X	X	X	X	X	X
Pilar/ 12072017	X	X	X	X	X	X
April/12132017	X	X	X	X	X	X
Rose/03212018	X	X	X	X	X	X
Ana/02032018	X	X	X	X	X	X
<i>N = X</i>	<i>N=6</i>	<i>N=6</i>	<i>N=6</i>	<i>N=6</i>	<i>N=6</i>	<i>N=6</i>
<i>N=6</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>6=75%</i>	<i>6=75%</i>	<i>6=75%</i>	<i>6=75%</i>	<i>6=75%</i>	<i>6=75%</i>	<i>6=75%</i>

**Exhibiting an Emotional Reaction.** All participants experienced a very emotional reaction. Sometimes the emotional reaction was negative. Such was the case with Luisa:

So, it was very hard for me. “I stayed working in the lab with her technician [her sister’s technician], struggling a lot trying to understand even the basics of any language: how to greet and response to greetings”. “And the other thing that I- I’m very insecure.

Other times, the emotional response was perceived as funny, and it was easily overcome with humor. Two participants shared funny memories. Pilar remembered: “So, it was so funny. I was asking for water, and they said, “What?” “Water.” I have to say, “Water” to learn how Americans pronounce it. But that was very easy to overcome.”



**Pilar's ABR.** The comic strip *Calvin and Hobbes* was syndicated from 1985 to 1995. It was created by William Boyd Watterson II (born July 5, 1958), an American former cartoonist. Watterson stated in 1987 during an interview that the names Calvin and Hobbes were "a tip of the hat to the political science department at Kenyon College ... I thought it was funny." Calvin was named after John Calvin, the 16<sup>th</sup> century Protestant theologian who believed in predestination, and Hobbes was named after the philosopher a century later who once observed that "life is nasty, brutish, and short." (<https://literature.stackexchange.com/questions/3268/why-did-bill-watterson-choose-the-character-names-he-did>).

This is what the author and cartoonist William Boyd Watterson II stated on his website under character descriptions (<https://www.calvinandhobbes.com/about-calvin-and-hobbes/>)

Calvin is named for a sixteenth-century theologian who believed in predestination. Most people assume that Calvin is based on a son of mine or based on detailed memories of my own childhood. In fact, I don't have children, and I was a fairly quiet, obedient kid—almost Calvin's opposite. One of the reasons that Calvin's character is fun to write is that I often don't agree with him.

Calvin is autobiographical in the sense that he thinks about the same issues that I do, but in this, Calvin reflects my adulthood more than my childhood. Many of Calvin's struggles are metaphors for my own. I suspect that most of us get old without growing up, and that inside every adult (sometimes not very far inside) is a bratty kid who wants everything his own way. I use Calvin as an outlet for my immaturity, as a way to keep myself curious about the natural world, as a way to ridicule my own obsessions, and as a way to comment on human nature. I wouldn't want Calvin in my house, but on paper, he helps me sort through my life and understand it.

Figure 21

Pilar/12072017 ABR: Calvin and Hobbes Strips

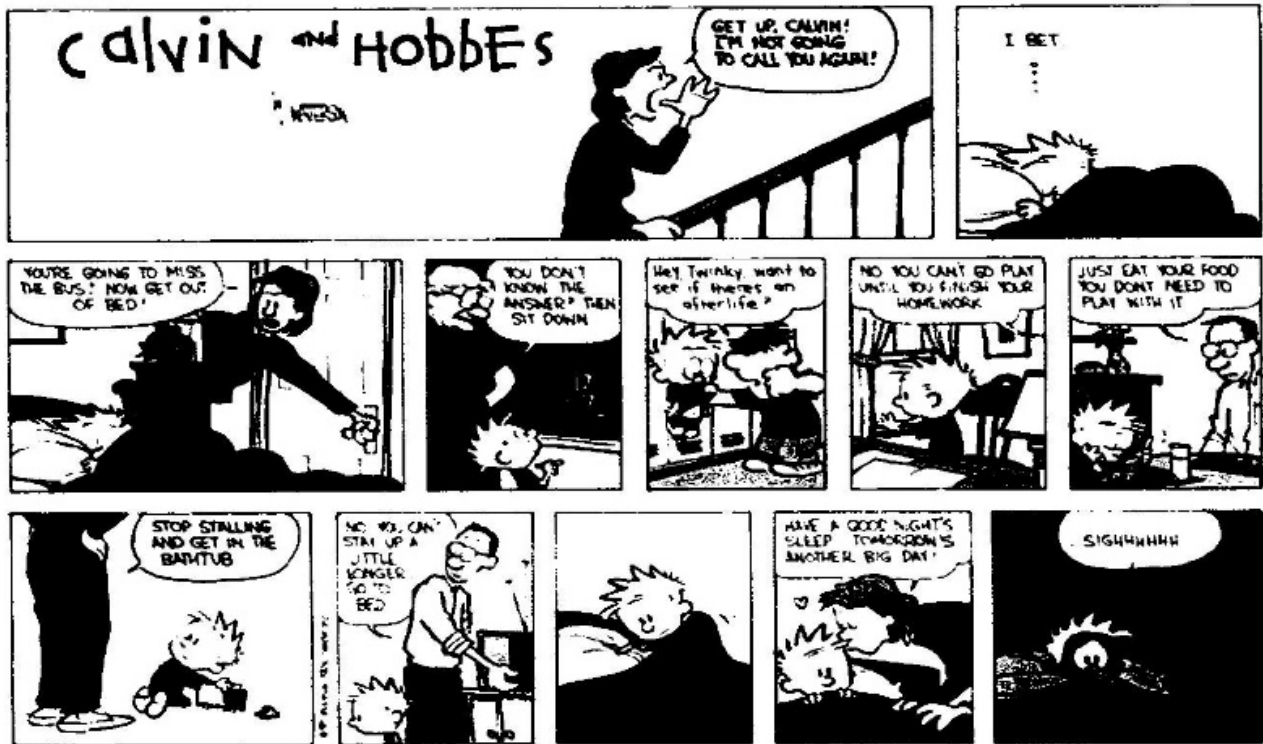
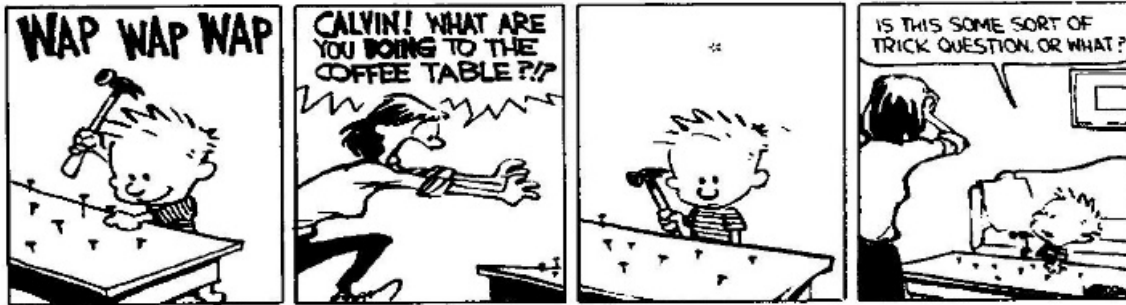


Figure 21 Continued





### **Overcoming the English Language Barrier Through Goal Setting, Practice,**

**Discipline.** For the conscientious STEM PhD students, overcoming the English language barrier requires setting specific goals, ‘practice, practice, practice to get it right and lots of discipline.’

April recalls:

But I used to record all my professors, and I studied a lot. I mean, that’s all I did. And that was my mindset ... But it paid off because all the time that I spend, you know, on my studies, you know, figuring out from my tapes—you know, listening back to my lectures, I had to make sure that I understood everything.

Pilar added:

But as soon as I was here, one of the things that I have to do is go and give a presentation on a program that we were doing. So, I practiced, like, the night before, like, for 2 hours or something. I say, okay, I feel confident enough that I’m going to be able to communicate clearly what we are doing.

**Seeking English Language Support.** Three participants explain how they sought support to improve their English as international students:

And I still remember one professor who was an American. He was a mathematical physics professor. And he used to announce the quizzes. And as I didn’t understand what he’s talking about, I was never prepared. And then in the next class when I’d come, everybody is ready for the quiz, and I’m like, ‘I didn’t hear it. Maybe I didn’t understand it.’ And then I was like, so left out. [laughs]. (Akilah)

And one day I decided to go talk to him. I told him that, you know, ‘I come from a different country, and I don’t understand what you are talking about. Could you please be patient with me?’ He came to the class next day saying, ‘Hey, all the quizzes that I gave to you so far, I’m gonna cancel it and start from the beginning.’ (Akilah)

Rose added: “I mean, I was actually very lucky because of my friend, [from her home country]. You know, her major was American literature. She was actually trying to explain to me.” To better improve her knowledge of technical engineering English terminology in civil Engineering, Ana joined the Society of Hispanic Professional Engineers: “The other thing that also helped a lot was being part of SHPE, which is the Society of Hispanic Professional Engineers.” Faculty were understanding of the English barriers:

But here it's different so the way they say things. It's different. And my professor, three of them, two of them, and the third one I didn't have much, you know, interactions with but two of them, they were really nice to me, and they were really understanding.

(Akilah)

**Taking Ownership of Their Learning.** Two participants described how they took ownership of their English language learning:

So, even with all the difficulties it was great, it helped me a lot because to learn a lot of my English during that time because I had no option. All of this happened in [State removed for confidentiality], where the Latino population is really low. There was nobody that spoke Spanish at work. (Luisa)

As April recalls:

“But it paid off because all the time that I spend, you know, on my studies, you know, figuring out from my tapes—you know, listening back to my lectures, I had to make sure that I understood everything.”

**Relying on Their Own Values and Beliefs.** Two participants reiterated how their values and beliefs helped them learn English proficiently. Pilar explained:

And my mother was very strong and determined. So, we have that character that we are determined. We're focused. Challenges are not deterrents for us. Challenges are just motivators. I mean, it's just like so I was determined to accomplish it and I was going to do it.

Pilar stated: “And always, I mean, I'm not [completely proficiently in English]—I am afraid but still I get nervous when I do public speeches and things like that.”

April explained:

And so, it was a lot of dedication, but I knew that was the way to be successful, you know? I'm like, this is not...cause, I knew I had the disadvantage not being fluent in English, right? Still having difficulty listening, right?

Learning English as a second language, while getting a STEM PhD or doctoral health science degree, is certainly not an easy task. The overwhelming majority of participants realized that the English they had learned in their home countries and in Europe did not prepare them well for life in the United States. The added challenges of taking Doctoral level courses in this

new English language in a difficult field like STEM was an added stressor. But through goal setting, practice, discipline, socialization with peers and faculty support, and understanding, they became quite proficient in their new acquired language.

### Theme 5: Overcoming Acculturation and Cultural Shock

#### Luisa's ABR

To overcome depression, isolation, and homesickness, Luisa turned to music; listening to Spanish songs was very therapeutic and motivating for her. She listened to this song quite often, “*Que Bonita es Esta Vida!*” by singer Jorge Celedon. Listening to this particular song helped Luisa focus on finishing her PhD and appreciating the support from her husband despite serious conflicts with her research supervisor.

#### Figure 22

Lyrics in Spanish of “*Que Bonita es Esta Vida!*”

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<i>Me gusta el olor que tiene la mañana</i>	<i>Es bonita hasta la muerte con aguardiente</i>
<i>Me gusta el primer traguito de café</i>	<i>Y tequila.</i>
<i>Sentir como el sol se asoma en mi ventana</i>	<i>Brindemos por la vida</i>
<i>Y me llena la mirada de un hermoso</i>	<i>Es Linda</i>
<i>Amanecer.</i>	<i>Quiérela, quiérela.</i>
<i>Me gusta escuchar la paz de las montañas</i>	<i>Me gusta escuchar la voz de una guitarra</i>
<i>Mirar los colores del atardecer</i>	<i>Brindar por aquel amigo que se fué</i>
<i>Sentir en mis pies la arena de la playa</i>	<i>Sentir el abrazo de la madrugada</i>
<i>Y lo dulce de la caña cuando beso a mi</i>	<i>Y llenarme la mirada</i>
<i>Mujer.</i>	<i>De otro hermoso amanecer</i>
<i>Sé, sé que el tiempo lleva prisa pa' borrarme</i>	<i>Sé, sé que el tiempo lleva prisa pa' borrarme</i>
<i>De la lista</i>	<i>De la lista</i>
<i>Pero yo le digo qué:</i>	<i>Pero yo le digo qué:</i>
<i>Ay, qué bonita es esta vida</i>	<i>Ay, qué bonita es esta vida</i>
<i>Aunque avece duela tanto y a pesar de los pesares</i>	<i>Aunque avece duela tanto y a pesar de los pesares</i>
<i>Siempre hay alguien que nos quiere</i>	<i>Siempre hay alguien que nos quiere</i>
<i>Siempre hay alguien que nos cuida</i>	<i>Siempre hay alguien que nos cuida</i>
<i>Aya, Ya, Yai que bonita es esta vida</i>	<i>Ay, Aya, Yai que bonita es esta vida</i>
<i>Y aunque no sea para siempre</i>	<i>Y aunque no sea para siempre</i>
<i>Si la vivo con mi gente</i>	<i>Si la vivo con mi gente</i>
	<i>Es bonita hasta la muerte con aguardiente</i>
	<i>Y tequila</i>

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Note. Source: [https://www.youtube.com/watch?v=pWsq\\_0FxzCg](https://www.youtube.com/watch?v=pWsq_0FxzCg)

**Figure 23***Lyrics in English of “How Beautiful is This Life!”*


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<p><i>I like the scent of the morning I like my first sip of coffee To feel how the sun peeks through my window And it feels my eyes with a beautiful sunrise I like to listen to the peace of the mountains To look at the colors of the sunset Feel on my feet the sand of the beach And to taste the sweetness of cane sugar when I kiss my wife. I know that time is in a hurry To erase me from the list But I tell him That: Oh, how beautiful is this life! Although sometimes it hurts so much But despite of all the sorrows There is always someone who loves us There is always someone who takes care of us Ouch, Ouch, Ouch how beautiful is this life! And even if it is not forever If I live it with my people It's beautiful until death with hard liquid and tequila Let's toast for Life!</i></p>	<p><i>It's beautiful Love her, Love her I like to hear the voice of a guitar To toast for that friend who left us and died To feel the embrace of the dawn And to fill my eyes With another beautiful sunrise I know that time is in a hurry To erase me from the list But I tell him That: Oh, how beautiful is this life! Although sometimes it hurts so much But despite of all the sorrows There is always someone who loves us There is always someone who takes care of us. Ouch, Ouch, Ouch how beautiful is this life! And even if it is not forever If I live it with my people It's beautiful until death with hard liquid and tequila</i></p>
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*Note.* “Que Bonita es Esta Vida!” English Translation by Maria P. Cantu: “How Beautiful is This Life!”

***Findings for Luisa’s ABR***

Luisa’s song, *Que Bonita es esta vida!*, contributed to the themes of family encouragement; overcoming acculturation and cultural shock (building systems of support); overcoming serious critical personal incidents; learning to grieve a family member’s death; close yet so far from loved ones; overcoming academic barriers; balance; resilience; and persistence.

**Building Systems of Support.** All eight participants expressed that to overcome all barriers during their doctoral science studies (in particular acculturation, cultural shock, learning the English language and overcoming academic barriers), they built systems of support. These systems of support included family members and relatives who already lived in the United States



and acted as “cultural brokers” helping them adjust to life in their new host country. They “showed them the ropes,” teaching them how to behave academically and socially.

All of the participants stated they were very close to their classmates and built good relationships with their fellow STEM PhD students or doctoral students in the health sciences. One participant explained how becoming a member of a research group in her home country during her senior year in college helped her come to the United States as an exchange student and eventually remained in this country to pursue her STEM PhD. Another participant explained that she built her system of support during a previous internship and during her master’s degree studies in the United States. Her “inner circle” included a faculty member who sponsored her visa; offered her a research job and scholarship that enabled her to get her PhD. This female mentor opened many doors for her and offered her a permanent position after she graduated with her doctoral degree.

One participant felt privileged to count seven male physicists on her dissertation committee. Some of these participants flew from out of state paying for their own expenses just to help her. She had met these male physicists working as a research assistant doing small jobs for them. Another participant narrated how a small group of academics recruited her from a small rural farming community and gave her a scholarship to major in math in the capital of her country. College mentors inspired her to come to the United States as an exchange student. Upon return to her country of origin, they introduced her to a young man who was already a graduate Math student in the United States. Soon after, that young man became her husband, which paved the way for her to come to the United States to obtain her PhD. During her PhD studies, she received academic support and guidance from other senior math PhD students from her native country living in the United States. The same young female STEM PhD international student

became pregnant and raised two small children during her studies. Other stay-at-home young mothers, wives of male PhD students from her country of origin, took turns to help her with childcare so she could finish her PhD. She built this network of support from her mosque and the University where she studied.

One young participant related how being recruited as a tennis athlete and offered a full scholarship to a college in the United States opened doors for her to get her PhD in civil engineering. The same participant reported joining a student group of evangelical Christians in her university who inspired her, motivated her, and supported her to achieve her academic goals. Another young participant relied on her older sister, who had obtained her STEM PhD in the United States and lived here for academic, emotional, and financial support. The same participant quickly networked with other STEM PhD students in her university when she did not have a car and needed transportation to and from the lab where she was conducting research after her classes. These group of students provided rides for her many times.

Family members and relatives who lived in the United States. Some participants were fortunate to have family members and relatives who already had moved to the United States, lived in this country for several years, and helped them in their acculturation process. Mira received help from her uncle and his family during those critical first months in the United States, which helped her get settled and adjusted in her host country and in her new university:

But, you know, so that initial—that's the time when you're trying to understand the things, you know, how to behave and just the social nuances. So, all those—you know, all those—like, if there is someone to show you, to explain it to you, it's so much easier. So, I actually lived with his [her uncle] family for 6 months, you know, in their house. And then I sort of went on and lived by myself with some other roommates.

Others chose to move to the same states where their immediate relatives were living to find family support. Tanvi stated:

But I chose [name of state university where she completed PhD], because I wanted to be closer to my two sisters who were already living in the U.S. even though I was accepted in Ivy League university, too, at [name of ivy-league private university]. But somehow there was no better for me at that time.

### **International STEM PhD Students in the United States From Their Country of**

**Origin.** For students who did not have relatives, extended or immediate family members living in the United States, other STEM PhD students from their home countries provided help with acculturation. Rose provides a good example of this:

But I mean, during that time we had a very nice company. Yeah, there were, like, we had four female students in math PhD program and one of them were [sic] actually from the same college that I graduate from [Muslim country] in the PhD math program. So, it was actually, great because I was, yeah, my husband he still tells me. He really wanted me to do PhD in math, but he didn't really have any friends like that. We had this company, so if I cannot understand anything, there was another friend who was telling me, or like, if they have some problem, then I was able to tell them these type of things. That was actually, a great blessing for us, and it rarely happens. It's just one more person we were together, like, four females. So that was a lot. It was very motivating to me.

There were other factors that the participants stated contributed to their success during their PhD studies, including support from peers and research coworkers. All participants reportedly received support from their peers:

My friends my fellow doctoral students, even though they were with other professors, we took a couple of classes together. But I found a lot of kind human beings here. They were able to help me whenever I was in a difficulty, especially in understanding a class. (Akilah).

But were some international students, but they were also from around the United States. But they were really eager to learn and all of us were there because of that, so I didn't have really a major problem [with peers]. (Pilar)

You know, it's funny. But in the United States at sort of each of these universities in STEM, if you look at the graduate student population, it's mostly international students, right? So, it's really your own peers. You know, like, peers that you are sort of familiar with. And I had so many [nationality] graduate students in our program, and then [other Asian] graduate students. So, you know, again, you have to sort of—of course, among the [my own nationality] graduate students it's kind of easier, you know? To sort of

assimilate, right? With the [other Asian] students, I had to sort of build that relationship, understand their culture a little bit. (Mira)

Five of the participants acknowledged receiving support from their research co-workers.

(See Table 14 for Theme 5A: Building Systems of Support). As Mira stated:

But I think in the graduate school, everyone is so driven to, you know, in their work that there was never a time when people didn't want to help you. And to answer your question of, like, how was it versus the domestic population? Like I said, I mean, there were hardly any domestic graduate students [in STEM research labs].

### **Other International STEM PhD or Post-Doctoral STEM Students in the United**

**States.** In the absence of relatives and peers from their countries of origin, international STEM PhD or post-doctoral STEM students in the United States provided needed support to get adjusted to the new country and culture. For example, April lived with a post-doctoral student from China, who offered her hospitality when she first arrived in the United States:

And so, there was a doctor, actually, that she came also from [Name of sponsor scientific organization] in Beijing. She was doing her postdoctoral training here [in the U.S] and she basically offered her house to me when I came because I didn't have a place. I didn't know anybody here in the United States. And so, I lived with her until I found, you know, a place on my own.

And that was also very crucial because it's not only a challenge and a difficulty, you know, leaving your family. But the whole setting, you know, in academics, everything is new. Everything is different. So, she was also a big help and a blessing for me to have during that transition.

### **Support From Faculty, Peers, Mentors, Research Supervisors, University Student**

**Life Staff, Employers, and Coworkers.** Many other people offered support in acculturation.

Following are 4 examples of these type of systems of support:

But I really have a very good support system. And that support system was built when I was doing my Master's. So, when I came back, Dr. [name of researcher employer] already knew me. We have a very good relationship, and we value each other, so I have support from her. I have support from the friends that I met during my Master's. So, it was a good environment. (Pilar)

The relationship that I did with my mentor was I think key for that because I was not afraid of her. I tried to be very strong, you know, in front of her but I have to tell you the truth. I broke up in 2 years a few times in front of her, you know, with different things that happened. So, I don't know. I kind of felt that I don't have anything to hide to her. (April).

Also, with my friends, you know, I was not very hesitant to ask for help, basically. Because I found people around me approachable. And it became clear to me that if I don't seek the help that I need, nobody's going to help me. You know? (April)

And I honestly, I even talked to—cause one of my friends in the teaching and learning scholarship program, he was doing his PhD in counseling. So, through him, I talked to the counselors and found out that there were a lot of resources that can help me, advise me to make things right. (Akilah)

**Professional Organizations.** Ana illustrated how a professional organization helped her during her PhD Studies:

The other thing that also helped a lot was being part of SHPE, which is the Society of Hispanic Professional Engineers ... And every year I went [to their conference] and every time I went, my group increased, and I came from [state], so now I have, like, three different groups. And it's sort of, like, a level of support and network and knowing that, you know, you're not alone kind of thing. And that really helped a lot in terms of, like, being truly empowered. Because that's an organization that's all about empowering the National Society of Hispanics Professional Engineers and empowering the community, the next generation of Hispanics. So, making sure that, you know, we're giving our very best to the world. And I think that every time that I went to the conference, I always felt empowered and knowing that I was growing thing.

Hence, for cultural adaptation, learning the English language, finding housing, food, health care, transportation, a place to worship, learning the application processes for admission to STEM PhD's to academic, social, athletic, and even finding "the right husband" or getting help with childcare, all of these women learned to build strong systems of support. After all, as one scientist posited: "you cannot get your PhD alone, you need an entire system of support." (See Table 14 for Theme 5A: Building Systems of Support.)

**Table 14***Theme 5A: Building Systems of Support*

DESCRIPTORS						
Participants	Family members and relatives who lived in the United States	International STEM PhD Students in the U.S. from their country of origin	Other International STEM PhD Students in the U.S.	Faculty (F)/ Peers (P)/ Mentors (M)/ Research Supervisors (RS)/ University Student Life Staff (USLS)/ Employers (E)/ coworkers (C)	Professional Organizations In their specific STEM Fields (PO)	Religious (R)/ Sports (S)/ Community/ Residence (CR)/ Organizations (O)/ Ethnic (E)/ Student Associations(SA) Clubs (C)
Luisa/07312017	X	X	X	FX; PX; MX CX		RX; EX;
Akilah/09132017	X	X	X	FX; PX; MX; USLSX; EX	X	RX; CRX; EX; OX; EX; SAX
Pilar/12072017	X	X	X	FX; PX; MX RSX; EX	X	RX; (CR)/
April/12132017	X	X	X	FX; PX; MX; RSX; ; EX; CX	X	RX; EX; SAX
Mira/09182017	X	X	X	FX; PX; MX; RSX; USLSX; EX; CX	X	RX; CRX; EX; OX; EX; SAX
Rose/03212018	X	X	X	FX; PX; MX;CX; USLSX; EX; CX	X	RX; CRX; EX; OX; EX; SAX
Ana/02032018	X	X	X	FX; PX; MX RSX; CX; USLSX; EX; CX	X	RX; SX; CRX; OX; EX; SAX; CX
Tanvi/04162018	X	X	X	FX; PX; MX; RSX;CX; EX; CX	X	RX; OX; EX; SAX
<i>N = X</i> <i>N=8</i> <i>8=100%</i>	<i>N=8</i> <i># = x 8= 100%</i>	<i>N=8</i> <i># = x %</i> <i>8=100%</i>	<i>N=8</i> <i># = x %</i> <i>8=100%</i>	<i># = x %</i> <i>FX=8=100%</i> <i>PX=8=100%</i> <i>MX=8=100%</i> <i>RS=5=62.5%</i> <i>USLSX=4=50%</i> <i>EX=7=87.5%</i> <i>C=6=75%</i>	<i>N=8</i> <i># = x %</i> <i>8=100%</i>	<i># = x %</i> <i>RX=8=100%</i> <i>S=1=12.5%</i> <i>CRX=7=87.5%</i> <i>O=5=62.5%</i> <i>E=7=87.5%</i> <i>SA=6=75%</i> <i>C=1=12.5%</i>

**Theme 5B. Overcoming Critical Personal Incidents During Their PhD Studies.** All of the participants learned to overcome serious critical personal incidents that included the following descriptors. These are shown in Table 15.

**Learning to Grieve a Family Member's Death.** Rose stated: "I often thought what is the worse [sic] that could happen during my PhD studies being away from home? Well death or the death of a family member. But from my Muslim Faith I found comfort even if death occurred."

***Rose's ARB***

Rose provided me with a religious song or hymn: "There is actually the following song (it is more like a hymn) that really motivated me during my PhD."

**Findings for Rose's ABR.** Rose's hymn song *Ezeli Nur* informed theme 5B, Overcoming Critical Personal Incidents during her PhD studies under *learning to grieve a family member's death*; and *Being Close Yet So Far from Loved Ones*. It also informed theme 2, Finding Hope and Strength in Religion/Faith/Spirituality, and theme 5, Overcoming acculturation barriers. This prayer and hymn contributed to the findings in theme 8, Self-Determination under internal *and external sources of motivation*; Findings 2: factors for success or factors that participants perceived enabled them to successfully complete their STEM PhD and graduate; and Findings 3, experienced barriers and how she was able to navigate those barriers. Two of the participants had to learn how to grieve a family member during their PhD studies. On this topic, Akilah remarked:

It's so funny that, you know, some days you will have, you know, night dreams about something else, and at the very end you will see, I mean, I see my grandmother coming, walking or something like that. And I give a call to my aunt the next day checking with her, 'Is everything okay over there?' And then there will be something happened, and then I get that whole feeling. And so, I mean, it's just maybe my feeling, but I believe in

that energy, it exists somewhere. Maybe, you know if there is a wavelength match, you will feel it. I don't know, but—I think I am able to still connect.

Tanvi commented:

I wanted to deal with it on my own. I shouldn't say I felt on my own. You never get out of that grieving phase. It's just, it mellows down, and you feel pain for your sibling all of your life. So, I was okay to deal with it. The whole thing, I was fine because I knew I had to take care of my parents because their grief is greater than mine. You know, to cremate a child, that's not how they expect it, right?

## Figure 24

*Image of Motivating Song*



Note. Source: <https://www.youtube.com/watch?v=BF3SaDHoZS8>



**Figure 25**

Rose/03212018: Song: *Ezeli Nur* [Turkish] with English Translation

<i>Ezeli-Nur</i> [Original Turkish Lyrics]	<i>Eternal Light</i> [English Translation]
Nurdan çehrendeki bu nikab da ne Güneşlere taç giydiren ışıkken Hep hicranlı bunca yıl, bunca sene Geçmiş gidiyor baharlar beklerken	What's this veil on your shining face? When its light gives the sun its crown Always with a feel of longing, all these years The springs are passing by as we're waiting
Ey Mukaddes Kitap, ey Ezeli Nur Ey iklimi ziyan, etrafı huzur Son demde bir kere daha ne olur Geri ver, bu ışık karanlığı boğarken	Oh, the Holy Book, the Eternal Light The climate of loss, the peaceful environment In the last moment of mine, for one more time, please
Bahar olmasa da, sonbahar olsun Cihanlar bütün avazıyla dolsun Yeniden namın her yanda duyulsun Şu fani hayatlarımız biterken	Give it back, as this light drowns the darkness If no spring, let it be the fall Let the worlds fill up with your sound Let your name be heard everywhere around As this ephemeral life of ours come to its end
Ey Mukaddes Kitap, ey Ezeli Nur Ey iklimi ziyan, etrafı huzur Son demde bir kere daha ne olur Geri ver, bu ışık karanlığı boğarken	Oh, the Holy Book, the Eternal Light The climate of loss, the peaceful environment In the last moment of mine, for one more time, please Give it back, as this light drowns the darkness

Note. Artist: [Grup Yeniçağ](#) Song: [Ezeli nur](#) Translations: English. Source: <https://lyricstranslate.com/en/ezeli-nur-eternal-light.html>. Translator: Submitted by [kertenkelesuratli](#) on Wed, 29/05/2019 - 14:46. Translator/Author's comments: It used lots of Arabic and Persian loanwords that are not used in Turkish much. The Turkish word for *nikab*, for example, is *peçe*. It also used some noun-adjective pairs in their Persian form *iklimi ziyan* would be *ziyan iklimi* in Turkish way of saying this. And lastly, some parts are unclear for example the chorus has no subject. Source: <https://lyricstranslate.com/en/ezeli-nur-eternal-light.html>. Lyrics powered by [www.musixmatch.com](http://www.musixmatch.com)

**Finding Safe Environments.** Three of the participants had to find safe environments to live or work. Pilar commented:

Sometimes they see you alone and you are in the supermarket, and they think that they can take advantage of you, but sometimes they get surprised when you seem ... [ready to defend yourself]. "You are not going to play with me." Or just you learn how to be still

wise in the sense that, “Oh, this is...” If you just feel that this is not going to be good, that that guy or those persons are looking suspicious, don’t be—just follow your instinct and just go away from there. That was something that was important to most of us to feel that I was safe.

So, I tried to, when I looked for the apartment, for me it was important that it was gated. Because if not I was feeling, “Anybody can come here and knock on the door or something.” So, safety is something that is very important, especially when you are a female.

April reiterated the importance of finding a safe place to live within a tight budget:

Until at the university I found a little flyer. And I went there, and it was basically this beautiful lady, that she lived by herself, that she rented the roof in her house to students or residents that were doing their work at the hospital. And so, I was actually able to find a room to live with her in her house.

**Close Yet So Far From Loved Ones.** All of the participants reported finding ways to keep in touch with their loved ones through the distance and feeling close to them in spite of the fact that they were far away. April best described how her family and boyfriend kept in touch:

Even from the distance that they used to write me letters or send me emails. You know, keeping my encouragement up, and that was big for me because, you know, I know they were there. You know? All the time. And they knew all my activities. They knew how my schedule was when I had an exam. You know, they sent me a little note, “Wishing you the best.” And if I do well, they’ll celebrate, you know, with me from the distance.

Ana shared the following:

Okay, so and I guess I want to share with you the background of what I’m going to share [for Arts Based Research artifact], I’m going to send you. As an international student I guess it’s really difficult, sometimes it gets lonely, right? Because all your family is abroad. And I live by myself, or sometimes I had a roommate, but it was not the same. You would still feel alone sometimes.

And I really, I traveled a lot, right? Cause I was in [state] and then I went to [state] And what I did is that I received letters for Christmas or happy birthday. Like I have my friends send me these letters, so that when you have a birthday, they send you greeting cards, right? And one of the things that really helped me, I guess making my home a little bit cozier or, like, making sure that I was reminded that I was not alone is that I created what I called our wall of love.

And what I did is that instead of throwing them...because they were all hidden, so then I realized I was getting so many. And it was always a great reminder that I had family and

friends that believe in me, that care for me, that I was—you know supported. So anytime I received or collected momentums, I created, and I physically created a wall that was made of all cards and experiences. And it's a reminder for me that I'm not alone, that I have family and friends that love me and also a reminder that I've done my PhD, a reminder that I've done my Master's, a reminder that I've done my Bachelor's, that I have traveled, that I have all these great experiences that were always good. So, I created this wall and it's like a collage of cards. So, I'll send you that. And I think that will be a sample of Arts-Based Research artifact—I think that's what they're asking for.

**Figure 26**

*Ana/02032018 ABR: Collage A. "The Wall of Fame"*



**Findings for Ana's ABR.** The two photographs of the collage titled "*The Wall of Fame*" contributed to the following themes: Overcoming Acculturation Barriers; Overcoming Critical Personal Incidents under *Close yet so far from loved ones*; Family Encouragement; Overcoming Academic Barriers; Overcoming Acculturation Barriers; Support from academic advisors, research supervisors, faculty and mentors; Balance; Self-Determination; Resilience; Persistence; and Identity Building. This collage contributed to findings of Self-Determination; one under

internal and external sources of motivation, Findings 2, factors for success or factors that participants perceived enabled them to successfully complete their STEM PhD and graduate; Findings 3, experienced barriers and how she was able to navigate those barriers; and Findings 4, Personal Attributes. (Collage B is provided as Figure 27)

**Table 15**

*Theme 5B: Overcoming Critical Personal Incidents During Their PhD Studies*

DESCRIPTORS			
Participants	Learning to Grieve Family Member's Death During PhD	Finding Safe Environments	Being Close Yet So Far from Loved Ones
Luisa/07312017		X	X
Akilah/09132017	X		X
Mira/09182017			X
Pilar/12072017		X	X
April/12132017		X	X
Rose/03212018			X
Ana/02032018			X
Tanvi/04162018	X		X
<i>N = X</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>N=8</i>	<i>2=25%</i>	<i>3=37.5%</i>	<i>8= 100%</i>

The international female STEM doctoral students succeeded in their difficult academic programs by overcoming critical personal incidents that took place during their studies, as noted in Table 15. Some of their strategies included learning to grieve a family member's death during their PhD, finding safe environments, and maintaining good communication to remain close to their loved ones who remained far away in their countries of origin.

**Theme 5C. Finding Alternative Transportation.** The following participants shared their experiences of using diverse forms of alternative transportation during their STEM/health profession PhD or doctoral studies. These are summarized in Table 16.

**Table 16**

*Theme 5C: Finding Alternative Transportation*

Participants	DESCRIPTORS						
	Walked	Took public buses	Took university buses	Took taxis (T), shuttles (S)	Driven by husband	Asked rides from peers	Rode in community rental cars
Luisa/07312017	X	X	X	TX; SX	X	X	X
Akilah/09132017	X	X	X	TX; SX	X	X	X
Pilar/12072017	X	X		TX		X	
April/12132017	X	X		TX	X	X	X
Mira/09182017	X	X	X		X		
Rose/03212018					X		
<i>N = X</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>N=8</i>	<i>N=5</i>	<i>N=5</i>	<i>N=3</i>	<i>N=3</i>	<i>N=4</i>	<i>N=3</i>	<i>N=2</i>
<i>8=100%</i>	<i>5=62.5%</i>	<i>5=62.5%</i>	<i>3=37.5%</i>	<i>3=37.5%</i>	<i>4=50%</i>	<i>3=37.5%</i>	<i>2=25%</i>
				<i>S=1</i>		<i>%</i>	
				<i>1=12.5%</i>			

**Walked.** Luisa shared: “I didn’t have a car the first year, so, what we did [found small apartment near university], but I could take the bus, or I could just walk to school from what I was living in”. Akilah had to walk to her university too: “I still remember I walked to the campus on my due date, April 13<sup>th</sup> in the morning to get the signatures.” Pilar reiterated having to walk: “I was living close by, so I can walk”. “Or if for any reason I wanted to work, it was close enough to walk”. April stated the same: “At the beginning I did. When I was living with some of the roommates, I lived within walking distance.”

**Took University Buses.** Mira recalled: “Also, when we moved to an apartment, which was a little of a—you know, some not quite a distance from the university, we specifically took a place where the bus service was there for the university”. “So, my husband by that time he was doing his internship as a pharmacist, and so he would take the car and I would just take the bus, university bus, you know?”

**Took Public Buses.** Two of the participants described their experiences:

The transportation was very tricky because when we applied and when my sister had me look for apartments, what I received in [country of origin] she looked, and they found me an apartment nearby the University. So, I could ride the bus. [Luisa]

So, when I was living with [name], you know, the lady that rented me the room from her house, it was a little far, so I did have to take the bus. So that was challenging sometimes because of the schedule, and it was not good. I missed the bus a few times. (April)

**Took Taxis or Shuttles.** Luisa’s research lab was out of her university: “But it turned out that my advisor was adjoined to that University, but his actual laboratory was in a medical school that it was only 15 minutes away, like, in car.” Luisa also stated:

As I didn’t have a car and there was no public transportation to take me to this place, I had to take a shuttle, which I had to pay for. It was kind of a taxi because I have to call every day to schedule the ride. And they would come get me. I always told them I needed to be at school by 8 in the morning. Because the shuttle often times needed to pick up different people to take to different places, sometimes they would pick me up at 6:30, sometimes at 7. And they will take me through the entire town until they finally dropped me off at school. Then I had them picking me up by 5 pm.

**Driven by Husband.** Luisa is a good example of a participant who was driven to classes and her research lab by her husband:

We were able to get a car a month after my husband came because it was going be not more difficult, and more uncomfortable for the two of us to get rides from friends or even my family ... and ever since my husband drove me everywhere.

**Asked Rides From Peers.** Pilar asked peers for rides, and they also helped her run errands:

Without that, and a friend from here—the friend that I lived with when I was in [name of city] doing my master’s and everything, she used to go to [name of city] every 15 days and she took me to buy groceries and everything before I got the car.

**Rode in Community Rental Cars or Carpoled.** Pilar used this system: “Some of my friends rented a car and I rode with them when commuting from a different city.”

### *Transportation Summary*

What many domestic, American-born students take for granted, especially at the PhD/Doctoral level, is owning a car and being able to be self-sufficient and go where they need or want to go. It is quite difficult for international students, particularly females from other countries. The participants in this study overcame these barriers by learning to use different forms of transportation.

**Theme 5D. Obtaining Financial Support.** The overwhelming majority, seven out of the eight participants, reported having to obtain additional sources of funding as international doctoral STEM /health professions students. A single participant had to obtain all funding by herself, outside her department. Additional sources of financial support included: obtaining financial help from family members; husbands’ work; obtaining teaching assistantships; research assistantships; scholarships; grants; working evenings, weekends, or during the summer; and doing menial jobs. (See Table 17, Data Summary Table for Obtaining Financial Support.)

**Obtaining Financial Help From Family Members.** Luisa relied on her sister and her brother in-law financially to get settled in the United States:

I had been saving some money to pay my sister because she had to help me when I first come here to rent the house, to buy a bed. To these things my sister really helped me, like, economically. So, I was saving money to pay her all of that money that she had spent only throughout the first year. Took a deposit for the apartment, the health insurance. They even, pay for some of the [airline] tickets.

Pilar also relied on her family for financial support, but only in cases of emergency; “and if I needed any assistance, my family supported me.”

**Husbands’ Work.** Three participants described how they depended on their husband for financial support:

Well, I think another important issue was the reason that he didn’t start for the PhD, we know that if you are two students in one house, it’s pretty much a lot, like a lot of stress. And at the same time, he didn’t really want us to have financial problems because of the salaries and things like that... I think whenever I was doing my PhD, actually, he was working at that charter school (Rose)

And it was in 2005 I believe I got married and like a dream come true, then my husband got a job here in San Antonio, USA. So, I followed him and accompanied him (Akilah)

At the time, he [fiancé] was an assistant professor back home. And we started looking for opportunities [in the US] for him, right...He’s a chemical engineer. But we were looking for things in science, too... In my third year. So, we got married and my wonderful mentor actually hired him as a technician so that, you know, we could have a little bit of stability. And so, he worked basically in the same lab that I was doing my graduate work. And I was able, you know, to graduate. (Pilar)

**Teaching Assistantships.** Mira chose the university where she was offered the most in terms of financial support. “And then I applied to a few places, and I got accepted to two or three universities. And I basically chose a university where I was offered assistance-ship. You know, teaching assistance-ship [tuition free] because financials do matter, right?” April explained:

“Yeah, we had a stipend. Yes, we have to TA [Teaching Assistantship] Right. But it, you know, it was very tight, you know?” Ana also reiterated she needed her Teaching Assistantship:

And then the rest of the years I was a TA for the Department of Engineering Education ... And I guess I want to emphasize that it was a completely different department, so it was not my advisor. Like, I did not receive [financial] support from my advisor ever during my master’s or PhD.

Rose also described her need for a teaching assistant position:

So, each semester I was teaching two courses as a full professor, you know what I mean? As like, a responsible person, as an instructor... Yeah, teaching assistant. But I mean,



normally, then you look at other PhD students, they usually teach either one or no classes for each semester.

**Research Assistantships.** Some participants were fortunate to be offered research assistantships. Two good examples are Luisa and Akilah:

So, luckily, I got accepted into a PhD program in [name of the university] also, in [state]. The PI that I worked with [as an exchange student] he had some money, so, he saw my skills [in research lab]. And a lot of the techniques that I had learned in [state] working with my sister were very like the ones he was doing ... He interviewed me through the phone [Offered a Research Assistantship and entrance to PhD tuition Free]. He gave me the opportunity. (Luisa)

Akilah shared: “I had a research scholarship [Research Assistantship, tuition free].”

**Scholarships Fellowships and Grants.** Three participants explained how they received additional financial support:

And also, I think I can say that my advisor, he was actually, he had a lot of funding, so he was able to send me to a lot of conference ... Yeah, so I know a couple times I got an award from the department. You know, sometimes they give some money worth. So, I think it was motivational (Rose)

Except for my last year of PhD where I got the Presidential [Fellowship] Services. So that allowed me to finish up my last year without having to be a TA ... But it was one of those things that it was just like I was one of a few. You know what I mean? Like, they don't give fellowships to everyone. So, I was one of the fortunate ones. (Ana)

So, there was one time that I found out that I'm running out of money. And I never asked my parents, or I didn't ask my husband to help me or anything. So, I applied for a scholarship at [name of state university]. It's a one-year scholarship for teaching and learning. So, they picked through a pool of doctoral students from different disciplines. So, among 12, teaching fellow—that's what they call it. University teaching fellow. There were 12 of us. I was the only person from STEM, I believe. So, it's a one-year program with \$25 k for the whole one year to pay for tuition and everything. But it gave me a wonderful opportunity to make me a greater teacher. (Akilah)

**Working Extended Hours, Evenings, Weekends, and During the Summer.** Most of the participants worked long hours, during evenings, weekends and/or summers. Luisa worked extended days and evenings in her research lab:

He [husband] was very understanding of my long days, my long nights in the lab. He made my life so much easier. He would come with me to the lab and even help me sometimes with my experiments. He has always had a lot confidence on what I can accomplish. Working independently in the lab showed me that I could really be successful in this field.

Akilah was asked to work on weekends:

But he [Research Supervisor] asked me to come on Saturdays and Sundays, telling me that if I don't do it, I won't graduate. And at that time, I never kind of took it personally because I thought, 'Maybe he is correct.' Yeah, I used to come on weekends, but I noticed that students from here, they never came on weekends. And it actually gave me a quiet atmosphere to come into the lab. It's all mine, and you know, find peace and work on it. So, I took it positive.

Ana had to find jobs to do during the summers:

And in some ways, it was always uncertain. Like, every year I had to renew my contract, so I will have to figure out ways to fund myself during the summer. And, you know, so that definitely put a rather strain ... and it was just time-consuming. And a person who is pursuing a PhD, they should be focusing on their research. Not really, you know, busy work. Don't get me wrong. I loved my TA position. It was great, but it was very time-consuming.

**Part Time Work /Menial Jobs.** Some students held other part time small jobs to supplement their income. April is a good example:

You know, I used to babysit for one of the girls that worked in the lab cause she knows that I also needed money. So, you know, sometimes she'll offer me ... I used to also take care of, like, when my mentor when she would go out for a business trip or something. You know, she would ask me to watch her house or just be home so that her son will not miss the bus. You know, things like that. And, you know, they did that I'm pretty sure on purpose so that they could give me a little bit of money for those services.

It is extremely difficult for international female STEM PhD and or doctoral health science students to obtain financial assistance in the United States. As opposed to domestic students, international students cannot apply for federal student loans. The majority do not have financial family support from their countries of origin, many of which are poor developing countries.

Table 17 provides a Data Summary for Theme 5D: Obtaining Financial Support.

**Table 17***Data Summary for Theme 5D: Obtaining Financial Support*

DESCRIPTORS							
Participants	Obtaining financial help from family members	Husbands' work	Teaching assistantship	Research assistantship (RA) Research associate job	Scholarships (S) Fellowships (F) Grants (G)	Worked evenings (E) weekends (W) Worked during the summer (S)	Menial Jobs
Luisa/07312017	X			RAX	SX; GX	EX; WX; SX	
Akilah/09132017		X	X	RAX	SX; GX	EX; WX; SX	
Pilar/12072017				RAJ X		EX; SX	
April/12132017		X	X		SX; FX; GX	EX; WX; SX	X
Mira/09182017		X		RAX	SX; GX	EX; SX	
Rose/03212018		X	X		SX; GX	EX; SX	
Ana/02032018			X		SX; FX; GX	EX; WX; SX	
<i>N = X</i>	<i># = x %</i>		<i># = x %</i>		<i># = x %</i>		
<i>N=8</i>	<i>N=1</i>	<i># = x %</i>	<i>N=4</i>	<i># = x %</i>	<i>S=6=75</i>	<i># = x %</i>	<i># = x</i>
<i>8=100%</i>	<i>1=12.5</i>	<i>N=4</i>	<i>4=50%</i>	<i>RAX=3</i>	<i>%</i>	<i>E=7=87.5</i>	<i>%</i>
	<i>%</i>	<i>4=50%</i>		<i>3=37.5%</i>	<i>F=2=25</i>	<i>%</i>	<i>N=2</i>
				<i>RAJ=1</i>	<i>%</i>	<i>W=4=50%</i>	<i>2=25</i>
				<i>1=12.5%</i>	<i>G=6=75</i>	<i>S=7=87.5</i>	<i>%</i>
					<i>%</i>		

In state universities, where the vast majority attend because they cannot afford the high tuition of private universities, by law, financial aid is only made available to international students if there are no domestic (American Citizens or residents of the United States) applying for it. Immigration laws have many restrictions on international students, who are only allowed to work an average of 20 hours and on-campus jobs only. Even then, most obtain teaching assistantships, which demand a lot from them in terms of time and dedication, taking away time to study. During the summers, most international students need to find additional jobs. For this

reason, financial barriers are the number one cause for attrition rates of these important population.

Overcoming acculturation and cultural shock for these international female STEM PhD students was a big impediment. The participants succeeded by building strong systems of support, learning to overcome critical personal incidents they experienced during their studies; finding alternative ways of transportation in the absence of cars; and seeking and obtaining additional sources of financial support.

### **Theme 6: Support From Academic Advisors, Research Supervisors, Faculty, and Mentors**

Ana shared the following with regard to the support she received from academic advisors, research supervisors, faculty, and mentors:

So, having a sense of community and recognizing that it's common and that you do have value. And for example, when I got an email from my student saying that I was a really good professor or that I really enjoy that, or I got feedback from the chair saying something encouraging, or like, "Congratulations on getting the fellowship," or something like that. Like, I will save these things in a folder so that during the rough times I will go back to the folder and, like, count your blessings. I like, count the things that are—like, the people that you respect and admire, and they say something good to you and they write you a commendation letter, and they share it with you and then you look at it you're like, "Wow. I cannot believe this person thinks this about me." It's amazing. So, saving those things I think helps me a lot in overcoming that imposture syndrome and just having, like, my advisor will tell me, it's like, "Look. So, you work hard for this." And he really, like, I didn't think I was going to get a professor position even if I was applying. Because I wanted to apply for a prospect position, he would be like, "No. You are faculty material. You can succeed at a research one institution." Like, he was my number one supporter, and I think that makes a big difference having an advisor that really respects your work and really believes that you can succeed in a certain field. Like, my advisor was really great about that, and I really did appreciate that a lot, especially deciding my path post-PhD.

Faculty, academic advisors, research supervisors, and mentors sent Ana encouraging words, e-mails, cards, and posted her work in bulletins. She included those messages on her "wall of fame," a collage that kept her motivated and focused on success during her PhD.

**Figure 27**

Ana/02032018 ARB: Collage B “The Wall of Fame”



**Findings for Ana’s ABR.** The two photographs of the collage titled “*The Wall of Fame*” contributed to the following themes: Support from academic advisors, research supervisors, faculty, and mentors; Overcoming Acculturation Barriers; Overcoming Critical Personal Incidents under *Close yet so far from loved ones*; Family Encouragement; Overcoming Academic Barriers; Balance; Self-Determination; Resilience; Persistence; and Identity Building. This second collage contributed to the findings for Self-Determination under internal and external sources of motivation; factors for success or factors that participants perceived enabled

them to successfully complete their STEM PhD and graduate; experienced barriers and how she was able to navigate those barriers; and personal attributes.

All participants narrated receiving good guidance from their academic advisors. Additionally, all of the participants in general reported working under very competent and knowledgeable, even “famous,” research supervisors. All participants in general felt their research supervisors motivated and inspired them, and everyone, without exception, praised their faculty members. Furthermore, the role of mentors contributed to all of the participants’ achievement of academic success.

Only one of the participants stated she received support, mentorship, and guidance from her entire STEM PhD Department. And only one participant stated that she was highlighted in the Department’s newsletter, which motivated her to become the first female to receive a PhD in civil engineering in 40 years at her university. Although one of the participants had perceptions of sexual harassment by her research supervisor, dissertation chair and professor; she thanked them for preparing her well for her dissertation. Another one of the participants had perceptions of being discriminated as an international student compared with the domestic (American) students. This participant struggled to understand why she received this unequal treatment. As previously noted, all participants praised their faculty members. They described their professors as compassionate, caring, experts in their fields, and always willing to help them. One participant narrated how a faculty member let her use his computer, lent her his textbooks, and shared his faculty power-points to help her produce her first presentation.

All eight participants fostered respectful yet caring relationships with faculty members. One participant was deeply moved when she went to visit a professor during office hours. She had not understood his “American English” and did not prepare for quizzes he had announced.

The professor announced in front of the class that all previous quizzes did not count and he made sure she knew when subsequent quizzes were due. This inspired her to not only to succeed in her PhD but to become a professor and embrace teaching after obtaining her PhD. The same faculty member was very protective of her during her pregnancy and served on her dissertation committee.

A very important finding is that none of the participants experienced what is referred to in the literature as “the chilly science and lab treatment by male faculty” (Flam, 1991; Shapiro & Sax, 2011; Yoshida et al., 2012). None of the participants experienced gender (female) discrimination from their male faculty members as compared to treatment of their male counterpart peers in doctoral science. The 3 participants who had female research supervisors, academic advisors, and faculty members reported very positive role models, motivation, support and guidance. One participant’s female research supervisor played a very important role in bringing the international student back to the United States after her master’s and making sure she applied for her doctoral degree. She was a mentor, research supervisor, faculty member, and her boss.

Another female mentor helped one participant obtain a Scholarships in STEM teaching and learning and sent her to conferences and workshops to prepare her for faculty positions. Yet another participant narrated that when she was a PhD student, a female faculty member and mentor helped her emotionally to overcome personal crisis when she broke up a romantic relationship and dealing with the tragic untimely death of her younger sister in a car accident.

**Table 18**

*Data Summary for Theme 6: Support From Academic Advisors, Research Supervisors, Faculty, and Mentors*

Participants	DESCRIPTORS						
	Good guidance from their academic advisors	Male research supervisors motivated and inspired them	Female research supervisors were positive role models	Professors (Faculty) were compassionate, caring, experts in their fields	Support from Dissertation Chair (DC) Dissertation Committee Members (DCM)	Mentors played a key role in their success	Support from STEM department
Luisa/07312017	X			X	DCM X	X	
Akilah/09132017	X			X	DCX; DCMX	X	X
Pilar/12072017	X		X	X	DCX; DCMX	X	X
April/12132017	X	X		X	DCX; DCMX	X	X
Mira/09182017	X	X		X	DCX; DCMX	X	X
Rose/03212018	X	X		X	DCX; DCMX	X	X
Ana/02032018	X	X		X	DCX; DCMX	X	X
Tanvi/04162018	X		X	X	DCX; DCMX	X	X
					<i>DC=N=7</i> <i># = x %</i>		
<i>N = X</i>	<i>N=8</i>	<i>N=4</i>	<i>N=2</i>	<i>N=8</i>	<i>7=87.5%</i>	<i>N=8</i>	<i>N=7</i>
<i>N=8</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i>DCM=8</i>	<i># = x %</i>	<i># = x %</i>
<i>8=100%</i>	<i>8=100%</i>	<i>4=50%</i>	<i>2=25%</i>	<i>8=100%</i>	<i>DCM=100%</i>	<i>8=100%</i>	<i>7=87.5%</i>

**Good Guidance From Their Academic Advisors.** Luisa recalled her academic advisor and professor gave her the tools to succeed in her first presentation: “He just said: ‘This is the book. Read the chapter.’ And he gave me a PowerPoint presentation with some slides already for that chapter, so I could build on these my presentation.” Mira reiterated the same: “So, I had a very good relationship with my graduate advisor.” Pilar had only compliments regarding her academic advisor: “He gave us a lot of independence, but good guidance to complete the studies.” During her PhD studies in civil engineering, Ana received lots of nominations and



support from her academic advisor and was able to publish several research papers under his guidance:

Like, when I got the financial fellowship, which is like the biggest award that you can get as a graduate student to pursue for your last year, and my academic advisor supported me. And I think that was huge. Like, any time there was an award or any time there was a nomination that needed to be done, he would nominate me. Like, he was nominated for a Nobel Prize. So, I got the answers that I needed because I was working with my advisor, like, no matter who they are. That's, like, the kind of power that my advisor had, I guess. He's just really big. Like, he has seven journals. He's the editor of seven journals. And he's the editor of the, you know, number one journal in civil engineering. So, everyone's trying to get published in his journal. You know what I mean?

Male research supervisors motivated and inspired them. Mira did not experience the *chilly lab climate*: “You know, I personally did not experience it.” “And, you know, my graduate advisor was a male, you know? Most of the professors that we had were males.” Mira was a consistent and hard-working PhD student and researcher: “And so fortunately I have not had any of the important people in my work who would behave like that, you know, cold.”

Akilah felt very comfortable working for male mentors and researchers. She did not experience a *chilly lab climate* from her male researchers, and she never felt discriminated against because she was a female: “But the people who I was working for, I was comfortable doing that. And they were always helpful, my mentors. They were always helpful.” “And then we worked a lot of papers together. So yeah, that's how they knew me.” These male professors became Akilah's mentors and served on her dissertation committee:

One of them, he is still working in one of the universities in Michigan. He volunteered to be a member in my committee. My other professor was not even working at that time, but he flew all the way from California, and he wanted to be another external advisor. He was not eventually on the committee, but he sat as the external advisor. And he paid himself to come over for my defense. So, I was so pampered to say that there were two external advisors. We didn't have to pay them. They paid for their flight to get here—and they came all the way from there to here to help me, support me. And as you're asking now, all of my committee members, like seven or eight, they were all males.

Female research supervisors were positive role models. Pilar's female research supervisor gave her time off from work to attend her doctoral classes: "But she [female research supervisor and mentor] gave me time to do it [The PhD]. I didn't have any problems since I have a class in the morning or in the afternoon." Pilar did not experience a *chilly lab climate* or any gender discrimination:

No. It's not a big issue because what I said. My boss was a female. Her boss, even though—he really respected her, valued her and, I mean, all of us. I had male and female co-workers and it was a good environment. I thank you, Lord, it was not discriminatory.

During her PhD studies, Tanvi did not experience a *chilly lab/science* environment, or any form of gender discrimination: "As a female? You know what? Our profession, nutrition science, it's a female field."

I don't think there are any gender barriers because 90% of my classes or 95% is same gender. Now at sometimes I think I wish there were more males because that will bring gender diversity to the field as gender is concerned. There were no gender barriers, no way. I wouldn't take it any less than any of my counterparts, gender, you know, different male class fellows ... Again, I may be a very different subject and I don't think I ever experienced what people think about it. It's not that I'm not sensitive and I'm not emotional. In fact, I'm a very emotional person. And I have mentioned to you earlier that that's the reason I didn't go to med school because I am very emotional. So, it's not that I'm not emotional and sensitive, and I'm not in touch with my feelings.

Professors (faculty) were compassionate, caring, experts in their fields. Rose had to wait to start her PhD one semester because she was pregnant with her first baby. "After I, you know, so the baby actually came, like, two weeks earlier so I wasn't able to take final exams in many of my courses." However, her professors allowed her to complete the exams at a later date and gave her incomplete grades:

But my teachers are very nice, so I talk with them. Some of them, they gave me incomplete grade. So, I can, you know, I was able to complete that lecture for the supreme semester. So, this is actually what happened.

Tanvi developed a very positive relationship with a major professor, who provided emotional support and guidance:

So, it was more of a colleague relationship. And I remember one time my major professor said the difference between you and me is just all these years of intellectually, emotionally. She was available when I needed her. She helped me to deal with my personal conflicts and losses. About if I can really tell my major professor anything which is going on in my life. And she'll be able to guide me, give me some advice or help me to come out of it. So, I had that relationship. So, she bestowed a lot of respect on me, intellectual respect. And I did not want to turn her down, so I tried my best and I came out of my personal, emotional breakdown okay. It could have been worse. I could have left the thing, but she kept me on track.

**Mentors Played a Key Role in Their Success.** April secured good mentors once she started her PhD in microbiology and Immunology:

And once I started at the university I also was blessed with a wonderful mentor from my graduate studies. The relationship that I did with my mentor was I think key for that because I was not afraid of her. She was very supportive of all my activities, not only in the lab.

Akilah was also helped by this female mentor who prepared her for a future teaching career:

And I got to talk to different people, especially from different disciplines within the STEM, & outside STEM. And it gave me a really wonderful opportunity to become a better teacher, I think. And that really helps me even now.

**Received Support From Dissertation Chair.** Rose recalled her first meeting with her dissertation chair: “The first day that I went into his office and talked with him about the opportunities, I really wanted to do something, so it helps humanity. You know, it helps to cure the cancer or things like that.” Her chair inspired her and motivated her: “So, he was so sweet. He told that, maybe we cannot do directly something, but if you do this, it hopefully helps the future scientists if they read this paper, hopefully they can consider something about it.”

**Received Support From Dissertation Committee Members.** April searched for an expert who could serve on her dissertation committee: “And so, I remember, you know,

composing an email to contact this faculty member. And, I mean, I spend hours just writing, like, five lines, you know, asking him to be a part of my dissertation committee.” “Well, a long story short, he agreed. He said, you know, he’d be glad to participate in my committee.”

And so, for my actual defense he had to come for my final evaluation. So, I had the opportunity to meet him. And that day of my evaluation I was, you know, asking him for, you know, kind of like suggestions, input about post-doctoral positions. And then he said, come visit my lab. And I was like, “Oh, my goodness.” So, I interviewed in a different lab, and then I went, and I visited his lab. And he offered me a job to do my postdoctoral training with him. And from that, you know, here we are.

For her dissertation, Tanvi was supported by more than nine faculty members: “I did research committee from computer science, from public health. I did international health from internship program.” “And I had my nutrition professors too.” “So, I had faculty members from a lot of fields, but it was very interdisciplinary”. “So that made my thesis committee who put up, like, nine members. Nine signing members.”

The most important contribution to the success of the participants during their doctoral STEM studies was the support from academic advisors, research supervisors, faculty, and mentors. All the participants reportedly received good guidance from their academic advisors, describing professors or faculty as compassionate, caring, experts in their fields. The participants credit the support from their dissertation chair, dissertation committee members as a contributing factor for graduation, and felt mentors played a key role in their success. Despite the fact that one participant had perceptions of discrimination from her male research supervisor as compared to domestic female STEM PhD students, the same participant credits this male faculty member for her numerous publications, professional connections, and success with her dissertation. Another student had perceptions of sexual harassment by her research supervisor but acknowledged he was very helpful in helping her pass numerous courses lending her books, giving her access to computers, encouraging her to participate during class, and was very instrumental in passing the

defense of her dissertation. Both participants felt their male research supervisors considered them dedicated and “*brilliant*” students. None of the participants experienced a cold or biased environment from their male faculty because of their gender as females in STEM fields. Many participants gave credit and acknowledged the great support received from male faculty. Female faculty was equally supportive.

### **Theme 7: Balance**

**Pilar’s ABR.** Pilar used humor for relaxation, achieving balance and overcoming stressful and difficult situations. She often read and liked comic strips. She presented me with three samples she found in her journal and notes she took during her PhD studies. One comic strip she was raised with and brought with her to the United States is from South America (*Mafalda*) and 2 comic strips were from *Calvin and Hobbes* that she used to read while learning American English and came to love as well.

“*Mafalda.*” There is a life-size statue of a little girl with a permanent seat on a bench in Buenos Aires, Argentina. She is wearing a green dress and matching hair bow with a large smile from ear to ear. Her name is *Mafalda*. Based on the statue, an Argentine comic strip was written and drawn by cartoonist Joaquín Salvador Lavado Tejón, better known by his pen name, Quino. *Mafalda* is not an average six-year-old comic strip character; she became a cultural icon. *Mafalda* first appeared in 1964 when she was 6 years old and ended in 1973. *Mafalda*, the highly intelligent and opinionated little girl who hates soup and loves the Beatles, has a big heart and a remarkable awareness of the world. She became an insightful commentator of social events all over the world. She challenged her nation and cared about humanity and world peace. She became a feminist role model for all the little girls in South America. *Mafalda* did not want to marry well, have babies, live in a big house, and own a luxurious car like all her South American

contemporary little girls. Mafalda wanted to study nuclear physics and become financially independent!

Mafalda questioned the state of the world, from the safe position of a fictional child. She tackled the Vietnam War, nuclear weapons, and the meaning of life. She became a political commentator. She even dictated the dietary habits of South American children who, after reading the cartoon, refused to drink soup [a staple feature of South American daily cuisine]. Mafalda still has fans who miss her and are exposing their little daughters, female students, and girls to this cultural icon as a symbol of strong intelligent and independent women.

(<https://www.peruforless.com/blog/cultural-vibes-mafalda-the-comic-strip-character-from-argentina/>); (<https://www.timetravelturtle.com/mafalda-statue-buenos-aires-argentina/>)

**Findings for Pilar's ABR.** The comic strip of *Mafalda* contributed to the themes of family encouragement; overcoming acculturation and cultural shock (building systems of support); overcoming serious critical personal incidents; close yet so far from loved ones; overcoming academic barriers; balance; resilience; and persistence.

All of the participants stated they had to work very hard to maintain balance and juggle their multiple roles and responsibilities. A summary of the descriptors regarding these issues can be found in Table 19.

Figure 28

Pilar/12072017 ABR: Mafalda Comic Strips in Spanish and English



ENGLISH TRANSLATION

I am not uncombed.  
It is only that my hair has freedom of expression!!!

{Third comic Strip}

*Mafalda learning the meaning of word*

*“Democracy” [In Dictionary]*

*“DEMOCRACY” (from Greek Demos*

*meaning THE PEOPLE and Kratos*

*meaning authority or POWER. It is a*



**Table 19***Data Summary for Theme 7A: Balance*

DESCRIPTORS							
Participants	Rigorous/ disciplined study habits	Husband delayed studies/ work plans	Shared household chores	Family members helped in childbirth	Family/ Community Helped Babysitting	Took time off from work	Took longer to complete all the required courses
Luisa/07312017	X	X	X				
Akilah/09132017	X	X					
Pilar/12072017	X					X	X
April/12132017	X	X	X	X	X		
Mira/09182017	X	X	X				
Rose/03212018	X	X	X	X	X	X	
Ana/02032018	X						
Tanvi/04162018	X						
<i>N = X</i>	<i>N=8</i>	<i>N=4</i>	<i>N=5</i>	<i>N=2</i>	<i>N=2</i>	<i>N=2</i>	<i>N=1</i>
<i>N=8</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>8=100%</i>	<i>8=100%</i>	<i>4=50%</i>	<i>5=62.5%</i>	<i>2=25%</i>	<i>2=25%</i>	<i>2=25%</i>	<i>1=12.5%</i>

All of the participants stated they had rigorous and disciplined study habits. Four shared that their husbands delayed studies and/or work plans to accommodate and support their PhD studies. The majority of the participants (five out of eight) shared household chores; however, only two of the participants received help from family members during childbirth. Two of the participants received help from close family members or their communities with babysitting and/or raising small children. Additionally, two participants took time off from work at different



stages of their PhD studies. Only one of the participants took longer to complete all the required courses. Two of the participants could not participate in most PhD activities and meetings due to work commitments. Half (four) of the participants had to delay their dissertations for various reasons, such as work, research, or the birth of a new baby. Two participants postponed dating and/or getting engaged. Four participants had to balance other major commitments such as competing in sports as a professional athlete, work as a research associate and/or teaching assistant, and dual majors or PhD/professional degrees.

Achieving balance was difficult for these overachiever female STEM PhD/doctoral health science students who had multiple roles such as new wives, first-time mothers or dealing with pregnancy, raising small children, teaching assistants, professional athletes, authors, research assistants, and research associates, among others. These were some of the strategies the participants used during their STEM PhD studies to achieve balance.

**Rigorous and Disciplined Study Habits.** During the first 3 years of her STEM PhD, April was single and lived by herself. But she was completely devoted to learning English and her doctoral studies: “I have no time here for fun or for anything but to study.” April took her PhD courses in English, which she was still trying to learn. This left her no time for relaxation, travel, or anything else: “So, I study, if I was not in the lab, I was studying. I was in the library, or I was home studying.” After her marriage in her third year of her STEM PhD and the subsequent pregnancy and birth of her son, she continued her dedication to her studies: “And basically, that did not put me on a delayed path. You know, my goal was, ‘I’m going to write my thesis.’ And that’s basically what happened.” April explained that,

When I had [name of first son] I was writing my actual dissertation. And so, it actually worked out pretty well because I was up all night. But I was writing, and I used to, you know, the baby woke up. You know, I fed the baby and continue writing.

**Asked Husband to Delay Studies or Work Plans.** Rose's husband forwent going for his own PhD to help Rose complete hers first:

Well, actually, it was his kind of the second master's program. Well, I think another important issue was the reason that he didn't start for the PhD, we know that if you are two students in one house, it's pretty much a lot, like a lot of stress.

Luisa's husband put his plans to study on hold too:

My husband wanted to study, but it was really difficult for him [husband] to study because we didn't have money to pay for anything, he saw a lot of possibilities to study, but he needed to study English as well and that was very expensive too.

Mira waited for her husband to get his credentials as a pharmacist in the United States:

Right. Yeah, I mean he's a pharmacist. My husband is a pharmacist. So, you know, when he came, he kind of went through the licensing process and it took him, like, about a year and a half because of the exams that he would have to take and the internship and so on.

Pilar also commented that:

My husband has been very supportive all the time, yeah. And he has always been. He's a Chemical Engineer. So basically, he gave up his career at home to come here. And then, so once he came in my third year, so I finished up pretty much on time. So, after that we moved to Ohio for my postdoctoral training. So, then he moved again with, you know.

**Shared Household Chores.** Luisa remembered that "every day after school I would get home and cook dinner."

But then my husband started learning everything that I know how to cook. Then he started calling his mom to ask her for recipes of all her dishes. And that is how he learned how to cook and has been taking care of that for the most part.

April shared household responsibilities with her husband too:

But that's where the support of my husband comes into play because without that ... so you have to be a team basically. Cause I couldn't do it alone, you know? And so, we basically shared every responsibility.

**Asked Close Family Members for Help During Childbirth.** Rose's mother came to the United States to help her during the birth of her first daughter:

So actually, I talked these things with my mom and my dad. So then, my dad actually he even told my mom that, “Oh, you should definitely go. We should get the visa for you and you should go. Then, yeah, she actually applied for the visa during that summer and so she was able to come for the baby before [baby girl] she came.

So yeah, she actually helped me a lot. Without probably, yeah, it cannot be possible, yeah. So, she came that year and that was funny. After I, you know, so the baby actually came, like, two weeks earlier so I wasn't able to take final exams in many of my courses.

Well, for the first one, because the second one when I got her, it was a time that my husband was not actually working anymore because he wanted to go back to graduate school. So, he actually stayed at home, you know, for one year or less than one year probably. So, he was able to, yeah, help me.

### **Asked Trusted Family Members or Community Members for Babysitting Small**

**Children.** Rose is a good example:

Well, my husband, for instance, whenever I was working for my qualifying exam, he took care of her during that summer. I mean, he was just preparing the formula and he was changing the diapers and things, so during the summer times he helped a lot.

So, once he [husband] started to do the PhD program, he actually started in math education. So, he was able to arrange his classes. So, you know, whenever I go to teach, he was taking care of her. Whenever he goes to teach, I was taking care of her.

So, our second daughter, she was actually lucky I can say because we both had a lot of time with her, especially my husband and they still have a very different relationship with her because he had a lot of time with her.

**Took Time off From Work.** Pilar had to take time off from work to prepare and take her qualifying exam: “I got a one-week vacation from work and then just devoted myself to that, and I completed, and I passed [qualifying exam].”

**Took Longer to Complete all the Required Courses.** Pilar had to do this to fulfill her job requirements: “So, I couldn't devote my entire time to the doctoral degree. I was just mixing it with— [work].”

**Not Participating in all PhD Activities.** Pilar was also very conscientious of the time off her supervisor gave her to attend her doctoral courses:

And I needed to honor what Dr. [name] from [university], who was giving me time. So, I went to class. The class ended. I went back— [to Research work]. I couldn't stay—well, the only thing is we have group assignments or something I will do that. But other than that, I couldn't do anything else because I had to really work.

**Postpone Dissertation.** Mira did not overwork herself. This is one of her traits for success: to be dependable and consistent while avoiding unnecessary stress. Her priorities were, in order, God and her Hindu faith, her family (at that time her husband), then her studies and research.

And, you know, again, it wasn't like I was a workaholic that I was in the lab for 20 hours a day. It wasn't like that, you know? And perhaps if I were doing that, I could have maybe graduated in 5 and ½ years. But I wasn't like that, you know. There was like a work-life balance, you know. That was important. Yeah, it's important. I don't regret, you know, taking that much time.

It took Pilar a total of 8 years to obtain her doctoral degree. Her dissertation took 4 years. She postponed writing her dissertation due to her job commitments:

About 6 years. Actually eight [time it took to complete her doctoral program]. It was 4 years with all the classes. But then the work took really over. I was like, "Oh, I need to do my proposal." So, what I did was, like, independent study to keep in the school until my advisor said, "No longer. You have to do this and this." I said, "Yes. You're right. I need to do this." And I said, "Let's do it right away."

For the birth of her second daughter, Rose chose to delay graduation. She wrote her dissertation and taught on-line courses as a TA:

Because I gave birth in 2011, so I didn't really want to complete it exactly at that time, and this is what my advisor he suggested me to. He said that if you do—I mean, we can do something wrapping up very quickly, but he didn't really want it, you know?

**Avoided dating, and or getting engaged.** Pilar made this difficult decision:

One of the things is that my personal life was on hold. It's not that I didn't go out. I went out, but one of the things I was very [careful], and that's something that may happen also is that I was very aware that I was emotionally susceptible because I was away from my family. So, I only Skyped to not get into a relationship that I think this is not going to be possible for me. So, I said, No. Let's focus on this, just be friends but nothing else or whatever. But that's something that is important, especially when you are a woman, and you came from another country.

Tanvi struggled to keep a balance between her personal romantic life and her duties as a PhD student and TA. Her long-time romantic relationship terminated, causing her to suffer a nervous breakdown:

Yeah, I think I had a personal issue with someone I was involved with romantically here [in the United States] for a long time and something which didn't work out. But a lot of it was because a lot of it was internalized and resolution delayed.

**Postponing Marriage.** April postponed her marriage during her PhD:

So, I used to keep in touch with my husband that at the time we were dating, but he was back in [Country of origin]. Right, yeah. We were separated for 3 years. And so, it was really difficult.

**Balancing Other Major Commitments.** Ana was a student athlete competing in major leagues during her STEM PhD:

And I got recruited to play at the university to play [sport] as a student athlete. So, I think that's very different. I don't think that's the usual...because I was recruited to the United States to pursue my tennis career and getting my education as a student athlete ... It so happened that I chose civil engineering and that's one of the things that I think is a little bit different. My priority was always [sport] and secondary was actually just getting an education.

Additionally, Ana had to balance her sport practice, her research, and her Teaching Assistant job:

So, I was really grateful to get in the position [Teaching Assistant] and different things like that, but I think I would have graduated faster if I would have had funding to actually do my research, which is why I went there in the first place, right?

**Maintaining Balance is a Major Obstacle for Female STEM PhD Students.** It is considered the major reason for leaving the STEM fields; a term the literature refers to as the "*leaky pipe syndrome in STEM*" (Blickenstaff, 2005; Cannady et al., 2014). Some of the many positive strategies the participants in this study used included: rigorous and disciplined study habits; asked husband to delay studies or work plans; shared household shores; asked close family members for help during childbirth; and asked trusted family members or community

members for babysitting small children. Some took time off from work; others took longer to complete all the required courses; not participating in all PhD activities; postponed dissertation; avoided dating, and or getting engaged; and/or postponed marriage; and or getting pregnant.

### **Theme 8: Self-Determination**

This theme's finding addressed the main research question:

What are the lived experiences of successful female scientists who earned a PhD as international doctoral students in Science, Technology, Engineering or Mathematics (STEM) or completed a dual PhD and/or Professional program in Health Sciences in the United States?

The majority of participants indicated high levels of internal and external sources of motivation that led them to pursue and obtain a STEM PhD. (See Table 21 for a Data Summary of Theme 8. Self-Determination. Motivation for Enrollment and Staying in STEM PhD/Public Health Doctoral Program,) Despite their many barriers and impediments, all eight participants (100%) had faith in themselves and never for a moment felt they could not achieve their goals due to their female gender. All participants had intrinsic and extrinsic forms of motivation. Some extrinsic forms of motivation are listed under the participants' profiles because they occurred before the participants started their STEM PhD programs.

The poem shown in Figure 29 contributed to this theme under internal and external sources of motivation; Findings 2, factors for success or factors that participants perceived enabled them to successfully complete their STEM PhD and graduate; Findings 3, experienced barriers and how she was able to navigate those barriers; and Findings 4, Personal Attributes.

**Figure 29**

*Mira /09182017 ARB: Poem "If You Think"*

*If you think*

*If you think you are beaten, you are.*

*If you think you dare not, you don't.*

*If you like to win, but think you can't,*

*It's almost certain that you won't.*

*If you think you'll lose, you're lost.*

*For out of the world we find*

*Success begins with a fellow's will --*

*It's all in the state of mind.*

*If you think you are outclassed, you are*

*You've got to think high to rise.*

*You've got to be sure of yourself before*

*You can ever win a prize.*

*Life's battles don't always go*

*To the stronger or faster man.*

*But sooner or later, the man who wins*

*Is the man who thinks he CAN.*

*Note.* Poem written by Mira, English Version.

### *Extrinsic Factors for Motivation*

In terms of extrinsic factors for motivation, the majority of participants (seven out of eight) identified as external sources of motivation for enrollment and graduating with a STEM PhD as being inspired by a family member. Here are some of their descriptions:

My sister asked her post-doctoral advisor, to consider the possibility of sponsoring a visa for me to come and help her during that year [sister's first pregnancy and maternity leave], for a year. So, I got a visa as an exchange student, a J1 is what it's called, I think? (Luisa)

Mira's extrinsic source of motivation came from her parents:

My parents were totally committed to our education. So, you know, so combine—I think those two things together, my mother's passion for education and then my father's for just his passion and capability and educator kind of shaped all of us.

Pilar's extrinsic sources of motivation came from her older sister:

My oldest sister is also PhD, and she has doctoral degrees, and she has studied overseas.” “I saw my sister getting all that ... I mean, pursuing her academic goals. And for me it was that I wanted to do that also.”

For April, both parents contributed as sources of external motivation:

So, they both struggled a lot. And neither of them was actually able to complete a college degree. But that was not a limitation for them to do the best they could to actually make sure that we had a better education than what they had.

Rose's sources of external motivation included her father and her mother, who was self-educated, and her older sister, who was the first in her family to graduate from college:

For instance, my mom and my dad. My mom, actually, I think she didn't even completed elementary school and my dad, I think he just got his middle school degree, but he was a very open-minded person. He was like a director of one company in the town that I was living. And my mom, she was reading a lot of books and things like that. She was all the time trying to encourage me. And I can say that, you know, in terms of the family I got a lot of encouragement as well.



With regard to Rose's older sister:

Well, I actually had a sister who is two-and-a-half years older than me. So, she went to college". "Yeah, it was something like that. It really wasn't very common" [In her small rural Muslim community].

Ana's external sources of motivation to pursue a PhD in Civil Engineering came from:

My dad, he's an electrical engineer. Of course, I think he played a major factor because having a scientist as a relative, usually relative will probably influence kind of those positions.

And my mom works, [she has a master's degree in Administration] my dad works so that—I mean, you never know how those little things influence you. But just having the non-traditional, I guess, role in the family really made me see that I guess, that was my normal, right? Like, women have to work. There are no questions about it.

Tanvi's external source of motivation can be traced to all her family members:

My mother is a professor in English. So, we tag all the environments at home. And our large [country of origin] community, or family I should say where we had the expectation in that sense that education is something—our human capital is the biggest aspect we have. So, there was always a push towards human capital.

Only 2 participants cited peers/coworkers as their external source of motivation. Akilah's external source of motivation to pursue a STEM PhD in the United States originated from her peers, co-workers, and friends:

And after my degree, after my MPHIL degree I got an opportunity to work as a research and development assistant at the really popular laboratory in [Country of origin]. It's called \_\_\_\_\_ Research Institute. And I worked there. Initially I did a project there with one of the advisors, scientists. And then following that, I got an opportunity to work there as the research and development assistant at the same lab. And then I got to make a lot of friends. Their dreams were different. You know, their family circumstances were rolling them into a dream like that to go to foreign countries and get their degrees.

But in my mind, it never crossed because nobody in my family had ever been abroad. [snaps fingers] But talking more to my friends, I'm like, *'I should do that as well.'*"

Rose's friends from college inspired her and motivated her to come to the United States for graduate studies:

But during that time, all the friends that I was with together—almost all of them after the graduation they came here to the United States. Some of them they got their PhD like me or some of them they got their master’s degree. So, I had these type of groups. They were all, you know, thinking about education, you know, how we can get our education better. Yeah, things like that.

Other extrinsic factors of motivation for enrollment and staying in the STEM PhD/public health doctoral program included the credentials status or career advancement reported by all participants, with 2 of the participants commenting:

And they actually supported these national programs in trying to look for talented students that will have kind of a profile to do research. And so, I ended up being selected to be part of that group. And that was basically the door that opened basically so many different opportunities for me to actually be here now. (April)

Like 6 more months because the J-1 visa required that we need to stay in your home country for 2 years. So, it was one year and a half into my 2 years when she called me [Female Mentor] and she said, “I am with [Baylor 0:15:25] College of Medicine here. I need you to work with me. Are you still interested in your doctoral degree? If that’s the case, I will give you the time to do that, but I need you here. So, I said, “Yes. Of course.” (Pilar)

And then I talked with my boss, with Dr. [name 0:15:42]. I said, “I have this opportunity. I’m leaving.” He said, “Okay, I give you 2 years and you tell me if you are coming back or not.” Somebody was going to replace me, but I also had the opportunity—that was good to me that if I come here to the states and do my doctoral, I will have a job back in [country of origin]. (Pilar)

Another extrinsic factor for motivation was financial gain expressed by only 2 of the participants, as evidenced by one participant cited here:

When I was in college, I started pursuing chemical engineering because petroleum engineering was really big in my country. “But that’s the only degree that kind of gave you money. So, you know, if you wanted to make money in my country, then petroleum engineering was the big thing”. (Ana)

But I guess it was a different situation, right? Like, any field here [in the US] can get you money and back home it’s not the case. Like, you have to be an engineer if you want to get money. So, I guess that’s just the different society event that made it kind of, like, if you want to make money, you pursue an engineering degree. And I guess in the U.S. you pursue a health degree. (Ana)

Another external source of motivation was to be able to remain or stay in the United States, expressed by two participants, with the following examples from Luisa:

But at the same time, I was scared of what the future would look like for me. As an international student, I have a visa and I only had it as long as I had an advisor and an opportunity to work. If I lose that, I lose my visa. I lose everything. So, what would I do?

I used the degree to stay in this country. To me it was, like, I have made up my mind that I want to stay here, to try to stay here. I needed to find a way. And because I loved what I was doing, I loved living here in USA.

**Table 20**

*Data Summary Theme 8: Self-Determination: Motivation for Enrollment and Staying in STEM PhD/Public Health Doctoral Program—Extrinsic Factors*

EXTRINSIC FACTORS				
Participants	Inspired by Family Member (FM) Peers (P)	Credentials Status/ Career Advancement	Financial Gain	To Stay in U.S.
Luisa/07312017	X (P)	X (CS) X (CA)	X	X
Akilah/09132017	X (P)	X (CS) X (CA)		
Mira/09182017	X (FM)	X (CS) X (CA)		
Pilar/12072017	X (FM)	X (CS) X (CA)		
April/12132017	X (FM)	X (CS) X (CA)	X	
Rose/03212018	X (FM) X (P)	X (CS) X (CA)		
Ana/02032018	X (FM)	X (CS) X (CA)	X	X
Tanvi/04162018	X (FM)	X (CS) X (CA)		
<i>TOTAL=8 100%</i>	<i>FM=7=87.5% P=2=25%</i>	<i>X (CS)=8=100% X (CA)=8=100%</i>	<i>3=37.5%</i>	<i>2=25%</i>

**Table 21**

*Data Summary Theme 8. Self-Determination. Motivation for Enrollment and Staying in STEM PhD/Public Health Doctoral Program—Intrinsic Factors*

INTRINSIC FACTORS				
Participants	To gain more knowledge	Intellectual challenge	Personal fulfillment	Gender challenge
Luisa/07312017	X	X	X	
Akilah/09132017	X	X	X	
Mira/09182017	X	X	X	X
Pilar/12072017	X	X	X	
April/12132017	X	X	X	X
Rose/03212018	X	X	X	X
Ana/02032018	X	X	X	X
Tanvi/04162018	X		X	
<i>TOTAL=8 100%</i>	8=100%	7=87.5%	8=100%	4=50%

The following were the main intrinsic factors for motivation:

**To Gain More Knowledge.** All participants stated their main source of internal motivation was to gain more knowledge. Two participants related their experiences this way:

First, I got my Bachelor's in physics, chemistry, and mathematics, and from there I got a Master's in applied electronics around physics. And another, we call it MPHIL, Master of Philosophy. In one of the branches of physics, it is called photonics. P-H-O-T-O-N-I-C-S. That's all about laser of light and things like that ... And finally, I got into the program for the Master's in Physics in the United States [graduated] and from there they considered my application for the PhD and then they gave me admission to the PhD. It was always my desire to gain more knowledge. (Akilah)

Because I did my undergrad in Texas. So, I did have that challenge there. So, as an international student going from speaking Spanish to a school that is all English. In Texas that was something that was a complete shock. But then because I did my undergrad there, coming to grad school that wasn't so big of a barrier, but I know that that was definitely something that I would have struggled even more if I was transitioning directly to grad school. [After my Master's] I did an internship, I really enjoyed being in a classroom a lot more. Like, it fit more with my personality and my lab style. So, I thought, like, that definitely solidified my decision to pursue my PhD... I wanted to learn more and more. (Ana)

**Personal Fulfillment.** All participants stated they wanted to obtain a STEM PhD or doctoral health science degree for personal fulfillment. This comment was cited by one participant:

When we were growing up in [Country of Origin], it was always like, you know, either you become a doctor, or you become an engineer. So those were the two chosen professions, you know? And so [laughs] those were actually my parents' dreams, you know, that we would become doctors—like medical doctors. And unfortunately, none of us could fulfill those dreams. But in our own way we kind of excelled in getting educated and developing good professional careers. (Mira)

**Intellectual Challenge.** The overwhelming majority, 7 participants, stated their inner source of motivation for enrolling and graduating in a STEM PhD or doctoral degree in the health sciences was to fulfill an intellectual challenge. April provided the following comment:

I used to get really down and kind of sad about, you know, when you put so much effort and then you think you did really well and then you get a list of things that you did wrong or that you could have done better... But then, you know, I was like, "Okay, what did I do wrong? This, this, this, this." Okay, next time I'm gonna make sure that I don't do this. You know, like, I took that as a challenge of I'm going to prove to you that I can do this better.

**Gender challenge.** Half of the participants described pursuing a STEM PhD as a gender challenge. Ana is a great example: "Well, I mean, I guess my barrier was also my motivator, right? Like, not seeing women who had a PhD in structures".

Well, I think one of the things that really motivated me the most. Yeah, like, highly motivated me, especially when things were really bad, was that I was gonna be the first woman graduating with a PhD in structures since 40 years ago. They made an article that it's been 30 years since a woman got a PhD at [name of University] with a structure's focus. In civil engineering, that institution may have gotten a lot of PhDs in environmental or hydraulics or transportation. (Ana)

## **Theme 9: Resilience**

All participants were very resilient in the face of adversity, obstacles, personal conflicts, and/or academic challenges. The resiliency theory was defined by Morales and Trotman (2004) as the "ability or process of remaining in-tact in the midst of potentially and often destructive

environmental factors (p. vii). Furthermore, all of the participants learned to manage the stressors responsible for their barriers and succeeded in conflict-resolution by self-directed means. (Table 22 provides a Data Summary for Theme 9: Resilience).

The majority of the participants (6 or 75%) sought first, direct conflict resolution. However, all of the participants reached out and increased social connections; sought out and obtained advice, treatment, and or support; learned life skills; sought opportunities for significant participation; and set clear and consistent goals. The great majority (7 or 87.5%) set clear boundaries. These were some of the strategies the participants used which made them resilient:

***Sought First Direct Conflict Resolution***

Luisa tried this strategy first: “And he [Research Supervisor, Academic Advisor and Dissertation Chair] was getting, he got too personal and at one moment he told me that he was attracted to me. And that changed the whole situation”. “

I was married. My husband wasn’t here and remember that even the first [meeting] ... and everything that kind of started, he [Research Supervisor, Academic Advisor and Dissertation Chair] was building up things in his mind without me knowing.”

Yeah. I was not willing just to start all over again. I was so tired. I felt so tired and so stressed and that I didn’t think that I could start all over again and lose my job. So, I tried everything. Multiple times, like, every time we would have some arguments, I would go and talk to him again and ask him to find a way for us to finish my projects so I could leave.

***Reached Out and Increased Social Connections***

April sought those connections: “And it became clear to me that if I don’t seek the help that I need, nobody’s going to help me. You know? So, I think that resourcefulness helped me a lot, too.”

Mira reaffirmed the value of those social connections:

You know, if you're feeling down, if there is someone to support you, just hear you out, kind of give you encouragement, you sort of overcome. Because, you know, most of these barriers are sort of short-lived, you know? And the barrier may be there, but you may sort of feel down at some points. And then if that support is there, I think that really is crucial. And so, I was very fortunate.

### ***Sought Out and Obtained Advice, Treatment and or Support***

Luisa consulted with a Dissertation Committee member:

I also talked to one of the other members of my dissertation committee... I was very afraid when I talked to him, but not about his situations, about my situation of leaving the lab. And that was at the time point that I needed to leave, that I knew I was in a good position to leave, but then my PI didn't want to let me go. So, I went to talk to him [Dissertation Committee Member] and he said, like, 'You need to get out of this place. You need to go. He's not gonna let you go, and you need to go. So, this is your opportunity.' He did tell me, like, 'If you go now, you'll find a place and it's very good for you.'

Ana met regularly with a group of international doctoral students:

But it was something that was constant and just having conversations we'd always talk about things that were happening in our daily lives and if you were struggling with research, then you open up that question. You know, like, "I've been working on this problem, and I haven't solved it. What do you guys think?" You know, and some of us are engineers, so we just put our brains together. You'll stand there, you'll try to solve an equation or something like that for work or in class. And just having conversations. And I remember being, having this problem and having them, just like brainstorm ideas. And some of the things that they were using in their field, kind of like, how that ties in. Civil engineering, and that really was very critical for my field of study and developing my research project. But it was just, like, a conversation kind of thing, so it's nothing really formal about it

Akilah sought counseling:

I talked to the counselors and found out that there were a lot of resources that can help me, advise me to make things right. Sometimes it could be me. That way that I think could be not the way it's supposed to be. So, they helped me to kind of clear the fog I should say and forget about what happened but find a way how you're gonna live your life today.

Set clear consistent goals and boundaries. Pilar experienced a hostile co-worker: But it was I think, it was more because of the personality or the issues that that person was facing, I guess. That it was, like, you can tell. I mean, it was difficult. In some moments, the relationship...because it was, like, it seems like it was, like, jealousy or like—[competition]

Yeah. Yeah. I really said, “I’m not going to argue with this person.” Her opinion really was not important to me. She was not providing for me the job—Or my salary, so I just, we need to work together because this is a work environment, and we need to be professional. So, I was clear in that sense. What I tend to do is I work with that person, but I don’t interact for any other reason because if I don’t like it, I need it to establish boundaries.

Additionally, Mira explained that:

So, I was the tortoise, you know? it wasn’t like I was the best student, there were others, but you know, I was a very consistent—you know, in the higher level, but a very consistent sort of a student. And so that foundation was there, you know, of trying to achieve and always moving on to the next level.

### *Learned Life Skills*

Pilar explained how studying abroad helped her become independent: “Going away from my family and living overseas helped me a lot. I really grew up and matured a lot and learned about responsibilities. So that was a good experience.”

Mira also stated that:

And then the third thing that I feel really that I personally feel is there, which I don’t know if people may agree or not. But when you come to a foreign country, you sort of, you know—how should I put this? It’s kind of like you are up against a lot of things, right? And you know how—okay, let me use this phrase. Let’s say when you’re in your own country, you know, everything is very familiar and you become kind of, you know, complacent. Right? When you are in a foreign country, you kind of want to prove yourself. You know? So, you work harder, and I think that’s a factor for success of, you know, people who come here from other countries. You want to prove yourself. You work harder.

Sought opportunities for significant participation. Ana sought these opportunities:

And I wanted to do some of the national conferences that are targeted for graduate students, and their early career grad students are also later—like, more advanced grad students. And those workshops really talk to you a lot about professional development and other opportunities that you could get as a PhD.

Rose shared:



I'm really ... I was doing a lot of presentations before and I think probably that was a very important thing that really helped me a lot to find a job Because right now the job market is so competitive, so it has really helped.

Ana reiterated the same about seeking opportunities:

Again, I was a TA, and so being able to develop those skills, develop the curriculum and being in the classroom. And eventually, I guess, more and more responsibilities because I got to lead a lab. I was able to open up a course to travel abroad, so that really helped me a lot in terms of being able to put my skills into something that I really enjoyed.

**Table 22**

*Data Summary for Theme 9: Resilience*

DESCRIPTORS						
Participants	Sought first direct conflict resolution	Reached out and increased social connections	Sought out and obtained advice, treatment, and/or support	Set clear consistent Goals (G) and Boundaries (B)	Learned life skills	Sought opportunities for significant participation
Luisa/07312017	X	X	X	GX	X	X
Akilah/09132017	X	X	X	GX	X	X
Pilar/12072017	X	X	X	GX; BX	X	X
April/12132017	X	X	X	GX; BX	X	X
Mira/09182017	X	X	X	GX; BX	X	X
Rose/0312018	X	X	X	GX; BX	X	X
Ana/02032018	X	X	X	GX; BX	X	X
Tanvi/04162018		X	X	GX; BX	X	X
N = X N=8 8=100%	N=6 # = x % 6=75%	N=8 # = x % 8=100%	N=8 # = x % 8=100%	G=8 N=8 # = x % 8=100% B=7=87.5%	N=8 # = x % 8=100%	N=8 # = x % 8=100%

Those participants who became most resilient were part of a high-risk group that predisposed them to failure; experienced unsurmountable obstacles; learned to deal with the stressors that caused the obstacles; and obtained conflict-resolution by self-directed means. These are the basic tenants of Morales and Trotman's (2004) Resilience Theory.

***Tanvi's ABR***

Tanvi presented me with a poster that reminded her as a PhD Student of Nutritional Sciences how blessed she was. Tanvi travelled extensively and a poster (see Figure 30) of marginalized and impoverished children in Africa, fending for themselves and trying to find food and water, kept her focused and determined. The African children are seen having to drink contaminated water. The poster informed themes 2, Finding Hope and Strength in Religion/Faith/Spirituality, and 9, Resilience.

According to the United Nations, countries in Sub-Saharan Africa spent an average of 40 billion hours per year collecting water [the same time spent during one labor year by France's total workforce]. That is an incredible amount of time invested in what most people in the United States take for granted. The lack of clean water seems like an insurmountable barrier to self-help and independence. The citizens of under-developing countries cannot cultivate their plants or grow their animals for basic food supply; children, teenagers and young adults cannot attend schools; and adults cannot go to work. Without access to clean water, breaking away from the cycle of poverty is impossible. Millions of women and children are affected by this crisis on a daily basis. They spend many hours of their days trying to find unclean water located far away from their isolated villages and transporting it back to their villages every day.

<https://thelastwell.org/the-current-state-of-contaminated-water-related-diseases-in-africa/>

In Africa, the average container called the jerry can weighs more than 40 pounds when filled to the top. Women and children carry these heavy containers on their shoulders or backs for many miles every day until complete exhaustion, causing physical and emotional disease and fatalities. It is estimated that more than 80% of deadly illnesses in developing countries are caused by drinking dirty contaminated water. Cholera, dengue fever, malaria and hepatitis are

just some of the most common deadly illnesses linked to drinking contaminated water.

<https://thelastwell.org/the-current-state-of-contaminated-water-related-diseases-in-africa/>

Contaminated drinking water supplies are the direct cause of water-related diseases. The drinking water supplies get contaminated with feces and urine of people and animals infested with diseases. Leaks and spills from sewers, septic tanks, landfills, residential, and industrial structures affect most drinking water supplies. Mosquitoes carrying malaria nests in the still contaminated waters, aggravating the problem. There is a great need in Africa and other developing countries to ensure access to clean water drinking water; educate the poor on better sanitation and hygiene by creating restrooms, showers, bathing, and washing facilities to impede waste and feces to contaminate water supplies. <https://thelastwell.org/the-current-state-of-contaminated-water-related-diseases-in-africa/>

### Figure 30

*Poster: African Children Drinking Contaminated Water*



*Note.* Poster provided by participant Tanvi/04162018 ABR; unidentified source [non-copyrighted]

**Theme 10: Persistence**

All of the participants persisted, succeeded, and graduated with their STEM PhD and or doctoral professional program in the health sciences in the United States. Bair (1999) defined persistence as the “the continuance of a student’s progress toward the completion of a doctoral degree” (p. 8). Obtaining a STEM PhD or doctoral degree in the health sciences in the United States is a monumental achievement that produces professional and personal prestige. But to achieve this milestone, the female international doctoral students who participated in this study had to go through many hardships and overcome many barriers. Before being “hooded” while wearing their cap and gown and walking the stage, they first had to endure interfering life events, personal sacrifices, and dissertation challenges (Spaulding & Rockinson-Szapkiw, 2012).

All of the participants described the personal factors that helped them to persist. Additionally, all of the participants reported the specific social factors that contributed to their persistence. And, furthermore, all participants were grateful for the institutional factors they believed helped them to persist. (See Table 23 for a Data Summary of Theme 10: Persistence.)

I will explain this theme by narrating the perceived factors that contributed to the persistence of one female PhD STEM Student (Mira) and one Doctoral Student in Public Health (Pilar).

***Personal factors***

Mira’s husband was very supportive and helped her to persist: “But, you know, I mean, like, definitely if someone is there with you that is a great source. And if they are not only there but they are encouraging you. You know, they believe in you.” Not becoming pregnant, and not having to deal with childbirth and raising small children during her PhD STEM studies actually worked in Mira’s favor:

Yeah. I mean, I think definitely if you have a family with kids, it would definitely be hard. I did not, like I said, I did not have that. But I can totally imagine that, you know, having a family with kids, you know, if it's just your husband or your wife, you know, it's different. But, you know, having to take care of kids, it is a whole different thing. So, I would imagine that it would be 10 times more difficult than if you don't have kids.

Mira learned the importance of being consistent and persist without getting burnt-out: It almost took me, like, 7 years to, you know, fully graduate, you know? Because of the amount and the quality of work that I produce for my dissertation.

Pilar also shared some personal factors:

All of us [siblings] are professionals. My oldest sister is also PhD and she has doctoral degrees, and she has studied overseas. Anyway, I saw all that stuff and my brothers are Engineers. And my other sister is a social worker. A lot of support. Family members have encouraged me.

### ***Social Factors***

Mira had family members in the United States who provided a lot of support:

So, if there is someone to show you the ropes, that's great. If you come, I think for someone who would come here and have nobody else of, say, immediate family or some family, friends and so on. For them it might be a little bit different, difficult. I mean I came here to the U.S.; my uncle was in [name of State]. And that was also one of the reasons why I chose [Name of University]. My sister was already in the U.S. So, I was not, like, totally alone. So that support system was there, you know? So those are things that really helped.

Pilar built a strong system of support since her first trips to the United States to conduct internships and her master's degree: "I was very lucky when I started coming to the States and met the right people. I really met the right people and they supported me, encouraged me, opened doors for me."

### ***Institutional Factors***

Mira's university was extremely supportive of her PhD endeavors. This contributed to her success:

And, you know, a few students—graduate students or post-docs in the lab, right? So those are all your support system, right? So, when you enroll into the graduate program, your director of the graduate studies definitely...and I guess the whole department as such.

Pilar found a lot of support from her faculty, academic advisor, and staff at her university:

But I got very good teachers also. And if I have difficulties, I talk with them and they clarify. But I have a very good academic advisor ... I love my advisor. He gave us a lot of independence, but good guidance to complete the studies. And usually in my quantitative Dissertation I worked with the statistician [from my university].

**Table 23**

*Data Summary Theme 10: Persistence*

Participants	DESCRIPTORS		
	Personal Factors	Social Factors	Institutional Factors
Luisa/07312017	X	X	X
Akilah/09132017	X	X	X
Mira/09182017	X	X	X
Pilar/12072017	X	X	X
April/12132017	X	X	X
Rose/03212018	X	X	X
Ana/ 02032018	X	X	X
Tanvi/04162018	X	X	X
<i>N = X</i>	<i>N=8</i>	<i>N=8</i>	<i>N=8</i>
<i>N=8</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>8=100%</i>	<i>8=100%</i>	<i>8=100%</i>	<i>8=100%</i>

As observed in Table 23, all of the participants persisted until they obtained their STEM PhDs or doctorate in the health sciences. What they experienced is stated in the textural descriptions. The structural description states how they persisted and their overall feelings after they completed their degree requirements are stated in the composite description or essence of

the experience (Moustakas, 1994). The structural description involves several factors. “These factors include personal factors (i.e., motivations for pursuing the degree, reasons for persisting, strategies for dissertation completion), social factors (i.e., support systems and coping mechanisms), and institutional factors (i.e., program characteristics)” (Spaulding & Rockinson-Szapkiw, 2012, p. 209).

### **Theme 11: Identity Building**

To illustrate this theme, Ana presented me with one ABR artifact, which I present as a digital picture in Figure 31. This picture was an actual painting created by a group of Hispanic female PhD student engineers during one of the conferences they attended to motivate and empower each other. The conferences were sponsored by the Society of Hispanic Professional Engineers.

#### ***Findings for Ana’s ABR***

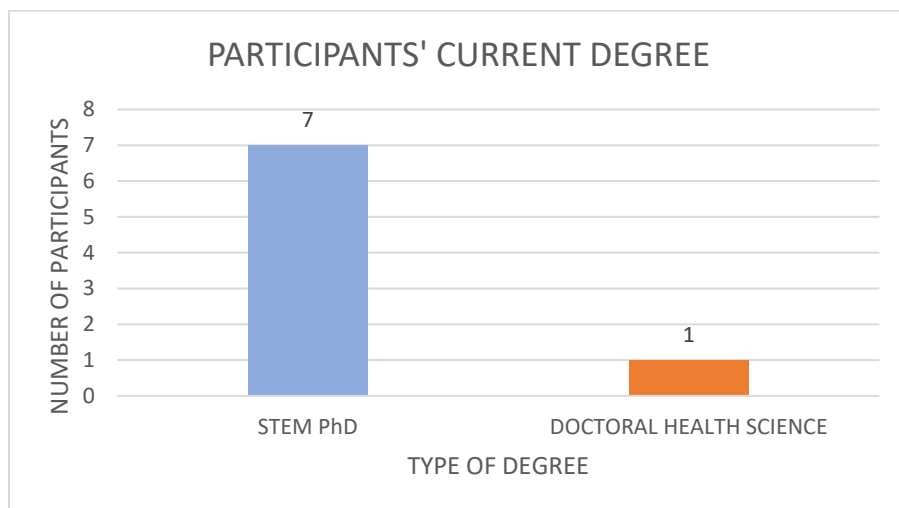
This picture informed theme 11, Identity Building, in which Hispanic female PhD student engineers motivated, encouraged, and empower one another to create a new identity for themselves as Hispanic female doctors in engineering in the United States, against all odds. After moving to the United States to pursue a doctoral program in the sciences, all of the women built a new identity for themselves, obtaining their STEM PhDs or Doctoral degree in the health sciences as represented in Figure 32.

**Figure 31**

*Painting by a Group of Hispanic PhD Female Students in Engineering*

**Figure 32**

*Participants' Current Degree*



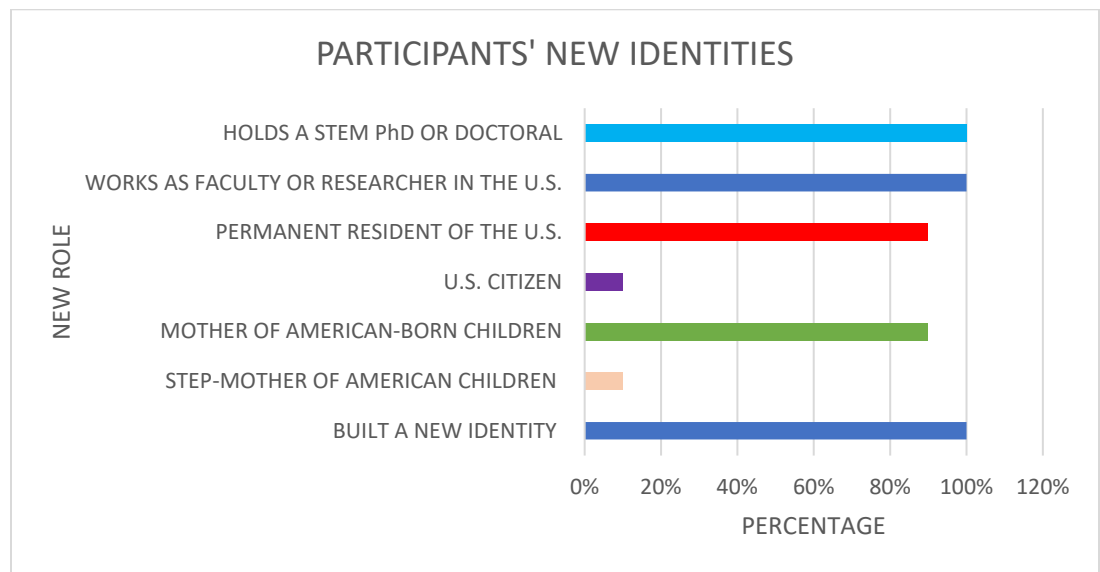


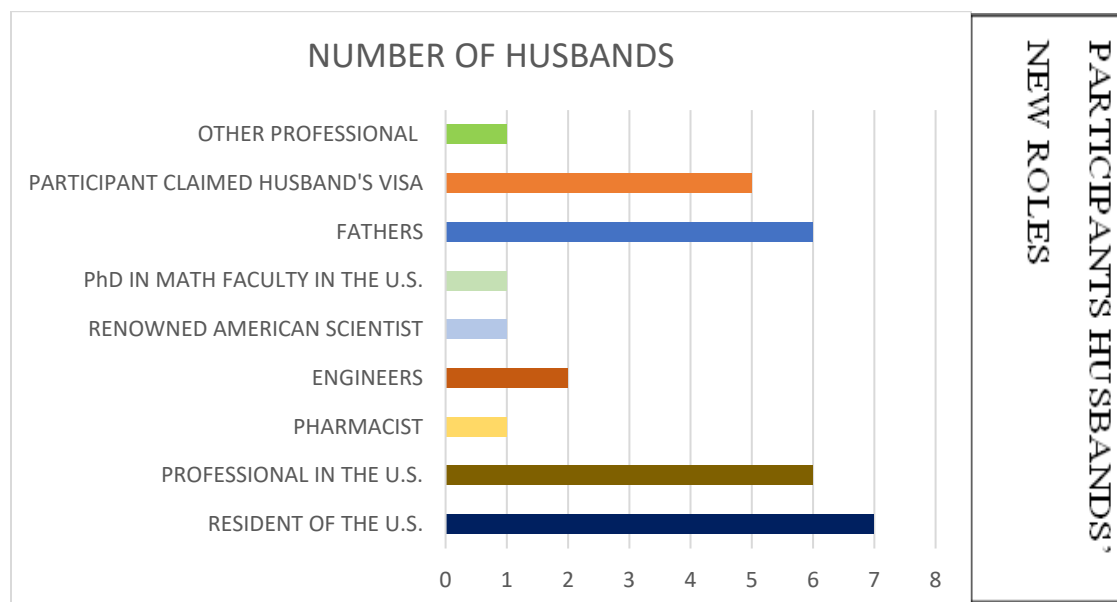
Currently, all participants work as successful scientists in the United States as faculty and/or researchers. All of them achieved permanent resident status in the United States, and one is now a citizen by naturalization. (Figure 33 reflects Participants' New Identities)

One young participant is single, six participants are married, and one is in a stable committed relationship. Six of the participants are devoted mothers of American-born children and one is a stepmother of American children. Five of the participants had to apply for visas for their husbands under their status and enabled them to obtain permanent resident status in the United States. One of the husbands is a professional pharmacist licensed in the United States and two work professionally as engineers in the United States. The partner of one participant is a well-known American-born scientist. Another participant empowered her husband to apply and complete his PhD and they are now both professors of mathematics at the same state university in the United States.

**Figure 33**

*Participants' New Identities*



**Figure 34***Participants' Husbands' New Identities*

I will explain the theme of identity building by describing the lived experiences of one participant (Ana) who best illustrates the various steps.

***Identity Building Requires Changes in Relationships***

Ana had to change many relationships to achieve her goals:

My peers were like, “Well, you know, it’s probably challenging, but maybe you should be pursuing something easier.” Or like, even my relationships, you know, my boyfriend at the time or something like that, they would say, “You know, why don’t you know, just maybe don’t do a PhD.” You know, like, maybe just start working and do something, you know, maybe easier or they just wanted something more traditional, I guess. Some peers, you know. And there were some peers that they just couldn’t, they would just look at me and be like, “That can’t be your work.” Like, you cannot be doing that complicated thing. Oh, you do [want to pursue a PhD in civil engineering]? Really? Hmm ...”

Identity building involves a process of transformation. Ana underwent a transformation to build her professional identity:

I mean, I'm a civil engineer, but all of the courses that I have to take to achieve my PhD were all electrical engineering. So, I have to become an expert in electrical engineering, in industrial engineering, in mechanical engineering, to do my work.

Participants went through changes in their learning processes to create a new identity.

Ana also went through changes in her learning processes:

Like, I had no coding experience and I ended up writing everything about [inaudible 01:08:52] and learning how to do high performance computing with a super-computer. I mean, in all of that I had to learn it on my own. Like, nobody told me, "Oh, this is how you set it up on the super-computer." Like, "No. Like, you figure it out."

Identity building included transformation and a new personality that resulted in increased self-esteem and empowerment. Ana recalls going through this:

So, a lot of times in STEM fields—in particular for under-represented minorities in women—because we don't see a lot of role models out there, you feel like you don't belong in a classroom, right? Because you sit around, and you feel like you're by yourself, so you feel like you don't belong there. And sometimes when you go to—when things get difficult, then it's almost like a justification to that fear.

This is how Ana overcame the imposture syndrome:

So, and again, it's why—you know, they have workshops about this at [name of state university withheld for confidentiality and institution anonymity]. They have workshops about overcoming it. Part of it is recognizing that it's a real thing. So, having a sense of community and recognizing that it's common and that you do have value. And for example, when I got an email from my student saying that I was a really good professor or that I really enjoy that, or I got feedback from the chair saying something encouraging, or like, "Congratulations on getting the fellowship," or something like that. Like, I will save these things in a folder so that during the rough times I will go back to the folder and, like, count your blessings.

New identity building comprised the advance of cultural awareness resulting in a greater insight of the host culture. To develop her personal and cultural identity in the United States, there were other barriers Ana had to overcome. These barriers included overcoming loneliness and isolation after being separated from her family due to political and economic instability in her country of origin; learning how to become independent, and self-supportive while

overcoming what seemed to be insuperable financial difficulties; overcoming discrimination; and acculturation barriers:

I like a sense of adventure, like, doing something, going to and looking at the unknown—exploring new areas, that kind of things. So, I think that translates well with a PhD. A bit of international, because I mean coming to a different country is certainly an adventure—looking for something new is also something that is very particular. Learning a new culture, learning a new language. I think that also translates to your ability to learn something on your own, right? Because I think in grad school, you're also learning these things.

**Table 24**

*Data Summary for Theme 11: Identity Building*

DESCRIPTORS					
Participants	Went through changes in relationships	Involved in a process of transformation	Experienced changes in learning processes	Increased Self-esteem and empowerment	Advance of cultural awareness resulting in a greater insight of the host culture.
Luisa/07312017	X	X	X	X	X
Akilah/09132017	X	X	X	X	X
Pilar/12072017	X	X	X	X	X
April/12132017	X	X	X	X	X
Mira/09182017	X	X	X	X	X
Rose/03212018	X	X	X	X	X
Ana/02032018	X	X	X	X	X
Tanvi/04162018	X	X	X	X	X
<i>N = X</i>	<i>N=8</i>	<i>N=8</i>	<i>N=8</i>	<i>G=8</i>	<i>N=8</i>
<i>N=8</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i>N=8</i>	<i># = x %</i>
<i>8=100%</i>	<i>8=100%</i>	<i>8=100%</i>	<i>8=100%</i>	<i># = x %</i>	<i>8=100%</i>
				<i>8=100%</i>	
				<i>B=7=87.5%</i>	

All participants underwent a new personal and professional identity building process. Those who were married helped their husbands achieve new personal and professional identities too. All of the participants are seemingly ordinary women who have achieved extraordinary milestones in cutting-edge scientific research. They are now the faculty, mentors, research lab

supervisors, and academic advisors responsible for the training and education of future generations of American scientists. All of these women have global scientific connections and have made world-wide scientific contributions.

### **Factors That Support Success**

All participants identified various factors they perceived enabled them to complete their STEM doctoral program and graduate. In addition to the main research question, there were findings that addressed the subquestions. These findings addressed the first subquestion: What factors do participants perceive enabled them to complete their STEM Doctoral program and graduate?

1. Family support
2. Personal attributes
3. Finding hope in Faith, Spirituality, and Religion.
4. Support from academic advisors, research supervisors, faculty, and mentors
5. Support from peers
6. Motivation
7. Balance
8. Resilience
9. Persistence
10. Self-determination
11. Identity building

Additionally, all of the participants identified and described various personal attributes that contributed to their success. In addition to the main research question, this finding addressed subquestion #4: What attributes contributed to the success of international doctoral female

students who completed a STEM PhD or dual PhD and/or professional program in the health sciences in the United States?

1. Forgiveness
2. Perseverance
3. Believing in her own potential and abilities
4. Determination
5. Resilience
6. Passionate towards her field
7. Determination
8. Responsiveness to feedback

**Table 25**

*Findings—Personal Attributes*

Participants	ATTRIBUTE DESCRIPTORS		N	X%
Luisa/07312017	Forgiveness	X	N=1	(12.5%)
Akilah/09132017	Perseverance	X	N=1	(12.5%)
Mira/09182017	Believing in her own potential & abilities	X	N=1	(12.5%)
Pilar/12072017	Determination	X	N=1	(12.5%)
April/12132017	Resilience	X	N=1	(12.5%)
Rose/03212018	Passionate toward her field	X	N=1	(12.5%)
Ana/02032018	Responsiveness to feedback	X	N=1	(12.5%)
Tanvi/04162018	Believed in her innate gifts and abilities	X	N=1	(12.5%)
Total	8 specific attributes	8	N=8	8 (12.5%)=100%

***Forgiveness***

Luisa forgave her research supervisor, principal investigator, and dissertation chair, whom she perceived was sexually harassing her:

He wrote a letter to me apologizing for what he had done and said. He said that he shouldn't influence or try to jeopardize my professional track. He said I was very smart, a very brilliant person and that it was not for him to compromise my life. I thought this was going to work, I trusted him.

### *Perseverance*

Akilah persevered despite many impediments:

And I knew it was a lot because there was nobody to talk to, nobody to get advice or anything. But it was the dream. I mean, it was my passion that was pushing me through. And I never was ready to give up.

### *Believing in Her Own Potential and Abilities*

Mira had self-confidence:

Like I said, you know, my husband's family and my husband, they are so encouraging. And he was always like, 'You can do this.' And frankly, you know, I did not have any doubt that I cannot do this, you know? So, I did not have any doubt on my capability.

But like I said earlier, you know, we had a very, very progressive environment at home growing up. So that thing never came into my mind that women are less than men. And so that, then, you know, kind of was never in my outlook.

### *Determination*

Pilar explained:

You always learn something. And now I try to instill that in my students. It's good. Yes, it was difficult for you. It maybe make you, cause you tears or something, but now you are stronger and now you know how to confront that type of conflict or that—you know how to overcome that barrier. So, there is always a positive thing in anything in any experience in life. And they say, "If life gives you lemons, you make lemonade."

### *Resilience*

April shared her resilience:

You know, I used to feel like, "What am I doing here?" You know? It's like, it would be easier if I just go back home, right? Cause every day sometimes felt like a struggle, but you know, at the end of the day, you take every day at a time. You have faith and everything starts kind of falling into place, right?

### *Passionate Toward Her Field*

Rose put her passion for math in action:

I'm actually all the time I'm kind of passionate. I'm passionate to do things. If someone tells me, "Oh, you cannot really do this," I become even more passionate towards to that, you know? So, I think, yeah. This is all the time, my dad also tells me that, "Oh, if you decide to do something, dear, you are going to do it. I know that if you put something in your head, you really are going to do it." This is my personality thing.

So, if there is a challenge, I'm very...how do you say? I just concentrate on the end. Like, I was all the time dreaming about the day that I am graduating, the day that I'm getting my PhD. So, I was thinking a lot about the pathway. This is my target, so hopefully I'm going to go there. So, whatever the situation is, I will hopefully go there. This is kind of my personality, so I'm very passionate about things.

### ***Responsiveness to Feedback***

Ana had a positive attitude toward criticism, a skill she learned as an athlete:

Well, I was an athlete. So, I think that definitely developed a lot of skills that I used for being in my PhD work. Because I'm used to having a coach pointing out faults in my technique or something like that, right? Like, I'm used to improving because we're working for the big leagues, right? So, I'm used to having that Constructive criticism constantly because I know that it's going to be eventually for good. So, I know that that's definitely something that I think translates directly to my PhD work.

### ***Believed in Her Innate Gifts and Abilities***

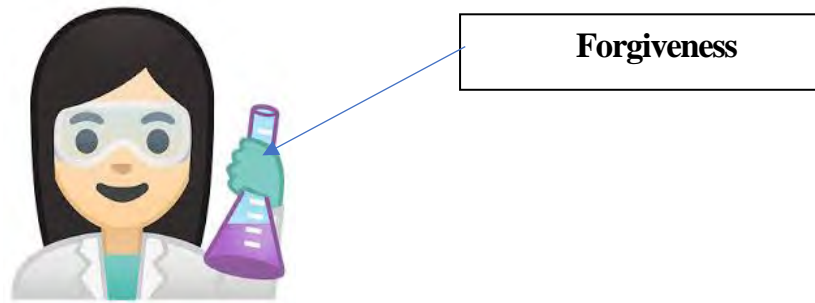
Tanvi came from a privileged background but succeeded in her PhD in nutritional sciences due her specific gifts and abilities:

No. I never consider myself blessed and having this opportunity. But I never had, I shouldn't say better opportunity because my dad was in a diplomatic position and my mom was in education. What I have done is what I have done on my own. And I never had more potentially better opportunities because of this. But at home they gave me this focus or in our bigger pathway we had this focus knowing all the other siblings and cousins, everyone is focused towards acquiring human capital in either sciences and math or engineering.

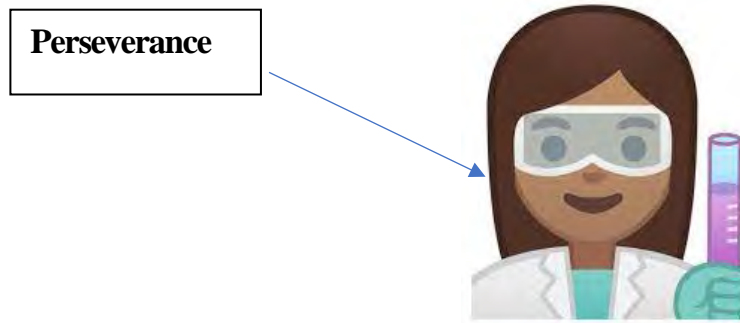


**Figure 35**

*Personal Attributes of Successful International Doctoral Science Students*



Luisa/07312017



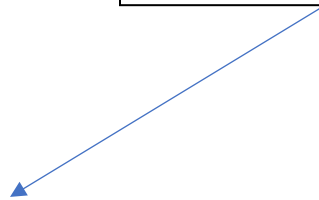
Akilah/0913207

Figure 35 Continued

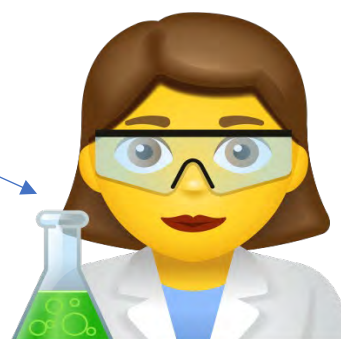


Mira/09182017

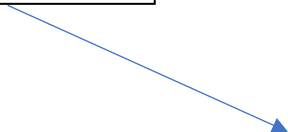
**Believing in her own potential and abilities**



**Determination**



Pilar/12072017

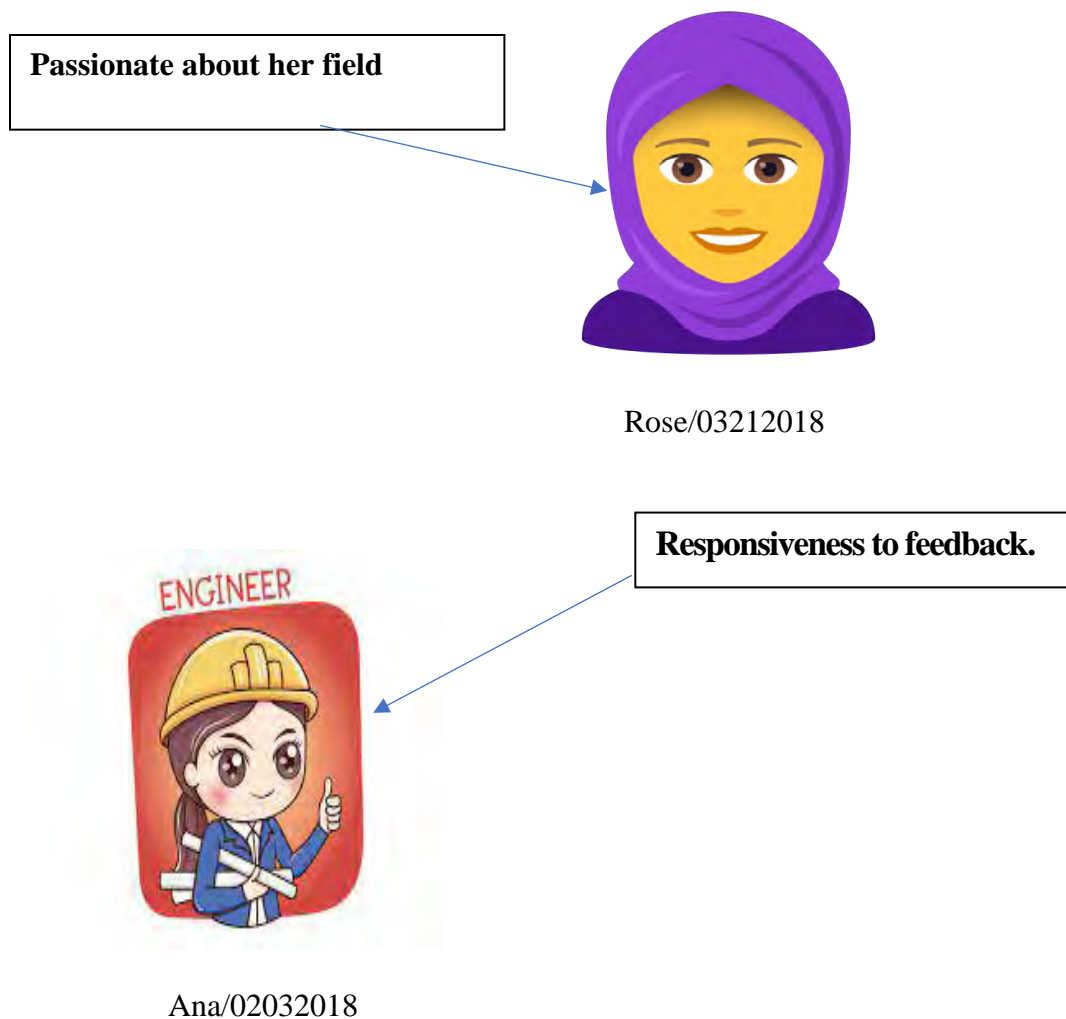


**Resilience**



April/12132017



**Figure 35 Continued****Barriers**

All participants experienced barriers while completing their STEM doctoral programs. In addition to the main research question, this finding addressed subquestion 2A: What barriers did the successful international doctoral female students experience while completing a STEM PhD or a dual PhD and/or professional program in the health sciences and graduate? Barriers varied by each participant and in level of experience.

### *Learning English as a Second Language*

Six participants experienced some level of difficulty with learning English as a second language and two participants did not. One participant learned English over a period of more than 10 years prior to coming to the United States. One participant is a polyglot who learned multiple languages, to include English, while living in various countries (e.g., England) with her diplomat father and English professor mother. The remaining six participants experienced English language barriers during their PhDs and/or the 1st years of acculturation and life in the United States. These barriers included learning the “American” English language and preparing to pass the graduate records examinations (GRE) in the English language and/or Tests of English as a Foreign Language (TOEFEL) exams. Two participants had learned “British English” and had to learn or become familiar with “American English.”

Four participants felt that the English language they learned in their home country did not prepare them well to live and study in the United States. All eight participants spoke with an accent. Four of them feel that they still have lots to learn in the English language and still need preparation, especially when speaking in public in front of a large audience. The overwhelming majority of participants (seven) experienced some level of difficulty learning English as a second language. All of them had been trained to learn “British English,” which is somewhat different than American English. This took effort on their part. The majority of participants (five) felt the English courses they took, both in their native countries and/or in English Language Centers in the United States prior to starting their doctoral level courses in STEM/health science, did not properly prepare them to function in everyday life situations in the U.S. Their study of English also did not help them understand difficult higher level STEM PhD/and or doctoral health

sciences courses in American English in the United States. This data are summarized in Table 26.

**Table 26**

*Findings Three D: Barrier Learning English as a Second Language*

DESCRIPTORS					
Participants	Experienced English language barriers	Polyglot who learned English and multiple languages while living in various countries including England	Learned English over a period of time	Had Learned “British English”	Spoke English With an Accent
Luisa/07312017				X	X
Akilah/09132017				X	X
Mira/09182017			X		X
Pilar/12072017				X	X
April/12132017	X				X
Rose/03212018	X				X
Ana/02032018	X				X
Tanvi/04162018		X		X	X
<i>N = X</i>	<i>N = 6</i>	<i>N = 1</i>	<i>N = 1</i>	<i>N = 4</i>	<i>N = 8</i>
<i>N = 8</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>8 = 100%</i>	<i>6 = 75%</i>	<i>1 = 12.5%</i>	<i>1 = 12.5%</i>	<i>4 = 50%</i>	<i>8 = 100%</i>

***Difficulty Writing in English***

Writing in English was the least difficult task in learning English as a foreign language. The overwhelming majority of the participants (seven) reported using and receiving help and tutoring from their universities’ writing centers to write final papers for a course, to write scientific papers for publications, and during their dissertation writing. Seven participants also used tools such as digital dictionaries, thesaurus, and translators. What was most challenging for

them was learning American Psychological Association writing style and formatting and making sure they avoided plagiarism, something which they were not familiar with or had different connotations in their home countries. Learning how to cite, write references, and getting to publish their research in the English language in American and global scientific journals was both a challenge and a thrill.

So, you know, I had to learn a few things, you know? How to sort of cite things, like, what they teach you early on. You know, they start teaching you in high school. You know, plagiarism and things like that, how to cite. Those are things that I had to learn here as a graduate student. But the thing is, if you have that capability, you learn very quickly, you know? And then you use that system. So just because you have not learned something prior to your graduate work should not let you discourage for your future work. (Mira)

Like, he [academic advisor] really wanted me to finish and be the best. Like, it was not finishing. It was, like, being the best and, like, getting published in the biggest journal, you know. And journals that I would be like, uh, I don't think my work is that good. Like, are you sure I want to try that journal? And sometimes we would get published, and sometimes we didn't. But he really thought that it was out there and nothing less, you know. So, I really did, I think that really influenced a lot of the positive part of it. (Ana)

### *Difficulty Speaking and Pronouncing in English*

Seven participants had difficulties speaking and/or pronouncing American English. Luisa was also afraid to participate in class discussions due to English language challenges: "So, I'm always afraid that I'm gonna be wrong. My English is not good, so, I don't need to participate." Faced with the challenge of participating in class discussions, despite her accent and language barriers, Luisa chose to participate to get good grades: "But for that class, it was obligatory. So, if you don't participate, you don't get a good grade."

Ana experienced this as part of her cultural shock: "So, as an international student going from speaking Spanish to a school that is all English. In [State in the United States] that was something that was a complete shock." Pilar first learned English in London. "And then when I

came from London to the States, they didn't understand my Hispanic heavy accent mixed with the British English accent.”

**Difficulty Understanding and/or Listening in the English Language, Difficulty Understanding or Listening to “American English” and/or Difficulty Listening and Understanding Other Foreign Accents in the English Language.** April recognized that the

English language was a serious challenge. She had difficulty understanding the lectures given by her American faculty: “English was a barrier.” Additionally, she also had difficulty understanding foreign-born faculty: “And the different accents from different professors because there were professors from other countries that had foreign accents.” April explained that,

and so, it was a lot of dedication, but I knew that was the way to be successful, you know? I'm like, this is not...cause, I knew I had the disadvantage not being fluent in English, right? Still having difficulty listening, right?

**Difficulty Speaking or Presenting in English in Front of Public Audiences.** Public speaking in American English in front of even small audiences, such as their fellow STEM PhD or doctoral health science fellow peers and faculty during class, was intimidating for most of the participants. Preparing to speak to large audiences, such as in conferences and during dissertation defense, took preparation for all. During the course of her doctoral studies, Pilar had to give many presentations. This was a barrier since she was afraid with public speaking: “But as soon as I was here, one of the things that I have to do is go and give a presentation on a program that we were doing.” To improve her public speaking skills in American English, Pilar had to prepare well in advance:

So, I practiced, like, the night before, like, for 2 hours or something. I say, “Okay, I feel confident enough that I'm going to be able to communicate clearly what we are doing or...”. “Those have challenges, of course, but really are challenges that are easy to overcome—not very difficult.

Nonetheless, to this day, she still feels insecure, especially during public speaking: “And always, I mean, I’m not—I am afraid but still I get nervous when I do public speeches and things like that.

Akilah had been taking English language courses for many years. However, she had learned British English and was used to a different accent:

And you know, I still remember my first semester here when I was a grad student. And the accent was different, cause in [country of origin in Asia] we are so kind of liked to the UK English, so I’m so used to hearing those.

Akilah did not understand what an American professor was talking about during class.

When the professor announced quizzes, she did not understand him and did not prepare for them:

And I still remember one professor who was an American. He was a mathematical physics professor. And he used to announce the quizzes. And as I didn’t understand what he’s talking about, I was never prepared. And then in the next class when I’d come, everybody is ready for the quiz, and I’m like, ‘I didn’t hear it. Maybe I didn’t understand it.’ And then I was like, so left out. [laughs].

**Everyday Conversation Struggles.** Most participants struggled with everyday conversations. Rose took math courses in English in her home country. She learned most of the mathematical terminology in English. However, she did not really learn the English language and conversation skills needed for everyday living: “I mean, the education back in my, you know, home country, the university that I was going to, the education was in English. But I was getting education in English for math.”

So, I was very much, I mean, I was lack of experience of this daily language thing. So, I remember, it was so funny. I mean, I was actually very lucky because of my friend. You know, her major was American literature. So, the first day or so some people were doing something to us. I was actually great saying “Thank you.” And I know that it’s polite, so I was thinking, okay, I should say, “Thank you, thank you.”

Her first year in the United States, Luisa faced many challenges trying to understand and learn the English language. In her home country, she had taken English lessons for 3 years, but



she was taught “British” English and felt she did not know much English in general. But soon, she saw this as an opportunity to learn the English language:

I understood the techniques and the science behind the work in the lab and could understand the concepts for the most part. But the daily conversations with people were very difficult, I didn’t understand much, nor even a lot of the science I knew in English.

***Preparing for TOEFL, GRE, STEM and Entrance Exams and Interviews in English***

The positive strategies the female international students used to overcome learning English as a second language, while taking difficult PhD/Doctoral STEM or health science courses, was discussed thoroughly under Theme 5: Learning English as a Second Language Proficiently. In this section, I discuss the tasks and entrance examinations the international female students had to take to gain entrance to their STEM/health science PhD/doctoral programs in the English language. These requirements are unique and pose more challenges for international students who do not master the English language as compared to domestic students.

Another English language barrier for these international PhD students in STEM was to be able to pass the TOEFL, required for admissions to most PhD programs in the United States. Rose received academic guidance from mentors in her country of origin who told her the exams she needed to prepare for and take to gain entrance to PhD STEM programs in the United States: “Yeah. Whenever I look at the mentors that were giving advice, they were all the time talking about TOEFL, which is English preparation course. Like, they were taking those courses.”

Actually, what I did, yeah, what did I do? I think the last year of my college I was still working on TOEFL. You know, I got one in one type, but it wasn’t high enough for me to do application because, you know, to apply to PhD programs here, you need to have certain TOEFL score. Right now, they say a different name for this test or whatever. They changed the name of it. I think I tried that year and it didn’t happen.

Rose worked for one year in her home country after her master’s degree, then married and came to live in the United States with her husband who was finishing his second Master’s.

She continued to prepare to pass the TOEFL. Hence, after arriving in the United States with her newlywed husband, Rose studied hard to pass the TOEFL.

Well, during that time at university [in the United States], there was a friend who was like a [international STEM PhD from her country of origin] female like me. I mean, I didn't really know her before I moved to [City of University in the United States], but then I met her. My husband, actually, he told me that there is a lady ... and then I met her, and she told me that, "Why don't you apply for the PhD?" which I was already thinking. But again, I was still working on my TOEFL score. So, I remember, whenever my husband goes to university, I was at home just working for the TOEFL in the morning. Then afternoon I was trying to cook something. And she encouraged me. She actually, she was able to take me to one of the professor's offices and I talked to him and he told me that if I can get my TOEFL scores and everything by December, he told me I can even start going to school for spring, you know?

Luisa came to the United States the first time for one year, hired by her older sister's P.I. to help in her sister's research lab for her STEM Post-Doctoral during maternity leave for a second baby. During this time, Luisa took graduate level courses, and prepared and took the TOEFL and GRE:

This motivated me to start taking Graduate level classes. It was really tough because I was still learning English, but I really wanted to start getting a feel for graduate school. I also thought that this could help me with my applications because I didn't have a lot of research experience and my English was not very good even though I studied, and I took the GRE and the TOEFL here. They were not the greatest, but they were decent enough.

Mira prepared well to take the TOEFEL and GRE Exams required for admission as an international student in her PhD program in the United States: "So, you know, it takes preparation". "Because you know you have to take the GRE. You have to take the TOEFEL"

**Had to Prepare to Take GRE in English.** It is interesting to know that most of these students did get high scores on the GRE because they were able to figure out content questions in their area of studies and/or understood scientific, technological, engineering, and/or mathematical terminology in English. Rose recalls she did not pass the TOEFL as stated above:

“But I remember that I got GRE score and my GRE score was good, but I was still considering to come back here.”

**Had to Prepare to Take Graduate/Doctoral Entrance Exams in English for STEM/Health Sciences Concentration.** Some of the GRE exams and specific STEM/health science concentration entrance required exams that were extremely challenging because they were in the English language and many times outside the area of expertise from the graduate students' background:

I mean, I'm a civil engineer, but all of the courses that I have to take to achieve my PhD were all electrical engineering. So, I have to become an expert in electrical engineering, in industrial engineering, in mechanical engineering, to do my work. (Ana)

Akilah also took STEM GRE and entrance exams outside her area of expertise: “So, my PhD is in physics, but I see a lot of chemical formula and math and everything.”

And I still remember my last 3 years even though my PhD was in physics, half of the time, my research was in the chemistry lab because they had the hooded, you know, experimental area where you can safely use the chemicals and everything.

Tanvi was very focused in preparing and passing her entrance exams. Hence, there was no time for her to be homesick. Being immersed in her studies helped Tanvi as a female international STEM PhD student overcome barriers: “You get accepted, you take courses, and you take the entrance exams”. “So, there was...I should say it didn't even occur to me I am in a different state or a new place.” Rose took the exams needed for admission in PhD programs in the United States while in her country of origin. She had a high score on the GRE but did not pass the TOEFL.

Table 27 is a visual representation of the barriers faced by participants while learning English as a second language.

**Table 27***Findings Three E: Barrier Learning English as a Second Language*

Participants	DESCRIPTORS				
	Had difficulty writing English	Had difficulty speaking English	Had difficulty reading English	Had difficulty speaking English in front of public audiences	Every day conversation struggles
Luisa/07312017	X	X	X	X	X
Akilah/09132017		X		X	
Pilar/12072017	X	X	X	X	X
April/12132017	X	X	X	X	X
Rose/03122018	X	X	X	X	X
Ana/02032018	X	X	X	X	X
<i>N = X</i>	<i>N = 5</i>	<i>N = 6</i>	<i>N = 5</i>	<i>N = 6</i>	<i>N = 5</i>
<i>N = 8</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>	<i># = x %</i>
<i>8 = 100%</i>	<i>5 = 62.5%</i>	<i>6 = 75%</i>	<i>5 = 62.5%</i>	<i>6 = 75%</i>	<i>5 = 62.5%</i>

**Had to Complete Entrance Forms for Graduate Doctoral STEM/Health Sciences Program and Pass Interview in English.** The participants who came from foreign countries, which used different educational systems, had to complete entrance forms to get admitted in their graduate doctoral STEM/health sciences program in the United States and pass interviews in English, without any guidance. For Akilah, understanding the admission policies at her state university was not an easy process. There were two separate applications to complete, one for the Graduate School and one for the Physics Department. Akilah felt overwhelmed: “And then after that I talked to the admin people, like the formalities that I have to go through. And I knew it was a lot because there was nobody to talk to, nobody to get advice or anything.” Additionally, Luisa

explained:

So, [the STEM PhD] it was a good fit. He [the principal investigator and academic advisor] interviewed me through the phone because he thought I was in the United States because I had applied and was here, but I had left. So, he wanted me to go and see him, but I was like, I'm in [country of origin]. So, he called me all the way down there. He interviewed me through the phone. He gave me the opportunity. I came back to start my PhD program in fall 2006.

### ***Acculturation Barriers and Cultural Shock***

All eight participants experienced several barriers related to acculturation and cultural shock during their first 1 or 2 years of STEM PhD and or doctoral professional degrees in health sciences studies. The barriers ranged from minor to severe. Acculturation barriers included having their educational records accredited and translated in the United States; applying to STEM PhDs and/or doctoral professional programs in the health sciences; and obtaining a student visa (for those who came to the United States originally as companions of their husbands, visitors, or with other immigration status). Other acculturation issues included adapting to a new culture that promotes independence from their family members by finding an affordable safe place to live close to their universities and/or place of research work because the participants' families lived in their country of origin. Cultural shock included feeling homesick and missing their countries of origin and cultures.

Learning English as a second language is considered part of cultural shock and acculturation barriers. It was discussed separately, in the preceding section, due to its importance and multifaceted issues. One participant had lived in many different countries, was a polyglot and learned to adapt easily to other cultures. Additionally, she mastered the English language very well, which helped her adapt to the American culture very well. One participant had a strong system of support from her extended family and did not experience severe barriers, only

minor ones. Two participants had trouble adapting to the weather, especially the winter. Seven participants reported trouble adapting to a new diet and food. For seven of the participants, it took some time before finding a place to worship. Six participants had to struggle to find teaching and/or research assistantships, scholarships, part-time jobs, or additional sources of income. These six participants endured financial hardships (listed under Financial Barriers) and difficult living accommodations.

Four participants who married during or just prior to their doctoral studies reported their spouses undergoing acculturation and cultural shock as well. Six participants felt isolated, lonely, and/or had little time to socialize. Five participants reported having health problems and having difficulty finding, affording, and/or accessing health care insurance and/or services. Three participants reported not having enough time to rest during pregnancy and/or after childbirth. Three participants reported difficulties with finding good, affordable childcare. Four participants reported experiencing severe emotional issues and/or personal crisis but only one participant sought the help of a professional counselor. Table 28 provides a data summary of these barriers.

**Having Educational Records Accredited in the United States.** The international female STEM PhD/doctoral health sciences students had to accredit all their educational records in the United States, translating them from their native language and mailing them to specific educational accreditation services. This process is lengthy and very expensive. There is also the risk of having original diplomas, professional licenses, and credentials lost or stolen in the mail, some of which cannot be obtained again. Personal and professional identities being stolen is rampant, causing serious legal and educational problems to international doctoral and professional students in the United States. Additionally, the credentials only last for 5 years, making it very difficult to renew if the PhD or doctoral program takes more than 5 years to

complete. The specific educational accreditation service centers remain unregulated in the United States. These educational accreditation service centers overcharge international students and force them to turn in original, notarized, and translated to English academic diplomas,

**Table 28**

*Findings Three E: Barrier Acculturation and Cultural Shock*

DESCRIPTORS						
Participants	Having Educational Records Accredited in the U.S.	Challenges Obtaining an International Student Visa in the U.S. for Herself (H) Spouse (S)	Difficulty Adapting To a New Culture/ Individualistic Society Herself (H) Spouse (S)	Barriers with Cultural Shock/ Loneliness/ Isolation Herself (H) Spouse (S)	Health Problems (H)/ Mental Health (MH)/ Finding Affordable Health Insurance (HI)	Difficulty Adapting to the weather (W)/ Food (F)
Luisa/07312017	X	H X S X	H X S X	H X S X	H X MH X HI X	W X F X
Akilah/07312017	X	H X	H X	H X	H X MH X HI X	W X F X
Mira/09182017	X	H X S X		H X	H X HI X	W X
Pilar/12072017	X	X	H X	H X		W X F X
April/12132017	X	H X S X	H X S X	H X S X	H X MH X HI X	W X F X
Rose/03212018	X	H X S X	H X S X	H X S X	H X MH X HI X	W X F X
Ana/02032018	X	H X	H X	H X	H X MH X HI X	W X F X
Tanvi/04162018	X	H X		H X	H X MH X	W X
N = X	N=8	N=8	N=6	N=8	N=7	N=8
N=8	# = x %	# = x %	# = x %	# = x %	# = x %	# = x %
#=100%	8=100%	8=100%	6=75%	8=100%	7=87.5%	8=100%

transcripts, and records. This can be difficult since many students cannot afford these expensive services more than once and/ or cannot go back to their countries of origin to retrieve their records.

Ana recalled having serious difficulties going back to her country of origin to retrieve new educational records and transcripts, after her country of origin was taken over by a dictator and her native country experienced a civil war:

And then, this uncertainly of, like, knowing if I'll be able to leave [my country of origin and come back to the United States] or not. Unfortunately, you know, those circumstances made it very difficult for me to make those decisions. So, I didn't get to travel much, but when I went was because I was, you know, I had a new visa, or needed my credentials and educational records re-evaluated, right? So, going there and making sure I get my new visa to change from master's to PhD, or obtain new transcripts from my bachelor's degree, that kind of thing. So, getting my passport renewed and getting my educational credentials and transcripts. It was easier back home. So, I would go there, visit my family, and make sure I do all those things.

#### **Challenges Obtaining an International Student Visa in the United States for Herself**

**(H) or Her Spouse (S).** All of these female international students underwent a strict immigration screening process, and some had to wait several years to obtain their international student visas and/or claim their husbands or fiancées as their dependents to be able to reunite or get married and live together in the United States (Haddad, 2006). For example, Rose was introduced to her husband by traditional Muslim professors and mentors who acted like “matchmakers.” She first waited for her visa to be approved before marriage, because she did not want to stay behind waiting to be reunited with her husband:

Yeah, you know, actually we got engaged, we actually got this—I don't know how you say—official marriage thing. I mean, because of the visa application we have to do this. But we didn't really marry physically, but you know, it was on the paper. Then I got the visa, so there was not any problem because I know some of my friends, they had a lot of these types of problems. They got married because of the visa problem. You know, like usually bride stays in home country and you know... But we didn't really want to have this, so I got married to him and after four or five days we came here.



When April came to the United States to pursue her PhD in microbiology and immunology, she was separated from her then boyfriend (who later became her husband) for 3 years. This was emotionally very difficult for both of them: “We were separated for 3 years. And so, it was really difficult.”

Luisa spent only 6 months with her newlywed husband in her country of origin when she learned she had been accepted to her PhD program in neurobiology in the United States.

I came by myself because when I applied, I had applied, I was not married at the time. Because I didn't have the money to bring my husband with me right away. So, during that first year, I saved some money so, he could come because he didn't even have money either to get his visa and come here.

Mira had to wait about a year before claiming her husband and being reunited with him: “He came a year later. So, I came as a graduate student and then he came, you know, on a dependent's visa.” Akilah had to wait several months to exchange her dependent visa status to an international student visa: “And finally, I mean, it took a couple of more months for me to go through the formalities and then change my visa from dependent to student.”

**Difficulty Adapting to a New Culture/Individualistic Society for Herself (H) or Her Spouse (S).** All the participants had to adapt to a new culture and individualistic society. For example, Ana found it hard to adjust to a new culture. She came from a communitarian society, and it was hard at first to adapt to an individualistic society: “It was difficult to adjust to a new culture, and to learn a new language: Learning a new culture, learning a new language.” Her ability to overcome acculturation, isolation, and loneliness proved successful in her pursuit of a PhD degree in civil engineering. “I think that also translates to your ability to learn something on your own, right? Because I think in grad school, you're also learning these things.”

Luisa's husband faced homesickness, acculturation barriers, and financial barriers that impeded him to study, and the fact that his dependent visa did not allowed him to work caused serious problems to the couple to the point he decided to go back to their home country. "So, he was kind of also depressed and that's when he decided that he wanted to go back because it was hard to live here." Eventually, Luisa's husband made friends, learned to socialize in the United States and was able to overcome his depression and isolation. "But he found some friends and he managed that."

### **Barriers With Cultural Shock/Loneliness/Isolation for Herself (H) or Her Spouse**

**(S).** Cultural shock, isolation, and loneliness are part of the acculturation process. The 1st year in the United States, Akilah felt lonely and isolated. Her newlywed husband was supportive, but he was very busy in his new job: "So, it was like, so close within four walls of my apartment. Nothing else, just the books and that's it."

Pilar was not used to living alone. To overcome loneliness when she first arrived in the United States for her doctoral program, she bought herself a TV to hear noise:

So, at the beginning it was exciting, but then I said, "Oh, the first thing that I'm going to buy is a TV because I need somebody to talk to me." So, I bought a TV, and while I was studying or wherever I just had it just to hear noise and voices. So that was my first buy was a TV because I was living by myself.

Ana experienced loneliness in the United States as a new female international student. She missed her family and friends from her native country: "As an international student I guess it's really difficult, sometimes it gets lonely, right? And I lived by myself, or sometimes I had a roommate, but it was not the same." Ana left all her family and relatives in her country of origin: "Because all your family is abroad." Even when Ana lived with roommates, she felt alone: "You would still feel alone sometimes."

Luisa and her newlywed husband, who joined her after a year in the United States, struggled financially and lived very modestly: “We lived in a small studio almost the size of this little space in here. There was just a small kitchen, and then a big space for the bed and the bathroom, and that was it.”

Luisa was able to overcome acculturation because of her personality and the fact that she was busy with her PhD Studies in neurobiology and her research. However, her husband, who came as her dependent and was not allowed to work in the United States, or study due to financial constraints, felt very isolated and almost went back to their country of origin:

I’m a person. I’m not a social person, but I’m not—I like to visit people, but I don’t need to be with people. So, for me, if I’m by myself I’m okay. With my husband, we did have to work on that because he’s very social.

Furthermore, Luisa’s husband felt very isolated and homesick: “So, we had to deal with his feeling of isolation, not been able to work and go out.”

### **Health Problems (H), Mental Health (MH), and Finding Affordable Health**

**Insurance (HI), Health Challenges.** One of the participants, Mira, was trying to conceive during her STEM PhD and underwent fertility treatments. She later described her inability to conceive as a blessing in disguise:

You know, my husband and I were not able to have children for quite a long time. And so, you know, that was something that used to bother me I used to want to have because I had been married for quite a number of years. During my PhD studies we tried to conceive through different treatments, but it did not happen. And so, but not having children was helpful at that time because you could totally just devote your time and energy to your work, you know?

**Pregnancy and Childbirth.** Three participants had pregnancies during their STEM PhDs. One participant experienced two pregnancies and two participants experienced a first pregnancy. Three participants reported not having enough time to rest during pregnancy and/or after childbirth. Rose recalled her first pregnancy:

But I remember in my culture there is something important. After you give birth, they say—especially the elderly, like, old people, grandma, grandpa—they say you have to stay at home for 40 days. You know, 4-0. But then what happened, I actually, there was some, I don't know, for some reason there was some project or something that I have to finish. I did not rest after my first pregnancy.

But, you know, in [country of origin] after a mom gives birth, there are 2 months or so they actually give you paid leave, you know? They actually pay you your salary and also at the same time you don't have to come to work because you can deal with your baby. But I don't think there was anything like that. It was kind of sad to me at first because everybody in [my home country] they are asking me, "Oh, are you going to stay home now, like, about 3 months?" I'm saying, "No. Here it's America. If you don't work, nobody pays you."

During her second pregnancy and second childbirth, Rose did not get much rest either, with the aggravating factor that she had a very small daughter to take care of too:

That was a challenge I can say because as the culture that I got used to, you know, if you give birth, you're a mom. You should stay home. You know, you need to take care of the baby or things like that. Because you are carrying the baby for 9 months. It's kind of a hard job. Then after the birth, you are kind of given a vacation to you. But we don't have this here, so that was a challenge, I think. But I'm still so grateful that my mom was here because, you know, she helped me.

**Difficulties With Finding Good Affordable Childcare.** Rose and her husband struggled to find affordable and reliable childcare:

Well, my husband, for instance, whenever I was working for my qualifying exam, he took care of her during that summer. I mean, he was just preparing the formula and he was changing the diapers and things, so during the summer times he helped a lot. And after that I think my mom, she couldn't really come, but yeah, I left her to a daycare for one semester where there was a camera, so I was able to see her. But if she went there only one semester, then my mom, she again came back. She again, took care of her.

**Barriers to Finding Affordable Good Health Insurance.** Young married participants struggled to find and pay for health insurance for themselves and their dependent husbands. As Luisa recalled:

He [her husband] took care of all the stuff he wanted to study, but it was really difficult for him to study because we didn't have money to pay for anything. Health insurance was very expensive and difficult to find.

**Mental Health Problems and/or Emotional Breakdowns.** One participant suffered from severe chronic depression; however, this student did not seek professional counseling from her university, which provided those services, for fear of being stigmatized, blamed, and losing her status as an international student. Three participants described severe symptoms of anxiety. None of these participants sought professional help nor did they seek counseling. Only one participant broke from the norm of her country of origin and sought professional counseling to deal with perceptions of discrimination from her research supervisor and uncooperative senior female domestic research coworkers.

Tanvi suffered a nervous breakdown as a result of the break-up of a long-term, close personal romantic relationship and the unexpected accidental death of her younger sister. However, Tanvi did not seek counseling at the time and did not even have sufficient time to grieve because she felt she had to be strong for her parents. She had to deliver the bad news to them and deal with the aftermath of taking care of the cremation and other arrangements related to her sister's death:

No. [did not get counseling] I was more... I wanted to deal with it on my own. I shouldn't say I felt on my own. You never get out of that grieving phase. It's just, it mellows down, and you feel pain for your sibling all of your life. So, I was okay to deal with it. The whole thing, I was fine because I knew I had to take care of my parents because their grief is greater than mine. You know, to cremate a child, that's not how they expect it, right?

Eventually, with the help of one of her close Faculty members and advisors, Tanvi was able to overcome her difficult personal loss:

So, I had been through really hard personal times, emotional times. But I was able to sail through and simultaneously grieve about it and just think about if I can really tell my major professor anything which is going on in my life. And she'll be able to guide me, give me some advice or help me to come out of it. So, I had that relationship.

**Difficulty Adapting to the Weather (W).** Tanvi was also accepted to an Ivy League university in the United States for her PhD studies in nutrition: “But I chose, because I was accepted in Ivy League university, too, at. But somehow there was no better for me at that time.” Hence, she decided to go to a state university because it was close to her two sisters who were already studying in the United States. The weather was also a factor as she did not want to be in a cold city during winter:

So, I took, or I just took not necessarily because it is a now good university. But I did find myself thinking, you know what? I don't want to go to [name of city of Ivy League university]. It's too far.

Sometimes I think it was stupid motivation [laughs] because I could have gone to [name of Ivy League university], which is a good school and I got accepted and it was all good. And I just thought, [name of city of Ivy League university]. “Oh, it's too far. is too far. I don't want to live in cold because living in Moscow in such a cold climate.” I was done with cold. ... And I think to this day I do regret, like, what was I thinking? Why didn't I go to [name of Ivy League university]?

**Difficulty Adapting to the Food (F).** Rose also remembered how difficult it was for her to adapt to American food served at the cafeteria in her dorm when she first came to the United States:

So why I'm saying these things is because whenever we first went there [dorm in the United States], I remember that my mom, she actually made some doughs for us, like a bread type thing, but we put feta cheese inside of it. I remember that I ate it for the first five days or so, and after that, like, the sixth day it started to get bad, like, the molding and things like that. So, I was so upset. “How am I going to solve this?”

Because we didn't have a car and I was living in campus, so we had the walk of about 10 or 15 minutes to go to the closest market, you know, to get things. But you know, at first, I was actually in a dorm where there was not any kitchen. Then we talked with the person there and we tried to arrange another place where it's kind of like an apartment where you have a shared kitchen. That was good because my friend, I actually had another female friend, and she was able to cook some chocolate cake for me. She was a very good cook, so I was so happy that we had our own kitchen.

So yeah, it wasn't really easy for us. But I mean, we somehow got used to it.

I was going back to home because of, you know, I think like the culture of eating was also very different, you know? So, most of the time people are eating pizza here, right, is the most popular thing. But [name of country of origin withheld for confidentiality] actually, in [country of origin withheld for confidentiality] we have a lot of very rich cuisine, you know, so that was I think very important to me.

So, I think it's very important, especially if, yeah, all the facilities that they are providing here for international students, even for undergraduates or graduate, I think they have to have some kitchen facility because I think it's very important, yeah.

Having access to specialty ethnic markets and food was important to students from Asia as well. Mira found special markets where she could buy the ingredients to cook the food she was used to: "I mean, like, we used to cook [Country of origin withheld for confidentiality] food all the time, you know."

Yeah, so it's not like, you have to go out at eight or, you know go to out to special restaurants to eat—all the, sort of ingredients for cooking [country of origin] meals, you know, there were [nationality] grocery stores. So, all those things were available.

Mira's uncle and his family, who acted as her American culture brokers, showed Mira where all those cultural resources were: "So, all those—you know, all those—like, if there is someone to show you, to explain it to you, it's so much easier."

**Finding a Place to Worship.** For the overwhelming majority of participants, it took some time before finding a place to worship: "I used to pass by the chapel from the university hospital. And I made basically a routine just to go there every morning just for a few minutes" (Pilar). For some participants, like Ana, not finding a place to worship on campus led to a new-found faith and system of support. Ana was raised in a Catholic family and her country of origin in South America is mostly Catholic. But she could not find a good parish or Catholic church on her campus In the United States; however, she found an Evangelical Christian Graduate Student Organization. Therefore, starting from her master's degree and throughout her PhD studies, Ana received a lot of encouragement and religious support from an Interdenominational Evangelical Graduate Student Christian organization:

We all had that core belief, you know, being Christian and or Catholic, you know, we just kind of have that community. So that really helped me as well knowing that I have just with people who are going through it. So that also helped me keep my sanity, I guess.

Ana remains a faithful member of the Interdenominational Evangelical Christian Church to this day. Mira was able to find a Hindu temple to worship in the city where she lived: “You know, we could go there.”

And then, like, in [name of city where her university is located] there is a very large [citizens of her country of origin] population. So, you know, there’s a temple, Hindu temple, so that was nice. The food, too, you know.

### ***Critical Personal Incidents***

All participants reported some form of situational, environmental, or personal problem they had to overcome, deal with, or come to terms with during their PhD studies. These are displayed in Table 29.

**Unsafe Situations.** Pilar explained that safety was

very important for me. I need to live in a place not only that I like that I say, “Oh, I’m going home because I like it,” but that I feel safe. That was something that could be a big barrier because if you are going to go outside at night or you need to work to buy groceries three blocks from where you live, you need to live in an environment that you are not going to get assaulted or mugged or something.

**Table 29**

*Findings Three. Barriers: Critical Personal Incidents During PhD Studies*

Participants	Critical Personal Incidents During PhD Studies	Percentage
Luisa/07312017	X	12.5%
Akilah/09132017	X	12.5%
Mira/09182017	X	12.5%
Pilar/12072017	X	12.5%
April/12132017	X	12.5%
Rose/03212018	X	12.5%
Ana/02032018	X	12.5%
Tanvi/04162018	8=100%	12.5%
N = X	# = x %	# = x %
N=8	8 = 100%	8 = 100%



**Death in the Family.** A small percentage of participants (two, or 25%) experienced a death in their family while they were international STEM PhD students. This is what they shared about their loss:

Yeah, in my first few years. It's actually my grandparents that are closer to me than my parents. So especially when my grandmother, my paternal grandmother being, you know, I being her first granddaughter and grandchild, I believed that she is more affectionate to me...

And so, after coming here, my grandmother was still alive, but then I came to know that she is sick. And she was sick, and she was not even the same person that I used to see cause her, you know, kind of diminished. And it was like, she was in really bad shape. I didn't want to see the picture or anything. But when I lost her, I was here. Even now when I run into problems, and I miss her because there is nobody to say that it's gonna be alright. But now I say it to myself, 'Yes, it's gonna be alright.' (Akilah)

I lost a sibling during this time. My sister was in a car crash, and I was an emotional wreck when she passed away... Sometimes when you have family, we have to take care of them. I had to think about my parents too: they usually losing child, as a young child. So, didn't want to fall apart and appear weak in front of my parents, so I wanted to take care of them, be there for them. So, I was okay. I was open to the sorrow and the grief that shielded me. It will always be with me 'til I die. But as your life goes on. (Tanvi)

**Separation From Significant Others.** None of the participants could go back to visit their families and countries, at least during the first year. One participant could not even go back to visit her family in her native country during most of her PhD studies due to a drastic change in the political and socio-economic leadership in her country of origin. One participant could not go back to visit her ailing grandmother whom she was very close and who raised the participant. This student was not able to attend her grandmother's funeral. Most of the participants experienced missing their parents, siblings, grandparents, and other extended family members. Others missed their husbands, fiancés, and or boyfriends and close friends. One participant reported missing her parents who were living out of the country and not having family support in the United States during a personal crisis and a personal loss.

### ***Transportation Barriers***

The majority of participants (five out of eight, 62.5%) reported having transportation problems during the 1st year or 1st years of their doctoral programs. One participant was transported by her husband as is the tradition for Muslim women. Another participant knew how to drive and got her car soon after arrival in the United States. One participant had bought her car and learned how to drive before starting her STEM PhD. A visual depiction of the transportation barriers experienced by the participants is shown in Table 30.

**Table 30**

#### *Findings Three F. Transportation Barriers*

DESCRIPTORS				
Participants	Using public buses & other systems of transportation	Learning how to drive in the U.S.	Obtaining a driver's license in the U.S.	Buying the first car
Luisa/07312017	X	X	X	X
Akilah/09132017	X	X	X	X
Mira/09182017	X		X	X
Pilar/12072017	X	X	X	X
April/12132017	X	X	X	X
Rose/03212018	X	X	X	X
Ana/02032018	X	X	X	X
Tanvi/04162018			X	
<i>TOTAL=8</i>	<i>#=x%,</i>	<i>#=x%,</i>	<i>#=x%,</i>	<i>#=x%,</i>
<i>100%</i>	<i>7=87.5%</i>	<i>6=75%</i>	<i>8=100%</i>	<i>7=87.5%</i>

#### **Barriers Learning How to Use Public Buses and Other Systems of Transportation.**

When April moved into an apartment with roommates after living in the house of a post-doctoral student for the first 6 months, she made sure it was within walking distance of her university.

Transportation became a challenge when she moved further away:

At the beginning I did. When I was living with some of the roommates, I lived within walking distance. But again, it didn't work out, so when I was living with [name withheld for confidentiality], you know, the lady that rented me the room from her house, it was a little far, so I did have to take the bus. So that was challenging sometimes because of the schedule, and it was not good. I missed the bus a few times. (April)

And, you know, you're working in the night. And, oh, you know, it's when those things happen that, you know, you get home and you think, "What am I doing here?" But again, your strength comes back, and you find the light and a nice message from the family. And then, okay, it's okay. I'm okay. I'll be more careful so that the bus doesn't leave me. But once I got the car, that changed everything. Oh, because I was not restrained by anything, really. I could go to the grocery store. (April)

The first year of her PhD in neurobiology proved difficult for Luisa as she experienced difficult barriers with transportation:

The transportation was very tricky because when we applied and when my sister had me look for apartments, what I received in [Country of origin withheld, for confidentiality] she looked, and they found me an apartment nearby the University. So, I could ride the bus. I didn't have to pay, or I could walk.

But it turned out that my advisor was adjointed to that University, but his actual laboratory was in a medical school that it was only 15 minutes away, like, in car.

The barrier with transportation became evident when Luisa could not take a public bus to her assigned lab to do research. This research lab was located in the medical school where her academic advisor and research supervisor worked:

As I didn't have a car and there was no public transportation to take me to this place, I had to take a shuttle, which I had to pay for. It was kind of a taxi because I have to call every day to schedule the ride. And they would come get me. I always told them I needed to be at school by 8 in the morning. Because the shuttle often times needed to pick up different people to take to different places, sometimes they would pick me up at 6:30, sometimes at 7. And they will take me through the entire town until they finally dropped me off at school. Then I had them picking me up by 5 pm.

All of this was kind of stressful because in the research field there are different series of steps every day to complete experiments. Sometimes you don't know what time you're going to finish, what time you are done...so, it was a very stressful situation.

Akilah applied to a state university that was close to her apartment. She did not visit or apply to other universities due to transportation issues: "And then [name of university nearby deleted to preserve Institution Confidentiality] was the only university I knew at that time."

Additionally, when Mira's husband came to the United States a year after she arrived, the couple changed apartments. However, the couple made sure their apartment was within the route of the university's bus service: "Also, when we moved to an apartment, which was a little of a—you know, some not quite a distance from the university, we specifically took a place where the bus service was there for the university."

***Difficulties Learning how to Drive in the United States.*** April's peer told her she could borrow her car. But April did not know how to drive and struggled to pass the driving test:

And so, she was like, "Okay, you can use my car, so you can take the exam." And I said, "Yeah, but the problem is that I don't know how to drive." And so, the very first time that I went back home, I told my mom, "Mom, I need to learn how to drive." "And I remember I got home, and she had already signed me up for driving lessons. So, imagine, I learned how to drive in three weeks."

***Barriers Obtaining a Driver's License in the United States.*** One of April's peers asked her why she didn't have a driver's license:

When I didn't have a car, you know, I remember a good friend that I made during my graduate studies, you know, we used to study together for our courses, and I remember, you know, one time when she realized how was it, you know, that I didn't have a driver's license? "You don't have a driver's license?" "No, because I don't have a car."

And then the expectation now is that I come here and take the exam and be ready. So that was really hard, but you know, my friend, she used to take me in her car so that I could practice. I failed the exam three times, okay? And the problem is that I think this person—it was always the same person. And the first thing that he asked me to do was parallel park. And I couldn't parallel park.

So, I thought that I was never going to get a driver's license. That was so frustrating. But, you know, I did it. I don't know how without a car, really. But just, you know, borrowing a car here and there. It happens. So, then after I got my driver's license, then, you know, I got my car. I basically learned how to drive after I bought the car. But I used to get up very early so that there was no traffic cause I was terrified. But, you know, in a matter of a few months, you get comfortable.

Eventually, Mira obtained her driver's license in the United States:

So, you know, like, driving in the U.S. is actually very easy. It's much easier than in [country of origin deleted for confidentiality purposes], you know? Because it's just so orderly. And if you follow the rules, you know, and automatic transmission, I think it's so very easy.

***Barriers Buying the First Car.*** Having only one car was not a big barrier in terms of transportation for Mira and her husband thanks to their careful planning: “So, my husband by that time he was doing his internship as a pharmacist, and so he would take the car and I would just take the bus, university bus, you know?”

Pilar’s initial living accommodations made it easy for her to walk to her university and she first relied on peers and friends she met during her master’s program to drive her to buy groceries or things she needed: “Without that, and a friend from here—the friend that I lived with when I was in [name of city] every 15 days and she took me to buy groceries and everything before I got the car.” Eventually, Pilar bought herself a car. “And then I got the car, and I was not needed.”

### ***Financial Barriers***

Seven out of the 8 participants reported having to overcome some financial challenge. Financial challenges varied from minor to extreme hardships. One participant was offered free tuition, a teaching assistantship, and several fellowships. Her family was very supportive and are members of the upper socio-economic class in her country of origin. Hence, she did not experience any financial barriers.

***Difficulties Applying for and Obtaining the First Credit Card to get Access to Computers, Textbooks, and Other Educational Supplies.*** Akilah and her newlywed husband had to wait to obtain their first credit card to buy their first computer, so she could search for PhD programs in the United States. “Then you will be accessible. I mean, you will get access to computers and things like that. ‘Till then I was dark cause I didn’t see any computer or anything in here.”

### Difficulties Finding Teaching and Research Assistantships as International

**Students.** Six of the participants had to struggle to find teaching and/or research assistantships.

These six participants (75%) endured financial hardships and difficult living accommodations.

### Barriers Finding Scholarships, Part-Time Jobs, and/or Additional Sources of

**Income.** Four participants (50%) experienced difficulties finding scholarships, part time jobs. or additional sources of income. (All barriers are shown summarized in Table 31.)

**Table 31**

*Findings Three G. Financial Barriers*

DESCRIPTORS				
Participant	Overcame a financial challenge	Difficulties applying for and obtaining the first credit card	Difficulties finding teaching and/or research assistantships as international students.	Barriers finding scholarships (S) part time jobs (PTJ) or additional sources of income (ASI)
Luisa/07312017	X	X	X	SX; PTJX; ASI
Akilah/09132017	X	X	X	SX; PTJX; ASI
Mira/09182017	X	X		
Pilar/12072017	X	X		ASIX
April/12132017	X	X	X	SX; PTJX ASI
Rose/03212018	X	X		
Ana/ 02032018	X	X	X	SX; PTJX; ASI

### *Academic Barriers*

Many participants struggle with academic issues relating to a lack of necessary scientific background and not knowing scientific terminology in the English language. Luisa shared her difficult first class:

It was another science class. A high level class. I did not understand the topic of the first class. I had no idea what they were talking about. So, as I was sitting there, I was thinking, ‘What am I doing in this place? I don’t know what they’re talking about. I could understand some sentences, some words, but the topic, I had no idea. When I went to see the list, I could not understand any of the titles of those chapters in there because there was a lot of electrophysiology, a lot of things that I’d never heard before.

I had to keep working with the lab, so, I struggled at the beginning a lot trying to understand, first of all the English. I know the science that she [her sister whom she replaced during her older sister’s maternity leave] was doing. I could understand that. I knew the technique, but it was the Scientific English terminology I struggled with... I didn’t know, and yeah, even a lot of the science I didn’t know in English.

**Challenges in the Research Lab.** Ana related her challenges:

So, like, I’m a civil engineer, but like, in my research lab the other person will be, like, a neuroscientist or, like, a biomedical engineer. They are working with gates in the lab. Like, I have no connection with this person. You know? So, we couldn’t really speak the same language in that way, so it was hard to...that was one of the main challenges, I guess.

**Difficult Courses.** The majority of participants took difficult science courses. April stated: “All the courses were challenging.” Mira added

You can say there was one course that was a little bit difficult, and that was spectroscopy. You know, even though I managed to get a good grade on it. But it was challenging. It was because I had not experienced anything like that before. And so, it was a little challenging. And at first, you know, like, yeah—that was the only course I can think of.

Ana reiterated the same thing: “My courses were all outside my field. They were all incredibly challenging, all of them.”

**Barriers Writing, Presenting, and Publishing Papers.** Luisa experienced severe challenges writing her dissertation:

I spent a lot of time, a lot of hours at his office [dissertation chair and research supervisor] just because that was the only way we could ask during my thesis, the advisor on my thesis, the preparation of my dissertation. We spent hours and hours. Because I know on my writing skills were not the best at the time, so he didn't like anything I wrote. But then so he had a student next to him talking about what I was doing just to make sure that I did know what I was doing. And then he would write it. Like, this is not working.

Pilar had challenges presenting specially in conferences:

And always, I mean, I'm not—I am afraid but still I get nervous when I do public speeches and things like that. But as soon as I was here, one of the things that I have to do is go and give a presentation on a program that we were doing. So, I practiced, like, the night before, like, for two hours or something. I say, "Okay, I feel confident enough that I'm going to be able to communicate clearly what we are doing or..." Those have challenges, of course, but really our challenges that are easy to overcome—not very difficult.

Luisa did not get to publish her dissertation:

Oh, yes, yes. Yes, I did. I did. I was allowed to graduate. I did have a paper. I was a co-author and so that school can accept that was pretty much the requirement for graduation, and that we needed to have a publication. It didn't have to be as a professional. I did need an application out of his lab, but my project since then, it hasn't been published. And I hope they get published because they were many beautiful projects.

No. We have not published that [Dissertation]. I don't know if he's going to. I don't know if he's ever going to because he [Dissertation Chair] had a lot of unfinished projects started left unpublished, but when I graduated, he was writing the paper from the project that they saw preview that just were completed before mine in the lab. (Luisa)

**Difficulties Preparing, Taking, and Passing the Qualifying Exam.** Pilar shared her stressful time during the qualifying exam:

Very stressful. I completed it [study program courses] in I think it was about 4 years. I completed all my courses, but what you heard from other students about the qualifying exam are terrifying. They said, "That's the worst thing that could happen to you. For a week you have to do this and this." I mean, everything that I heard from others was, "[gasps] Qualifying Exams! Pobrecita [Poor thing]. Oh, my God!"



I was given one week [to complete qualifying exam] I have five supervisors, five advisors that gave me questions and I have to respond to all of them. I got a one-week vacation from work and then just devoted myself to that, and I completed, and I passed.

Rose took her qualifying exam earlier, while pregnant with her first child:

My husband applied and obtained a teaching job. I mean, it was kind of the branch—there were different branches in Houston, Austin or some other cities and they said that they want to send him to different branch. Then this is what we decided. We said that, okay, if we take the qualifying exams earlier, maybe you know, we can say to these people that, “Hey, my wife is doing her PhD and she is very serious on that.” So that was one reason that I wanted to take it earlier.

**Dissertation Challenges.** April’s greatest challenge during her dissertation was her first pregnancy, the birth of her first child, and taking care of a newborn baby. Her first pregnancy occurred during her dissertation:

It was a challenge because we had our first son in my last year of graduate school. And basically, that did not put me on a delayed path. You know, my goal was, “I’m going to write my thesis.” And that’s basically what happened.

### **Factors Used to Navigate Barriers**

In addition to the main research question, this finding addressed Subquestion 2 B:

Which factors did the participants use to navigate the barriers they encountered? All factors the participants used to navigate barriers were discussed under Factors Which Support Success. The specific strategies the participants used to navigate and overcome these barriers were discussed in the following themes:

Theme 3: Overcoming Academic Barriers

Theme 4: Learning English as a Second Language Proficiently.

Theme 5: Overcoming Acculturation and Cultural Shock

Theme 6: Support from Academic Advisors, Research Supervisors, Faculty and Mentors

Theme 7: Balance

Theme 8: Self-Determination

Theme 9: Resilience

Theme 10: Persistence

### **Summary**

There were 11 themes presented in this chapter that emerged from the participants' direct shared experiences, illustrated with artifacts the participants provided of Arts Based Research of those experiences. Additionally, I presented findings of factors which support success; personal attributes; and, barriers and factors used to navigate those barriers. I provided a discussion of my findings. In the next chapter, Testimonios, I present the complete *testimonios* of three preselected participants, along with their collective Testimonial Narrative Themes.

## Testimonios

The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international doctoral female students who succeeded in their PhD programs in STEM fields or completed a doctoral program in the health sciences in the United States. To arrive at the *essence* of their lived experiences, I had to further uncover injustices, tyranny, and unfairness the participants experienced. *Testimonios* as a methodological tool was a perfect fit to describe perceptions of oppression, discrimination, marginalization, and sexual harassment expressed by some participants.

I used *Testimonios* of my participants' reflective narratives regardless of their ethnicity and/or country of origin. These *Testimonios* were not limited to the Latina (South American) international doctoral science students. They included the voices of female participants from Asia. Delgado Bernal et al. (2016) posited that "the methodological strategy of *testimonios* is by no means limited to the research conducted by or with Chicanas/Latinas" (p. 3). Moreover, I used *testimonios* as a space to describe and reflect on the lived experiences of these international women scientists who succeeded in their STEM PhD programs.

These lived experiences were delimited by gender, race, socio-economic status, religion, civil status, and immigration status. The participants' *testimonios* document their battles to learn English as a second language, adapt and survive in a new country, and in challenging STEM and health sciences academic doctoral programs. "It narrates their efforts to persevere and become resilient in the face of what appeared as oppressive institutional policies, unique complex interpersonal relationships, and critical personal events" (Perez Hueber & Cueva as cited in Delgado Bernal et al., 2016, p. 35).

*Testimonios* can be extracted in different ways, including quoting verbatim the participants' spoken words from transcripts; incorporating observations taken by the researcher during the interviews; from analytical memos during coding; and from insights written in the researcher's journal (Delgado Bernal et al., 2016). I looked for *testimonios* that emerged naturally from the participants telling their stories. I extracted *testimonios* from the participants' transcripts and incorporated them in my analysis of data. The *testimonios* are quoted verbatim using the participants' own words.

Reflexión entails an examination of the inner self and sharing that inner self with a trusted dialogue partner. Through reflexión, we move beyond self-reflection and self-inquiry toward a shared experience where our dialogue partners reflect our truths back to us as they share their own life journeys. This process accounts for the distortions and (mis)perceptions of ourselves based on the vestiges of oppression that continue to manifest within academe, tethering us to one another in the midst of racist, sexist, and classist environments. Reflexión helps us situate and explain how our lived experiences exist within a broader set of social and institutional structures. Through this process we analyze data at multiple moments in time. (Espino et al., 2012, p. 445)

I added my personal "*reflecciones*," or reflections, added my interview observations, and my analytical memos to the data corpus during data analysis. These *testimonios* were verified from the participants during member-checking transcripts and during second interviews if more information was needed. Furthermore, following the steps of Cantu (2008), I take *testimonios* one step further to inform the policies and recommendations for increasing the number of recruits of international female STEM PhDs and doctoral health science students in the United States and ensure their retention and academic success.

In this chapter, I introduce to the readers how I met the participants for the first time and then tell their complete narrative stories or *testimonios*. I then share themes found among all *testimonios* in a section on *Collective Testimonial Narrative Themes*, where I take profound pieces that speak to each theme to support evidence of my thinking/interpretation. This chapter

will culminate with a summary of *testimonios*. The *testimonios*' connection to current literature is discussed in the following chapter. Implications of themes and key findings from *testimonios* to higher education is discussed in the final chapter under "Recommendations."

### **Participants' Selection for *Testimonios***

In addition to the criteria for general participation in the study, the participants were pre-selected for extraction of *testimonios*. The criteria for the participants' selection included:

1. To have experienced discrimination, oppressive environments, unfair treatment, sexual harassment. and/or to be considered a student at risk due to deficient academic preparation from country of origin, lack of proficiency in the American English language, poor socio-economic status, lack of funding, and/or difficulty maintaining non-immigrant international student visas (Delgado Bernal et al., 2016).
2. To have successfully overcome all barriers and graduated with a STEM PhD.
3. To have become agents of change, providing a voice for other at-risk students and those international female STEM PhD students who have similar experiences.

Four participants met these criteria: Luisa, Akilah, April, and Ana. In the previous chapter, under the theme of *Identity Building*, I selected and discussed Ana as the most salient example of developing a new personal and professional identity, despite numerous barriers. For this reason, I only chose Luisa, Akilah, and April for extraction of *testimonios*.

The *testimonios* include the participants' narratives and perceptions of the many barriers they had to overcome to obtain their STEM PhD or Doctorates in the health sciences. The *testimonios* provide in their own words what conditions of oppression, discrimination, marginalization, sexual harassment, and/or extremely difficult barriers they experienced during their doctoral studies. Their words of wisdom for current and future international female STEM

and health science doctoral students in the United States will be provided in the following chapter.

### **Luisa**

Another participant who acted like my “gatekeeper” referred me to Luisa by word of mouth. I contacted Luisa by e-mail and phone, and she kindly agreed to be a participant in my study. She signed an informed consent and was sent a survey for demographics prior to our first meeting. Luisa obtained special permission that allowed me to interview her in her research lab, in a pier one public research university in the United States. I first met Luisa in her high security STEM research lab. I texted her from my cell phone and she came to greet me at the entrance of the building. She then took me to a small section of the lab that we used as an office for the interview. Luisa’s *testimonio* follows:

Luisa, the youngest of three siblings, grew up in a low-income but very loving and close family in a poor developing country in South America, characterized by more than 50 years of civil war, and political and economic instability. Luisa provides a good example of family encouragement and motivation. Her father conveyed to Luisa and her two other siblings the importance of education. Higher education is highly regarded in Luisa’s country of origin. However, in her developing country of origin, public education is very limited. Only citizens of the upper middle class and upper class can afford private schools and private universities. Additionally, young children are expected to help their families financially after high school. Hence, very few fulfill their academic dreams.

So, I grew up in a small family. In my family, there were my mom and my dad and three kids. So, I’m the youngest. I have a sister and my brother is the oldest. We grew up in a very modest family house. We were all very close and we were always home. And for my dad it was very important that we study. Study for my dad was the major thing that everybody should do.

Luisa lost her father at a very young age. “But my dad passed away when...he was very young, and I was only 11 years old. He developed cancer and he passed away very fast.” After the death of her father, Luisa continued to study hard, graduated from high school, and applied for college. “So, I did well in high school. I had no problems, no issue.” Luisa’s older sister was also a source of inspiration, motivation, and encouragement. Luisa’s sister was the first to graduate from college in her family with a science degree and came to the United States and obtained a STEM PhD. Luisa’s sister guided her academic path:

When I was in 9th grade, my sister was finishing up her thesis in biology and got a scholarship to come here to the United States for a year as an exchange student. During that year she learned a lot and got more passionate about science. She decided to apply to graduate school and she stayed here pursuing a doctorate degree.

Luisa graduated from college with a bachelor’s in science degree, majoring in biology with a minor in chemistry. She struggled with unemployment after college. The internship barely covered transportation expenses working in her lab, but Luisa volunteered anyway because she could not find a job. This was one of the reasons for Luisa following her sister’s path of going to graduate school.

Moreover, Luisa also broke up with her long-time boyfriend. The young couple had contemplated getting married but could not because of financial difficulties. Luisa decided to study English and seek other opportunities in the United States. Her sister was instrumental in bringing Luisa to the United States the first time as an exchange student: “I graduated [with a bachelor’s degree in biology] and was applying for jobs.” “I stayed working in the same lab I did my thesis, getting paid just enough to cover the transportation. But I did it because I didn’t want to stay home and do nothing.”

Luisa’s sister encouraged her to study English, and Luisa had inner motivation to do so as well:

While I was in college, I had started taking English classes because my sister encouraged me to do so, as it would benefit me if I ever had the opportunity to come to the United States and pursue further studies. So, I continued studying English after I got my college degree.

Luisa felt “stuck,” unable to move forward. She loved her boyfriend of many years, but they could not get married because Luisa’s boyfriend made very little money and Luisa could not get a job after graduating from college. Culturally, the young couple was supposed to either get married or break the relationship, because they had been dating for many years. Luisa’s mother, a widow, did not approve of the marriage because she could not afford to support the young couple with her modest income. For these reasons, Luisa decided to come to the United States to seek other opportunities.

My sister had her son when she was finishing her dissertation [for STEM PhD]. But the time she was pregnant with her second baby she was performing her post-doctoral training and I had graduated already and having a hard time in [country of origin] because I could not find a job. I was living with my mom and the situation with my boyfriend got complicated because we got stuck. He had a job, but we were not going to be able to live with that and I couldn’t get a job so, we broke up because things were not going anywhere, and my mom was not very happy with my relationship.

As my sister was getting ready to have her baby, she realized that she was going to need a lot of help in her lab and all the projects she was developing. My sister asked her post-doctoral advisor, to consider the possibility of sponsoring a visa for me to come and help her during that year, for a year. So, I got a visa as an exchange student, a J1 is what it’s called, I think?

The fact that Luisa’s older sister had completed her STEM PhD and was already conducting her post-doctoral studies in a STEM field in the United States opened opportunities for Luisa to follow the same study and career plan as her sister’s. Luisa’s sister had overcome many barriers as the first one in her family to graduate from college in a STEM field and to complete a STEM PhD in the United States. Older siblings from Luisa’s country of origin are expected to help their younger siblings achieve their academic goals; help them navigate the university paths; and are expected to help finance their younger siblings’ PhD studies.



Furthermore, her older sister acted as a cultural broker helping Luisa overcome cultural shock, loneliness, and language barriers. It would have been much more difficult for Luisa to obtain her STEM PhD without the guidance, support, and motivation from her older sister.

Luisa's sister played a critical role in empowering her to apply and obtain her PhD later on: "I do have to say my sister and having my sister and her family here was a big support for me." Luisa struggled with English and acculturation but soon recognized these impediments were an opportunity to learn:

So, it was very hard for me. But at the same time, it was the best opportunity to learn it [The English Language]. I stayed working in the lab with her technician, struggling a lot trying to understand even the basics of any language: how to greet and response to greetings.

During the year Luisa was helping her sister, she started looking for PhD STEM programs, prepared herself, and applied to graduate schools to avoid returning to an oppressive and difficult situation in her country of origin. Luisa had learned just the basics of her STEM Biology in her undergraduate degree in her country of origin. Her thesis was very simple and basic. In her poor developing country, especially in a public state university, there were very little resources for reagents, chemicals, basic scientific equipment, and technology. She was amazed by what she saw and learned in the United States:

During that year I started looking into graduate schools. Because I started thinking that going back to [country of origin] was going to continue to be very difficult, I wanted to find a way to stay here and graduate school seemed to be a good idea and I liked it, when I came here, I saw science at a different level. What I did in [country of origin], it was very basic. It had nothing to do with the type of research I saw here, we were very limited with the resources we had. The thesis I did for my college degree was very, very simple and when I came and saw all the different techniques and technology that you could use and apply got me really fascinated with that.

During that first year in the United States, Luisa took English courses and some graduate degree courses; prepared for, took, and passed the TOEFL; and the GRE exams. She also applied

to several STEM PhD programs before returning to her native country. Luisa married her long-time boyfriend soon after returning to her country of origin. When Luisa took all the entrance examinations and applied for admission in a PhD neurobiology program, she was still working temporarily in the United States. She then returned to her country of origin. Luisa was still single, even when she completed her interview by long distance phone call. She was hoping to gain admission and was awaiting the results of her PhD application. However, during this transition, she got married and continued to try to find a job in case she would not be granted admission to her PhD program.

After we got married and stayed living with my mom because we didn't know what was going to happen if I was going to get accepted and would have to come back here or if we were going to have to stay down there. So, I was looking for a job during that time, but still with the hope that I could come back. Luckily, I got accepted into a PhD program in [name of university and state withheld to preserve institution anonymity].

Luisa could not come with her newlywed husband because she had not yet filed the paperwork with the U.S. embassy to bring her husband as a dependent on her international student visa. This was a process that takes at least a year; it is expensive to apply, and the young couple lacked the financial resources to do so.

I came by myself because when I had applied, I was not married yet, therefore I didn't submit any papers for my husband. I came by myself, and I stayed by myself for a year. Because I didn't have the money to bring my husband with me right away, I saved some money for him to get the visa and come join me.

Luisa worked and saved money and filed the paperwork to claim her husband as her companion with her international student visa. Luisa's husband came to the United States a year later. Nonetheless, her husband experienced many acculturation problems, and it was difficult for him, due to his visa restrictions, not to be able to work in the United States and not to be able to study due to financial limitations:

My husband wanted to study, but it was really difficult for him to study because we didn't have money to pay for anything, he saw a lot of possibilities to study but he needed to study English as well and that was very expensive too. As a graduate student I had an F1 visa, and my husband was a dependent of my visa, with the limitation of not being able to work, so, he did not work while I was in graduate school, which was rough.

Luisa comes from a paternalistic society. Men are supposed to be the main bread winners of the family. To this day, most Latino men from Luisa's country of origin are "*machistas*" [male chauvinists]; they have very traditional gender roles, especially after marriage. Women have gained access to universities and have even surpassed men in many fields of study. Nonetheless, after marriage, most professional women become stay-at-home mothers, at least until their children go to elementary school. There are a few exceptions like female medical doctors completing residency. In those cases, traditional Latinas from South America recruit the help of doting grandparents, extended family members, and/or hire live-in nannies. These are exceptions, however, and not the norm.

It became a little hard for him because as a man, it's really difficult to stay home and do nothing and not contribute financially to the household. So, it was getting really difficult to the point of being very close to go back to [country of origin withheld for confidentiality]. He was very close to go back. At that time, I didn't know what was going to happen with us. I told him that I did not know what was going to happen to our marriage because I knew the situation in [country of origin withheld for confidentiality] and there was no warranty that he would get a job.

But I was also, having a really difficult time in graduate school. I was doing great with my classes, but I started having problems with my advisor. So, there was a moment that, a few moments, but I remember it was just one day that I almost, I almost quit.

During the time that her husband was experiencing cultural shock, isolation, and feeling bad for not being able to study or work in the United States, and adapting to breaking from traditional gender roles, Luisa experienced severe problems with her research supervisor and academic advisor. Luisa felt her research supervisor did not understand her behavior and culture as a Latina from South America. As a young South American Latina, Luisa loved to try new

things. She loved makeup, nice stylish clothes, long hair, and high heels. She liked to dance and enjoyed occasional drinks.

I was like, you know what? And it was around the same time my husband wanted to go back. I was like, you know what? Maybe this is a sign. Maybe it's just a sign that I shouldn't be in this place. I should go back and I'm just gonna quit. I'm just gonna leave it as it is because it was really hard, you know, with my advisor. He could not, he was not understanding my culture where I came from. And he was getting, he got too personal and at one moment he told me that he was attracted to me. And that changed the whole situation. He was a married guy, and he really misunderstood a lot of my behavior and the way how we [Latinas from South America] work.

Luisa lived by herself the first year of her PhD studies and her academic advisor and research supervisor wrongfully assumed she was single:

Like, I was married. My husband wasn't here and remember that even the first year. and everything that kind of started, he was building up things in his mind without me knowing. As a [country of origin in South America] woman, when I got married in [country of origin in South America]. I wear my wedding ring on my right hand, not on the left one. And I don't have a diamond.

Due to cultural misunderstandings, her research supervisor and other faculty were not aware Luisa was married:

So, for that people [faculty and research supervisor] did not know that I was married, but all my friends knew because you know, when we start making friends, like, 'Hey, are you dating?' I'm like, 'Oh, no. I'm married.' '[gasp] Where's your husband?' I'm like, 'Well, my husband is in Colombia.' He was not here, so, everybody in the lab knew that I was married. During that first year my advisor, he invited us over to his house to celebrate something. I don't remember if it was for Christmas, Thanksgiving, something. He celebrated us and he invited us to come over with our significant others and when told us that, he kind of looked at us and nobody had anybody. Like, so, me people...oh, no. I think there was one with baby, so, she came. And when he looked at me, I didn't say, 'I'm married, but I have...' And I told him, like, 'Where's my significant other? He's not here.' That's all I said. But I didn't say my husband is not here. So, he thought that I was alone and one day, so, we went there by ourselves. I mean, it was fine. One day, I don't know how we were talking. Like, all the people from the lab. There were, like, five students at that time. We were talking, and somebody brought up my husband. And he's like, 'Do you have a husband?!' I'm like, 'Yes. I'm married.' 'Why didn't you tell me?' I'm like, 'You never asked, and I never felt that I needed to say that I was married.' I'm like, 'I'm here to study. And even when my husband was here...' Ah, no. But when he knew that I was married, my husband was already here. But when I was in graduate school, I was in graduate school. And I was studying. I was staying in the lab early and

staying late as I needed. My experiment, I never left my experiment. And my way of thinking is like, 'I know I'm married. I know I have a life, but I cannot let that life interfere with my studies.' And nobody needs to know what's going on with my private life. They don't need to know, so, I never felt, and I never had, like, the confidence or the need to talk to him about my personal life. Like, there was never a situation for that.

Luisa's research supervisor seemed surprised and upset to learn that Luisa was married.

He based his wrong assumption of Luisa being single on Western stereotypes about women:

So, when he knew that I was married, I thought he was kind of joking but the more I thought about it, I'm like, 'He was kind of upset.' I was like, I don't understand why. Like, there was no, like, 'Why didn't you tell me?' I'm like, 'Because you never asked. There was never an opportunity for us to talk about it.' Like, and it's my personal life. Nobody needs to know it. 'Well, but there is no cue that you're married. You're young. You're pretty. You're this. And you don't have a wedding ring.' I'm like, 'I do have a wedding ring. This is my wedding ring.' And he was married, and he never wore a wedding ring. So, why? I didn't know.

Luisa's research supervisor misunderstood Luisa's cultural behavior. Luisa, a South American Latina comes from a communitarian society. In Luisa's country of origin, it is quite normal to have drinks and dance. Singles and married people, young and old, get up and dance and it is not considered inappropriate. Additionally, Luisa's research supervisor had a sense of entitlement to do what he thought was correct based on his misunderstandings on stereotypes based on Western ideology such as not wearing a wedding ring on the left hand; abusing his power and imbalance in the student-advisor relationship; "grabbing" Luisa and forcing her to dance with him:

So, I didn't pay attention to that. I'm like, it's fine. So, on after that, we went to a meeting to Colorado. Another graduate student, my advisor and me. He took us, what was it? Skiing. So, at that time we spend a lot of time, like, the three of us together, like, outside the lab. So, we spent a lot of time when we were in the lab, in his office, talking about experiments, talking about science. But during this meeting we spend so, me, like, social time, which it was a complete mistake. Like, I'm a person. I like, well, I'm not very social, but I like parties. And we went skiing. So, we were laughing. We were having a good time. At night times, you know, there were receptions, and we have a drink. I would have, like, with the other friend, with my other lab mate it was fine. But he misunderstood everything that happened over there. And there was one time that I made a mistake and I realized that after the fact. I didn't do it with an intention. We had a glass

of wine in the table. We were talking to other people, and then I went with my friend, and we got a margarita, each of us. We got a margarita and we brought it back. And he looked at us, like, 'Oh, you're drinking by yourselves?' Because the wine, the people that were holding these meetings, they provided a bottle of wine for the table. So, everybody was drinking from that bottle, but I didn't like that wine. So, that's when I went with the other girl, and we bought a margarita for us. When we came back, he's like, 'Oh, you're drinking yourselves. You don't want to drink with me.' And we're like, 'You're drinking wine.' And he's like, 'There's no more wine.' 'Oh, do you want a wine? I can go get you a wine.' So, I went, and I got him a glass of wine. And I didn't think about it now. It was social and we stayed there and then later that night they started playing music. I love music. I love music. I love dancing. I was dancing. Like, everybody dances by themselves. So, we were dancing, but then they started playing some music that people from here, they know how to dance. Like, it's in couples. So, he grabbed me, and we started dancing. We were dancing, I didn't say anything on it. I lied to them. My husband didn't go, but he was home. Like, it's nothing. I'm like, this guy...he's way older than me. He's my advisor. There was nothing that could happen there.

Luisa's research supervisor and academic advisor made her work long hours. This was also a sign of abusing his power in the adviser-advisee relationship. She did not see anything wrong with that as he had the same practice with other research assistants in his lab:

Because of that, and another thing that contributed to all this mess is that I spent too much time with him. Every time I have a problem, or I had a question, I would have to sit there with him hours. Sometimes I will go 9 in the morning, and it was 5 o'clock and I was still sitting there trying to solve a question because if I didn't know, he would not give me the answer. If I will start giving a wrong idea, he will let me go all the way over there to show me that that was wrong, and then started dragging me back to the right. So, it was a long, a lot of conversation. It was not just for me. It was all the students. And we even made a rule in the lab. Like, if it is 3 o'clock, 3 or 4 o'clock don't go talk to me because he will sit and he will keep you until 7, 8. He didn't care.

Then, one day, Luisa's academic advisor and research supervisor openly expressed his feelings for her. Luisa was shocked and very scared:

I did spend a lot of time with him. But I never saw anything like weird until he invited me to this lunch, and I thought we were gonna talk about this other girl and he just threw it to me. 'I feel attracted to you. All this time that we have spent together.' I did not know how to react to that. I was just in shock. I could not speak one word. I was like, my life is ruined here. What am I gonna do as an international student if I don't have a PI? If I don't have a place to stay in, I cannot stay in this country. I'm gonna have to go back. I'm not going to be able to graduate. That's all that was going through my mind. So, it made it really, really difficult. So, that day I was just, the only thing that I said, like, 'I'm so, sorry. I'm so, sorry, but that is just wrong. There's no way. I don't know why you felt that way, but I cannot deal with that.' Like, 'I leave the lab.' And I told him that, 'You

know? If I need to leave the lab, I leave the lab right now. But there's nothing I can do. It's not because you're married. It's not because I'm married. It's because there's nothing. Like, no. There's no possible way that I could be interested in you or that there's a possibility that there could be something here.

Luisa faced a very difficult problem. The much older man, married with children, who was making advances at her, happened to be her academic advisor, professor of several of her courses, research supervisor in her lab, dissertation chair, and principal investigator of her STEM PhD program in neurobiology. As an international student who needed her student visa to remain in the United States, and her husband dependent on her, Luisa (who had already spent 3 years in her STEM PhD program) felt cornered, with nowhere to turn. Luisa reached out to her research supervisor trying desperately to clarify her position. She apologized for giving him the wrong impression. She was trying to neutralize the power imbalance, explain cultural differences while trying to save her STEM PhD:

So, that changes my whole entire experience, because I was into my third year of graduate school and things just went downhill from there. It was really, really hard. But it was my husband, so, I didn't tell my husband right away for a while because I thought I could handle that. I didn't tell anybody because I was feeling, to me that it was a dream. Like, this is not happening to me. Like, not a dream, a nightmare! Like, this is not happening to me. This can ruin my life. So, I didn't want to tell anybody. What I did is that the next day I talked to him and was like, 'You know what? I'm sorry if I did anything that gave you the wrong impression, but I'm just here to do science, to get my PhD. Please let me know if I can still do that in your lab. If not, I will leave. I will try to find a different lab. I will try to- I know that will be hard,' but I told him, 'I will try to find a different place. But I cannot, I don't want to leave, but if I have to leave, I will leave right now because you have a family, and I don't want to ruin that.' Like, I know my marriage is not being compromised because I didn't have any feelings. But it was like, 'You have a family.' Cause he would bring his sons to the school cause their school was across the street from this place. So, after school they will come and stay with him until it was time for him to go home. 'You have a family, and this is that.'

Luisa's research supervisor wrote a letter of apology to dissuade her from quitting her neurobiology PhD program but continued with the inappropriate behavior. But it became evident to Luisa that he continued with his sexual innuendo, and she recognized that it was sexual

harassment, and it was wrong on his part. Furthermore, Luisa's research supervisor refused to understand the Latina South American culture and would watch her interactions with male Hispanics from South America feeling jealous and falsely accusing her of inappropriate behavior with them, which was creepy.

So, he wrote me a letter apologizing what he had done. He said that his feelings should not interfere with my dream, that I was very smart, very brilliant person.' Because that's another thing that he said. He was not physical. He was like, 'You are so, smart. You're one of the smartest person that I've ever met and it's kind of impossible to have people that are smart and that, of course, they always brought up the physical thing, that you are so, pretty. You're this and you're Latina.' And then he started talking, at the time I didn't feel it so, inappropriate, but then I realized like, 'Yeah, he was inappropriate.' Like, everything he will say, it had, like, a sexual context. Like, [gasps], 'Your sexy long hair.' You know, like, we all have long hair in my family in our country, so, he misinterpreted all of that wrong. Like, I was doing it on purpose. I'm like, this is how we are [in my Latina culture and South American country of origin]. This is what we do. And if there were any social events, I met a guy, like, another graduate student joined a different lab in the same place, and he was from Uruguay. We felt like we had known each other since forever just because we could speak Spanish. So, this guy was so, sweet, and we are, this is how I see most of the Latino population. We are very...I don't know we express ourselves very much, like, through hugs, kisses and of course, my advisor will see that, and he will come like, 'Huh, you were having a lot of fun the other day.' We're like, it was nothing. It was just, it's everyone [from South America].

Luisa tried to make things work in the lab after making it very clear to her academic advisor and research supervisor that she was not interested in having a personal relationship with him:

I was in the middle in a serious and very compromised and very time-consuming situation. I couldn't say any of that. So, the first thing that, I think it was the next day, when I talked to him about that and I asked, 'Can I stay? Or like, can we just put this aside and there's nothing that I'm doing that can help you with your feelings for whatever. I just want to pursue my thesis. I just want to graduate.' And he said that it was okay.

Luisa also tried to minimize contact with him. But her research supervisor retaliated, creating a rule for everybody in the lab to go talk to him every single day:

When with his work, I trusted him. I was like, okay, let me try to do this from the back. So, what I tried to do kind of ask him, this whole situation, that I tried to minimize my



contact with him. My office was the office where the graduate students were sitting, which was next to his office. I would start to minimize contact. And I would go to the lab, my office, do the job in the lab. And I didn't continue interacting with him, and any time I had a question, when I made it the lab, like an advisor. But it was very, very difficult because it changed the whole relationship. Because oftentimes I think that it was often my side that I felt that some comments, I would take them [comments] personal when they might not have been personal. But that's the way I took them. But it was not very...it was a very difficult time for that. And I...so but then by me trying to stay away from that situation, that created another issue with him and in the fact that he stated I wasn't willing to go and talk to him. He said that I was trying to be too defensive, and he was not pleased with that because everybody knows, everybody in the lab knows that he likes to have control of everything. Everything was his own company. So, he set up a rule for the lab which nobody was willing to follow, and it was that he wanted us to go and talk to him every single day about the assignments and now who's gonna have any independence. It was okay to a healthy extent, but there were times that it was a little bit too much.

Luisa's research supervisor was very controlling and forced all students to report to him every day, even for minor assignments, and for this reason, most graduate research students left his lab. Luisa's research supervisor put her down as a professional and tried to make her feel worthless for not reciprocating his feelings:

At the time that all this happened, a lot of his students had left the building. So, there were only two other people in the lab, maybe one or two that would come in the lab. So, I felt like, you know? I'm not gonna go talk to him every single day. So, I went, and I talked to him as I felt it was necessary, which he didn't like at all. Sometimes he was saying that I was insubordinate, that I was not listening, and I wasn't being a good servant because I didn't want to connect with him at the professional level. That I was not engaged, that I didn't want to engage with the conversation, with the small group conversation. So, it was very, very, very difficult because, and every time, like, I tried to, I didn't want to keep bringing up the issue. I didn't want to say, 'Hey, I just didn't want to share with you because of what happened.' But I would just stand and do my work that Monday through Friday. He was not happy with that. So, anyway I tried, he would just go with my...use my own guidance. I didn't even have to go and ask and tell him that I'm going to go to the lab to measure water. I feel like there's no need for that.

Luisa's research supervisor forbade her to get involved in other research projects with other principal investigators. He seemed jealous and possessive; perhaps afraid that Luisa would reach out and seek advice from them. Luisa felt isolated:

So, it created some problems because he was not very happy with what I was doing. Around the same time, I engaged in a project with another PI that they were collaborating, and it was going pretty well in that lab, but he decided that he didn't want me to continue with that. So, I couldn't do it because it was taking too much time out of his lab. So, he was not fine with that. So, it was very uncomfortable. It was very, very uncomfortable. I try not to talk about the issue, and we didn't talk about it. But he kept, for a while he was kind of serious and our conversations were kind of very short. But then he started kind of forgetting and getting comfortable again. And I just felt like I just felt that I had to deal with it. I just, I'm not gonna fight with this guy. I need to graduate. I just need to get out of this place, but I need to finish my requirements. So, it was like a complaint. It was very, very uncomfortable because there were places where, there were instances when there were, like, activities that involved many of the other persons in the lab, which were very, very uncomfortable. We didn't know any of this situation because we didn't tell her. But there were places that there were some activities when everybody went golfing [at some conferences]. He just wanted my attendance at a conference. He had...you should be fine, you should go. I didn't want to go but I didn't want to make it look like oh, there's something going on. I didn't want him to think that I could not be around him.

Luisa's research supervisor insisted they travel together, and that Luisa attend all the conferences he was involved in. Luisa felt very uncomfortable. Her research supervisor seemed to stalk her, becoming jealous and possessive if she even spoke to another male Latino graduate student. Luisa had plans to attend the conference with a friend from the same lab. But her research supervisor insisted both female students drive with him at all places.

So, we went, but it was alcohol with a maze. People were having drinks, and then many uncomfortable comments. And so, it was very difficult. It was very difficult. Sometimes I felt like he treated me like I was more than friends because the way if I were to talk to another guy, like a friend of mine was a graduate student, he didn't seem like he was really happy and that I was talking to other people. So, he created a very uncomfortable situation. We went to a meeting in Washington, DC. We caught a whole dose of it. It was a mess. I didn't want to be with him. I went with my friend, and we were together. Well now he decided that he had to take us and that we had to drive with him, be friends with him, to be alone with him in his car. It was very, very uncomfortable.

Luisa finally told her husband the problem she was facing. Her husband supported her and empowered her not to give up despite the inappropriate behavior.

But I didn't want to get my husband involved. I didn't tell my husband about the situation, like, right away. But I think it was very uncomfortable. There were a few times

that it was really ‘Just the quit. Just leave everything and go, find my husband. Tell me.’ And he’s like, ‘No. You need to talk to him. He cannot interfere with your life. You just go talk to him and knowing that I know all of this, that if he...’ I don’t know. My husband was not trying to get him in trouble. You don’t want to get him in trouble. He was like, ‘You’re not alone here.’

‘You cannot let those ruin your life.’ So, he was the one that kind of kept me going. At the end I just decided to deal with him. I really was not good. It was not comfortable. I spent a lot of time, a lot of hours at his office just because that was the only way we could ask during my thesis, the advisor on my thesis, the preparation of my dissertation. We spent hours and hours.

When Luisa started her dissertation, her academic advisor and research supervisor was also her self-appointed dissertation chair, and she was forced to spend long hours with him:

Because I know on my writing skills were not the best at the time, so he didn’t like anything I wrote. But then so he had a student next to him talking about what I was doing just to make sure that I did know what I was doing. And then he would write it. Like, this is not working. I don’t like, I guess you need to learn how...I was right and I’m telling you, my writing skills are not bad. If you’re bad, I think he needs to see you for if you need to be in his office with this. And for the things for my presentation, I have appreciated, like, big time, to have practice making sure that I did very good presentation. Because I had to go give presentations at private schools. I had to make the presentations at the various departments. And the department over there which you before maybe well known in another science field. And he really prepared me. He prepared me really well. He helped me prepare the presentation. I know very well like, the top, what I was going to say.

When Luisa’s husband would go to the lab when it was getting late to pick her up after long hours in the lab, her supervisor would make her feel bad about her value and worth as a scientist, stating she didn’t want to prepare well for her dissertation presentation:

But I think that it was a little bit too much. It was too much interaction. It was endless hours with him in his office. Sometimes my husband would come to pick me up, to see what was going on and he would see my husband, he never cared. Like, sometimes he looked surprised, like, what is he doing here? But he never said anything. And he didn’t ask, like, ‘Oh, I have to go now because my husband is here. It’s getting late. I think we can continue tomorrow.’ Like, then he would always say, ‘Okay, well, if you don’t want to finish this presentation. You don’t want to complete this thesis. It seems like you don’t care.’ So, it was very difficult. It was very difficult and, but it was, I guess it was, yeah, a few moments in which I thought that I could not do it anymore. So, I was ready to quit. I was ready to go back home. But at the same time, it was the fear. One of the things that helped me and that made me stay there is there were not ability that I had, that I spared at

the moment. Cause as an international student, I have a visa and I only had a visa as long as I had an advisor and an opportunity to work. If I lose that, I lose my visa. I lose everything. So, what am I going to do? (Luisa)

There were many times Luisa wanted to quit, but she just could not see herself wasting so many years of her life, and there were no PhD STEM programs in her country of origin, and in the United States she could not transfer all her doctoral credit hours. Luisa's research supervisor made her feel ashamed, despite the fact that it was his fault. He abused the power as a research supervisor-research assistant relationship. He made her feel guilty by the way she dressed and the way she looked. It was severe sexual harassment and predatory behavior.

So, for me it was difficult, but it is the mostly fear. Because I couldn't see myself just wasting 3, 4, years of my life trying to pursue this degree and to let it go because of him. Cause for me it would have meant having to go back to [country of origin] to a very difficult time and very difficult place to do research in the neurosciences, which that is what I wanted to do. And that's what I learned to do. And that's when I did my professional effort, it was to go through and finish a degree. So, for me I think it was just that the fear helped me to persevere with him. It was not fun. It was not good, because he was very thankful. I know, I didn't ask, I didn't speak for him [did not report him] because I felt even though it was not my fault, I felt ashamed. And sometimes with big thoughts, like, some topics he was telling me, and it was very offensive because he made me feel like I was responsible for that., that I was responsible for being pretty, for trying for new things, for dressing nicely. He just, everything that I did, he judged me. If I wore high heels, that was like a huge thing for him. Like, 'Why would you do that? You wouldn't look so good.' I'm like, it made me uncomfortable, the whole situation. It was how I dressed. It was how I talked. If I did my nails if I didn't do my nails. All of those things, he always had a comment.

The sexual harassment took a toll on Luisa, physically and emotionally. However, she did not go to counseling. Part of not seeking counseling comes from the culture of her country of origin where only severe psychiatric patients go to counseling. But part of it was the fear that the counselor at her university would notify her department of the sexual harassment and this would jeopardize her PhD and her visa as an international student:

So, it was very intrusive, and I just got used to it and I think I was in depression. I got depressed but I didn't seek counseling. I didn't want to get up. In the morning, it was really hard. I didn't want to go to the lab. I know I had my studying to do. Every time I

needed to go to him, my stomach hurt. Like, I said that I need to be picked up at this time and I needed to just go. Because with him it was very unpredictable because some days, we could have a good, like, professional talk, but some days he would be a whole mess and he would start screaming. And he didn't disguise his behavior very well. So, no matter what he did that was flawed, he always unpredictable.

Luisa was very shy, and unhappy, but did not confront him. She did cry in front of him. It is obvious that her research supervisor exerted power and control over her.

And he didn't have time because I just want to be what it needs to be. I know that you're capable to do anymore from just talking to you. So, I just want you to be regular. So, I just want you to be stronger. So, I just want you to come out of the shell. Because I'm very shy. I mean, I'm very shy with everything. I learned to come out of my shell a little bit just to protect myself a little. That's why I did show him a lot of my emotions. I cried a lot. Sometimes I try not to cry in front of him. But there were sometimes when he would be just really hard with me. And I felt he was just making me feel bad that he was supposed to go at this time with me just because he knows that I was a very brilliant student. And he knows that I was a very shy person, but that I was not appreciated above that.

Furthermore, Luisa was afraid of reporting him for sexual harassment for fear of retaliation and an unsupportive department:

I was too afraid because he had the ability to toss everything away from him. And I saw that with a lot of people. So, he was a person that he didn't have maybe good relationship with his colleagues. He was very famous in that place for being really hard on the students. So, he had had reporting from a lot of students, but none of them lasted in the lab. And everything was because there was something wrong that he was seeing. He never took responsibility, a little bit for anything he did. Worst of all was when I joined the lab, there were like, seven, eight people in his lab. Nobody, they know his standards than he did. And it was because of him that they left.

But he never took the responsibility for that. He felt like he didn't want to take responsibility to help any student. He decided that 'She didn't want to do this anymore. And I know they say that I'm too hard on them, but I'm not. I'm just trying to make them the best they can.' And so, I was very afraid. I'm like, I don't want to get into a situation which he's going to embarrass me and he's gonna make me look like I was the bad one because I felt very vulnerable. And the other thing is that I know I could have done something. And oftentimes, like, I will talk to him or, like, 'Hey, don't talk to me like that.' Because he felt, there were times he felt like he wanted to be my friend. And I'm like, we cannot be friends. It's like, he was trying to play joke and he would send me emails with jokes. I'm like, 'I don't like this. This is not the kind of relationship that you have with your advisor.'

Like, he's like, 'No, but it's fine. It's okay.' And I know he will send some of the other people the jokes as well. I was like, 'Okay, maybe it's not just me.' But I know, oftentimes he'd try that, to be too nice and too close to me. And I didn't like that. And so oftentimes I just didn't want to, when I try, like, to talk to him and he would say, like, 'I'm not doing everything wrong. Like, you haven't forgiven me for what I did.' I was like, 'Oh, my God.' So, it was very difficult because sometimes I didn't, I felt like I was always trying to bring the issue up, but he was not. He was like, assuming that that has nothing to do with this. This is just being me. 'You're fine.' I was like, 'But you cannot be fine or even try to be fine.' And so, he would, like, ask me about my family, a lot of my fears, and if I did not get along with that or come along letting him ignore me, like, 'What is it with you? You don't want me to know you?' And I said, 'It doesn't matter at this point. You don't need to be talking this.' So, it was very difficult. It was very difficult, but I just let it go. And that's why I didn't ask for help because I felt that I was...he was gonna blame me for all of that because he said it many times. He'd tell me how I looked, the way how I dressed, how...I don't know, how I hid my personal life, and I didn't tell him from day one that I was married and then we had fun. With me first and the way he came, being nervous. He didn't, well, he didn't bring him to the lab so he could seem like if I did anything inappropriate. But my friends know him, my husband, but I didn't feel I denied him.

Luisa felt her dissertation took longer due to this situation and that it delayed the time for her degree completion. She even considered the possibility of staying in his lab for a while to ensure publication of her research projects and her dissertation.

It took me 6 years [to complete my PhD]. It took me 6 years because the way the whole situation when...I don't even remember the days, but I think it was 3 years—in dissertation. I worked with him when I joined the graduate school. I worked with him from day one. I just started in fall 2006 and I graduated on May 2012. So, it was a long time.

And it was the whole situation and about, yeah, it was bad. It was bad. There were times that were okay, but it felt that it was always something that I had in the back of the mind. What's he saying? What's he thinking? And then I have to double-think everything that I wanted to say, everything, everything. It was now very difficult. And even towards the end, it was, he didn't want to make me graduate. He was trying to get me to stay. And I was so stupid that I was even considering the possibility to stay until now because he had on grants. He had no money, and we had a lot of assignments, projects that just started on—

Luisa was conflicted because she was a good student and acknowledged that at times her research supervisor promoted her research and helped her with her dissertation. But at the end,

her research supervisor retaliated against her and did not publish her research papers nor her dissertation.

Yes, because he had good moments. There were moments that he hated me and didn't want to deal with me, but there were some good moments, I'm a good student, so he could have liked that and so he knew that if I leaved him he would be by himself. A lot of the data, like, I lost my data. My dissertation hasn't been published. To this day he has not published my dissertation.

Luisa's research supervisor postponed publishing all of her research projects and dissertation to force her to stay in his lab. To complicate matters, he filed for divorce from his wife, hoping to be free and convince Luisa to have a relationship with him.

No. We have not published that. I don't know if he's going to. I don't know if he's ever going to because he had a lot of research projects started, but when I graduated, he was writing the paper from the project that they saw preview that just other PhD Students in the lab, you know, had done. There was a lot of information. He wanted me to stay for a little longer to stick him out, but I decided not to stay because it was just making me feel uncomfortable. He even blamed me because his marriage. He decided to end his marriage.

Luisa's research supervisor tried to play the victim and blamed Luisa for his failed marriage when he himself was the reason for his failed marriage for spending too long hours in the lab:

I didn't know, and he even blamed me for that one. I was like, 'What are you talking about? It doesn't make any sense.' So, it was not good. It was not good, but for me it was the fear.

Luisa feared to lose of all her hard-academic work, courses, research, and time invested in her STEM PhD. Luisa also feared losing her visa as an international STEM PhD student and being forced to leave the United States:

The fear of not having a degree and then not being able to stay in this country because I really wanted to stay here. I know I have more opportunities here. My marriage had worked with me in this year, and I want to have a family. And I know raising kids in this society was better than in [country of origin]. So that brought me fear. I can stay in that situation because I didn't—also, I know I have an opportunity to look for another lab and try to study with this...but it was just a waste of 2 or 3 years that I had already had.

Luisa finally decided to leave her academic advisor, dissertation chair, and research supervisor's lab. Before she left, she talked to the Department Chair and a member of her dissertation committee seeking advice without filing a formal sexual harassment complaint.

Yeah. I was not willing just to start all over again. I was so tired. I felt so tired and so stressed and that I didn't think that I could start all over again and lose my job. So, I tried everything. Multiple times, like, every time we would have some arguments, I would go and talk to him again, like, 'Can you please make a way?' [for me to be able to publish and graduate]. These are the projects that I have right now. Let's change this part and then I go. But there were oftentimes when he came in just stay clear and just finish this. We know what we want to do. We know that if we do something that I'm really scared. Let me accept that and then I'll go. We were in the lab and really a lot of things, but he wanted to do a million things. And yeah, I left a lot of stuff, a lot of graduate status so we could continue on my project.

I sort of believed him that, what did he say? He had, like, five or six papers that he made us do it, first at night. So that's why I left because I know that in 6 months, in 4 months that he wanted me to stay. He was not going to publish this paper. He had just published two or three since I left his lab, and he was working on another paper from previous years. So, I know my papers are not going to get through his right away anyway. So, I just decided to leave.

Before I left, when I was ready to leave, I did go and I talked to the Department Chair, he was there. So, between passing dissertation defense but before obtaining graduation status. I didn't say anything about the whole situation, but I just said that he was a very hard person and that I asked him will you please look at the female students in his lab, who will work in his lab. And I think, I sometimes I feel like a lot of people kind of had the idea that something was going on.

Luisa did talk to another member of her dissertation committee who listened to her. It was a relief to Luisa that someone believed her and offered support and good advice:

But nobody said anything. Nobody said anything. I also talked to one of the other members of my dissertation committee. I was his best friend over there. I was very afraid when I talked to him, but not about his situations, about my situation of leaving the lab. And that was at the time and point that I needed to leave, that I knew I was in a good position to leave, but then my PI didn't want to let me go. So, I went to talk to him [the dissertation committee member] and he said, like, 'You need to get out of this place. You need to go. He's not gonna let you go, and you need to go. So, this is your opportunity.' He did tell me, like, 'If you go now, you'll find a place and it's very good for you.' The thing that he did say, and I know a little bit about is, like, knowing my research at that lab group, may not be published. Or he [her research supervisor, academic advisor, and



dissertation chair] can give it to somebody else. If somebody else comes to the lab and decides he wants one more thing, I can do the main authorship for that paper.

Luisa did pass her dissertation defense, was allowed to graduate, and received her PhD in Neurobiology. Luisa's university policies did not require dissertations to be submitted for publication before graduation and/or publishing the dissertation for granting the PhD degree, only to have published at least one research article and present it in a conference, which she had done.

Oh, yes, yes. Yes, I did. I did. I was allowed to graduate. I did have a paper. I was a co-author and so that school can verify I did publish and presented one research paper in a conference, that was pretty much [the only academic requirement], and that we needed to have a publication. It didn't have to be as a professional dissertation. I did need an application [for a patent] out of his lab, but my project since then, it hasn't been published. And I hope they get published because they were many beautiful projects.

But I don't know. I don't know. And I have the feeling that, yeah, I may not even get an authorship because I haven't talked to him since then. That was another thing. When I left the last day, I went, I said bye to him, I left him all my final research papers, contact information and the author of the organizations that I have been a member. He...that last day was a very strange day because he took me and the other students out. We wanted to just go have lunch, have something like that good-bye thing for one thing. No. He decided to take us cycling and he acted very strange that day. But even though he was very inappropriate, I told him, 'Hey, bye. Thanks for everything and I'll keep in touch. We'll keep in touch so we can write a paper.' And that's it, and I left. The other student, she also graduated. She graduated with me, but she got her Master's. She was also going to get her PhD, but she couldn't handle this guy. So, she graduated with her Master's. She was gonna stay working in the lab, like, a few more months after I left.

Luisa did not reach out to any other faculty members. Her academic advisor was extremely controlling and isolated her. He controlled Luisa's progress and opportunities to branch out to other professors, stifling her growth as a professional.

You know? I didn't reach out to them too much because somehow, and maybe it was my mistake, but it was also my advisor. He was very, how do you say? [Controlling]. I would go sometimes to ask them something and they would give me suggestions. Yeah, it was good advice. I would come to him, 'Hey, you know what? They said that's a good point you should consider.' 'Is he your advisor or I'm your advisor?' I'm like, 'Well, I'm just saying that we could use your name.' 'I don't think that's relevant to what we're doing, so don't waste your time. Why bother?' So, he kind of blocked me a few times. When

other people would give me advice, he would try to guide my project a different way. I was not intending to do it, but I would come to him, like, ‘Hey, I talked to Dr. so and so and he mentioned this, and I think it’s a good idea and he makes a good point. And do you think—?’ He never liked what any other people said. So, I kind of said, like, ‘Mm...you know, I didn’t try. I was afraid. I was afraid. Because I didn’t want anybody to know about the situation.’

Luisa also felt thankful because her academic advisor, research supervisor, and dissertation chair helped her prepare well to pass her dissertation defense.

Yes. Yeah, he was okay. He helped me a lot with the reading part because, yeah, he—and that was for everything. He helped me write it and we wrote it and then I did the presentation. Yeah, I defended my dissertation, and he was fine. He was very fine. He was very supportive. He gave a very nice compliment in front of everybody ...on the day of my dissertation. He was kind of awkward. But he did a good job. And he told in my school in my department, he was very pleased with my presentation.

Luisa felt treated as an object and for this reason and her hostile work environment in her research lab. She decided to leave.

He was very happy with it. But then, like, two days later he was a complete ogre again. He was very unpredictable, very unpredictable. But yeah, I just—after the dissertation defense that I wanted to leave, and he wasn’t pleased with that. He just wanted me to stay. He wanted to keep me as a [“piece of furniture or lab equipment”] stock in his laboratory. No, I just decided to leave, and I left. I left, but because of the visa issues I couldn’t start my job when I was supposed to. So, I didn’t write him back. I didn’t check my email after I left because when I left, it really hit me all of that bullshit. I was like, ‘Oh, my God. What just happened?’

After graduation and leaving her oppressive and unprofessional lab environment, Luisa had time to reflect back and process what she went through:

Why did I stay in that place for such a long time? [in such a difficult environment], I cannot believe, even though I was talking, I talked with my friends again and realized, ‘Why did I spend so much time in there? Why did I let him do this? Why didn’t I do this?’ So, I was trying to forgive him and forgive myself. I was like, ‘You know what? And I needed to, I was still working among this to complete my dissertation and what I needed to do to publish my paper. And so, I was like, I know I should have kept in touch to be able to publish...I needed to send him an email. ‘Hey, this is my new contact information.’ But I didn’t have the email from my university.

Luisa added: “So, but I was kind of pushing it. I was like, I don’t want to ... [sighs] start this whole situation with him again.” Luisa’s research supervisor contacted Luisa’s sister and inquired about Luisa’s contact information with the pretense of wanting to publish Luisa’s dissertation and other research projects:

And one day he didn’t write me. He wrote to my new PI, my sister, ‘Hey is not your sister interested in publishing any of her research papers anymore? ask her to send me all the documents and everything and I will do that.’ So, she told me that and so I just handed him [by email all my edited documents] and I’m like, ‘Hey, I’m sorry I didn’t write sooner to you, and it’s just been very busy,’ but and I told him that, okay, that I wanted to publish...that I had sent him everything. I did all the things [edits] that he had asked for. And he didn’t work to email it to me [back], he did not publish them or emailed me anything to me anymore. And after that we hadn’t talked, never again. I haven’t seen him, and we haven’t been in contact anymore. So, I don’t know.

Despite the fact Luisa’s research supervisor and her university did not get to publish Luisa’s dissertation and other research projects, she is happy and proud she persevered and obtained her PhD in neurobiology: “Yeah, I did make it. I made it through the dissertation. So, keep going. I finished my PhD.”

But looking back, she now believes she was taken advantage of by her research supervisor because she was a vulnerable female with international PhD student status and a visa. Luisa chose not to report the sexual harassment. In part, it was for cultural reasons from her country of origin, which puts all the blame of sexual harassment on the females. And for institutional reasons from her department and university that in the past had blamed female victims of sexual harassment and retaliated against them for reporting sexual harassment by forcing the doctoral and graduate students to leave.

Yeah. I think that too [I was taken advantage of due to my Female International Student Status]. I think this was bad. I didn’t know any better, and yeah. I didn’t want anybody to know that, and I didn’t want anybody to see me with him [from a different lens—or like, another stage [because nothing really happened, but I know I would be blamed]].

Luisa felt the experience made her stronger, but she still suffers from the trauma and emotional scars to this day. She felt she was sexually harassed and treated like an object, mainly due to the fact that she was a female international student on a student visa and even her husband depended on her status. Additionally, Luisa feels Latinas from other countries are easy targets due to cultural misconceptions.

Yeah. It made me stronger in a way. Sometimes I also think I'm too weak because oftentimes I get emotional when I think about it, when I talk about it because it was hard. But it made me tough in a way and it opened my eyes. I mean, [how sexual harassment is very real]. Because I see here, just how harassment is very, very common. It's very hard and very common towards the Latina population just because of the nature, the way how we are if the American males don't understand it [the International Latinas culture].

I think for me because I'm also very close to quit. But I think it was even though it sounds sad, for me it was fear. The fear was also the one that kept me here. The fear of knowing, of not knowing what was going to happen with my life if I didn't get a degree.

I used the degree to stay in this country. To me it was, like, I have made up my mind that I want to stay here, to try to stay here. I needed to find a way. I needed to find a way. And because I loved what I was doing, I loved Neurobiology, like, that every day. Like, that's how I wanted it to be because I couldn't find another way.

A lot of people say, like, 'Why didn't marry somebody, an American guy so you could stay here?' I'm like, 'No. That's not the way. That's not who I am. And I want it for good reason, I loved my husband and I know that he's with me and we had the possibility to stay here.' So, for me I think it was, it was sad because thinking that I was gonna have to go back and start—cause I had already tried to find a job in [country of origin]. And in [country of origin] there was NO opportunity to do a PhD and prepare [and obtain] this scholarship that I got here it was gonna be very...difficult. I know my mom didn't have the resources to support me financially. So, for me I think it was just the persistence and I know that I could do it. Because I know academically I could do it. It was just that something that I know can happen to a lot of people even to successful and intelligent women. I can see that; their brilliance and they're very smart. It was just something that just happened, and they go down and they cannot, like, overcome the situation.

I included fragmentations of *Testimonios* in boxes that are parallel to each other, which clearly shows my thoughts of their *testimonios* following Espino et al. (2012).

### ***Reflection and Fragmentation***

As evidenced by the above extracted *testimonies*, Luisa, as the “testimonista” [the one giving the *testimonio*], and I, as the novice researcher, developed a very strong, intellectual, yet intense emotional and even therapeutic relationship. By allowing Luisa to speak for herself through the *testimonio* and then inviting her to participate in “theoretically mediated interpretations” (Henze, 2000, p. 238) of lived experience through dialogue as co-researchers, we engaged in the process of ‘reflexion’ [reflections] and formulated our shared and cooperative awareness. Bounded by space and time of that specific moment, our joint ‘reflexion’ [reflection] exemplifies the core values we both share as Latinas, “*Latinidad*,” South Americans, and ex-international females in STEM graduate programs in the United States yet different due to our complex and various identities and personal differences (Espino et al., 2012).

In the following side-by-side transcript excerpts taken from my interview with Luisa, I display the theorizations that emerged from our mediated interpretation of Luisa and me as one example of how I coded for *testimonios*. Selected excerpts from Akilah’s and April’s *testimonios* will follow in narrative form.

Theorizations from Mediated Interpretations. Testimonista: Luisa. Dialogue Partner and Researcher: Maria

Luisa

So, I grew up in a small family. In my family, there were my mom and my dad and three kids. So, I'm the youngest. I have a sister and my brother is the oldest. We grew up in a very modest family house. We were all very close and we were always home. And for my dad it was very important that we study. Study for my dad was the major thing that everybody should do. But my dad passed away when...he was very young, and I was only 11 years old. He developed cancer and he passed away very fast". "I graduated [with a bachelor's degree in Biology] and was applying for jobs". "I stayed working in the same lab I did my thesis, getting paid just enough to cover the transportation. But I did it because I didn't want to stay home and do nothing.

While I was in college, I had started taking English classes because my sister encouraged me to do so, as it would benefit me if I ever had the opportunity to come to the United States and pursue further studies. So, I continued studying English after I got my college degree.

Maria

Dr. Luisa, I can see the love and importance you give to family.

Your father instilled in all his children the value of Education at an early age. Because Higher Education is highly regarded in your country of origin; your father knew he had to give you and your siblings' motivation and encouragement to face any barriers you might encounter. Especially to find the resources including financial resources to achieve your academic goals.

It must have been very traumatic for you losing your father to cancer at such early age. I can only imagine the grief you and your family experienced. (Maria). As a South American who also graduated in a STEM program with a Bachelor's degree from my country of origin, I understand the barriers of finding a job after graduation. Many domestic students in the United States are currently experiencing the same problems. Your sister guided your academic path. Dr. Luisa, this was also your choice. You had vision and wanted to be prepared to follow your older sister's steps to

## Luisa

As my sister was getting ready to have her baby, she realized that she was going to need a lot of help in her lab and all the project she was developing.

My sister asked her post-doctoral advisor, to consider the possibility of sponsoring a visa for me to come and help her during that year, for a year. So, I got a visa as an exchange student, a J1 is what it's called, I think?

I do have to say my sister and having my sister and her family here was a big support for me. So, it was very hard for me. But at the same time, it was the best opportunity to learn it [The English Language]. I stayed working in the lab with her technician, struggling a lot trying to understand even the basics of any language: how to greet and response to greetings.

I went back to [Country of origin] and married my boyfriend. After we got married and stayed living with my mom because we didn't know what was going to happen, if I was going to get accepted and would have to come back here or if we were going to have to stay down there. So, I

was looking for a job during that time, but still

## Maria

Your older sister experienced what many domestic STEM PhD students suffer in the United States: the lack of support while pregnant, during childbirth and raising small children. This is the main reason Domestic STEM PhD Doctoral students do not finish their degrees or leave the field soon after.

Dr. Luisa, your sister was very supportive of you. Likewise, her doctoral advisor was very supportive of both of you and International Female PhD students.

Having family members already living in the United States facilitates the process of acculturation. Having an older sister already familiar with the academic system and requirements of a STEM PhD in the United States was a double system of support: Cultural and Academic. It would have been more difficult for you as an international student if you did not have your PhD in STEM older sister in the USA and her connections. Your older sister paved the way for you to become a scientist in the USA. Seeing difficulties and or barriers as opportunities for grow and learning is a positive

### Luisa

I came by myself because when I had applied, I was not married yet, therefore I didn't submit any papers for my husband. I came by myself and I stayed by myself for a year. Because I didn't have the money to bring my husband with me right away, I saved some money for him to get the visa and come join me.

My husband came to the United States one year later. It became a little hard for him because as a man, it's really difficult to stay home and do nothing and not contribute financially to the household. So, it was getting really difficult to the point of being very close to go back to [country of origin withheld for confidentiality].

He was very close to go back. At that time, I didn't know what was going to happen with us. I told him that I did not know what was going to happen to our marriage because I knew the situation in [country of origin withheld for confidentiality] and there was no warranty that he would get a job.

But I was also, having a really difficult time in graduate school. I was doing great with my

..... but I started having problems with ....

### Maria

Acculturation processes are never easy. In general, for accompanying spouses of international students these processes can be even more difficult due to visa restrictions which impede them to work and finances which may impede them to study, there are academic impediments if the spouses lack the necessary academic background to enroll in educational programs in the United States. The English Language Centers can be quite expensive. If the spouse is a male, coming from a paternalistic society he will struggle to stay at home without working or being the primary breadwinner. South American countries are well known for their paternalistic, even male chauvinist, traditional views. Your husband was breaking traditional gender roles from country of origin. Professional relationships can be difficult for all STEM PhD female students. However, International female STEM PhDs are more vulnerable due to the possibility of losing their International Visa Student status. Spouses of these students can lose their companion visa status, simultaneously.



### Luisa

I was like, you know what? And it was around the same time my husband wanted to go back. I was like, you know what? Maybe this is a sign. Maybe it's just a sign that I shouldn't be in this place. I should go back and I'm just gonna quit. I'm just gonna leave it as it is because it was really hard, you know, with my advisor. He could not, he was not understanding my culture where I came from. And he was getting, he got too personal and at one moment he told me that he was attracted to me. And that changed the whole situation. He was a married guy and he really misunderstood a lot of my behavior and the way how we [Latinas from South America] work.

Like, I was married. My husband wasn't here and remember that even the first year. And everything that kind of started, he was building up things in his mind without me knowing. As a [Country of Origin in South America] woman, when I got married in [Country of Origin in South America]. I wear my wedding ring on my right hand, not on the left one. And I don't have

### Maria

Cultural behavioral differences are difficult to understand and can be a source of great misunderstandings and conflicts between International Students and domestic (Americans by birth and/or long-term citizens and residents of the United States). Gender cultural differences can contribute to mixed messages, confusion, and false stereotyping.

Universities and Institutions should provide training and continuing educational development on multiculturalism and inclusive teaching practices in doctoral programs. Likewise, the academic institutions should educate and warn International Students regardless of gender or sexual orientation of unfair practices including sexual harassment and provide a Specific Professional and or Department where international students can file complaints safely without being retaliated.

It is the responsibility of both the faculty, supervisor and or administrator and the Doctoral Student to create a Professional environment for mutual respect.


 Luisa

So, for that people [faculty and research supervisor] did not know that I was married, but all my friends knew because you know, when we start making friends, like, 'Hey, are you dating?' I'm like, 'Oh, no. I'm married.' [gasp] Where's your husband?' I'm like, 'Well, my husband is in [Country of Origin].' He was not here, so, everybody in the lab knew that I was married. During that first year my advisor, he invited us over to his house to celebrate something. I don't remember if it was for Christmas, Thanksgiving, something. He celebrated us and he invited us to come over with our significant others and when told us that, he kind of looked at us and nobody had anybody. Like, so, me people...oh, no. I think there was one with baby, so, she came. And when he looked at me, I didn't say, 'I'm married, but I have...' And I told him, like, 'Where's my significant other? He's not here.' That's all I said. But I didn't say my husband is not here. So, he thought that I was alone and one day, so, we went there by ourselves. I mean, it was fine.

One day I didn't know how my name talking


 Maria

There were cultural misunderstandings between you and the faculty and you and your research supervisor. In very large State Universities, it is very possible for Faculty in a Department to NOT know anything about some PhD students particularly Female international STEM and Health Sciences Doctoral students who tend to be quiet; shy and introverted. Providing academic and social opportunities for Faculty and Doctoral students to get together and know each other is essential to establish best practices. Faculty and Administrators have practice hospitality in their homes to Doctoral Students for many years. Domestic students in general welcome and like such functions. International Doctoral Students, however, may decline the invitation, out of not knowing how to behave or what to expect in a new culture.

Dr. Luisa, you assumed the Domestic Position of not disclosing your marital status out of privacy. I can understand if you did not want to be put in the spot of having to explain why your newlywed husband was not with you in the

## Luisa

‘I’m like, I’m here to study. And even when my husband was here...’ Ah, no. But when he knew that I was married, my husband was already here. But when I was in graduate school, I was in graduate school. And I was studying. I was staying in the lab early and staying late as I needed. My experiment, I never left my experiment. And my way of thinking is like, ‘I know I’m married. I know I have a life, but I cannot let that life interfere with my studies.’ And nobody needs to know what’s going on with my private life. They don’t need to know, so, I never felt and I never had, like, the confidence or the need to talk to him about my personal life. Like, there was never a situation for that. So, when he knew that I was married, I thought he was kind of joking but the more I thought about it, I’m like, ‘He was kind of upset.’ I was like, I don’t understand why. Like, there was no, like, ‘Why didn’t you tell me?’ I’m like, ‘Because you never asked. There was never an opportunity for us to talk about it.’ Like, and it’s my personal life. Nobody needs to know it.

## Maria

Dr. Luisa you wanted to conform and behave like a professional STEM PhD student in the United States. For this reason, you worked long hours for the sake of your studies and experiments in the lab. However, to keep a good balance newly married; pregnant and or new mothers in Scientific Doctoral Programs, and in other fields, do let their supervisors know [without unnecessary details and explanations] to enlist their support and understanding. Your research supervisor assumed wrongfully that you were single. Cultural differences; depending on countries of origin; race; ethnicity religion or lack of it; and presence of a disability along with personal preferences determine whether a person chooses to wear a wedding ring or not. In STEM fields and Health Sciences many Doctoral Students choose not to wear jewelry to avoid contamination in the lab, or if they have to wash their hands constantly. It appears that your supervisor was oblivion to these issues and had a double standard, since he did NOT wear his wedding ring. He also felt a



## Luisa

So, I didn't pay attention to that. I'm like, it's fine. So, on after that, we went to a meeting to Colorado. Another graduate student, my advisor and me. He took us, what was it? Skiing. So, at that time we spend a lot of time, like, the three of us together, like, outside the lab. So, we spent a lot of time when we were in the lab, in his office, talking about experiments, talking about science. But during this meeting we spend so, me, like, social time, which it was a complete mistake. Like, I'm a person. I like, well, I'm not very social, but I like parties. And we went skiing. So, we were laughing. We were having a good time. At night times, you know, there were receptions and we have a drink. I would have, like, with the other friend, with my other lab mate it was fine. But he misunderstood everything that happened over there. And there was one time that I made a mistake and I realized that after the fact. I didn't do it with an intention. We had a glass of wine in the table. We were talking to other people, and then I went with my friend and we got a margarita, each of us. We got a margarita and we



## Maria

Dr. Luisa Your cultural differences may have played a role. In your country of origin and in South America at large we are very gregarious and communitarian societies. We grew up attending all sorts of parties and social gatherings. We literally learn to dance before learning to walk. Our bodies react to the sound of music. You may have not seen "red flags" because of your cultural upbringing. Latinas from South America, offer hospitality to the fault, and are always making sure everyone has food and drinks. Your research supervisor, and academic advisor may have misunderstood the attention you gave him offering the drinks and or dancing with him.

## Luisa

We got a margarita and we brought it back. And he looked at us, like, 'Oh, you're drinking by yourselves?' Because the wine, the people that were holding these meetings, they provided a bottle of wine for the table. So, everybody was drinking from that bottle, but I didn't like that wine. So, that's when I went with the other girl, and we bought a margarita for us. When he came back, he's like, 'Oh, you're drinking yourselves. You don't want to drink with me.' And we're like, 'You're drinking wine.' And he's like, 'There's no more wine.' 'Oh, do you want a wine? I can go get you a wine.' So, I went, and I got him a glass of wine. And I didn't think about it now. It was social and we stayed there and then later that night they started playing music. I love music. I love music. I love dancing. I was dancing. Like, everybody dances by themselves. So, we were dancing, but then they started playing some music that people from here, they know how to dance. Like, it's in couples. So, he grabbed me and we started dancing. We were dancing, I didn't say anything on it. I lied to

## Maria

Another factor which could have led to misunderstandings is that as Latinas from South America we assume that much older married men with children are respectful, and "safe" to dance with and or have a drink or accept a ride from. But even in our culture and society our parents and older siblings warn us that there are "*viejos verdes*" we called them "*the green old men*," [dirty old men] whose intentions are not good and behave inappropriately towards younger, pretty females. Hence, there are always sexual predators out there. Some men do abuse their position of authority regardless of age. This is not a reason for you to feel guilty about it. Some of these predators can be very deceiving and manipulative. You research supervisor displayed a sense of entitlement to grab you and force you to dance he abused the power balance between a research supervisor and research assistant.

## Luisa

Because of that, and another thing that contributed to all this mess is that I spent too much time with him. Every time I have a problem, or I had a question, I would have to sit there with him hours. Sometimes I will go 9 in the morning, and it was 5 o'clock and I was still sitting there trying to solve a question because if I didn't know, he would not give me the answer. If I will start giving a wrong idea, he will let me go all the way over there to show me that that was wrong, and then started dragging me back to the right. So, it was a long, a lot of conversation. It was not just for me. It was all the students. And we even made a rule in the lab. Like, if it is 3 o'clock, 3 or 4 o'clock don't go talk to me because he will sit and he will keep you until 7, 8. He didn't care.

I did spend a lot of time with him. But I never saw anything like weird until he invited me to this lunch, and I thought we were gonna talk about this other girl and he just threw it to me. 'I feel attracted to you. All this time that we have spent together.' I did not know how to react to that. I was just in shock. I could not speak and

## Maria

Dr. Luisa, spending long hours in the workplace or research lab can lead to this type of situations. Your research supervisor may have just developed feelings for you or felt physically attracted to you, after working long hours side by side for several consecutive years. It may have not been necessarily something he planned. This could have aggravated if he had an unhappy marriage, or his needs were not met by his wife. Your research supervisor abused his power in research supervisor-research assistant power balance by forcing you to work exceedingly long hours. He may ask other research doctoral students in the lab to do the same to cover up what he was doing.

You did NOT notice his feelings for you, and agreed to attend this lunch under false pretenses from him to speak about the problems he was having with a different STEM female student who wanted to leave his lab; because she felt he was too harsh on her and mistreated her. I can understand your shock; fear and confusion when he expressed his feelings for you. You also


 Luisa

So, it made it really, really difficult. So, that day I was just, the only thing that I said, like, 'I'm so, sorry. I'm so, sorry, but that is just wrong.

There's no way. I don't know why you felt that way, but I cannot deal with that.' Like, 'I leave the lab.' And I told him that, 'You know? If I need to leave the lab, I leave the lab right now. But there's nothing I can do. It's not because you're married. It's not because I'm married. It's because there's nothing. Like, no. There's no possible way that I could be interested in you or that there's a possibility that there could be something here.

So, that changes my whole entire experience, because I was into my third year of graduate school and things just went downhill from there. It was really, really hard. But it was my husband, so, I didn't tell my husband right away for a while because I thought I could handle that. I didn't tell anybody because I was feeling, to me that it was a dream. Like, this is not happening to me. Like, not a dream, a nightmare! Like, this is not happening to me. This can ruin my life. So, I didn't want to tell anybody. What I did is that the


 Maria

Dr. Luisa you apologized for giving him the wrong impression, even though this was his fault. You were trying to neutralize the power imbalance, explain cultural differences while trying to save your STEM PhD.

Dr. Luisa It was positive that you made it very clear to your research supervisor and academic advisor that you did NOT share his feelings and that honestly felt you will never experience for him that kind of feelings. You had to set the record straight. Your willingness to leave his lab if you needed to, was indeed a brave and honorable act on your part.

This incident really had a negative impact on your STEM PhD in the United States experience as a Female International Student. You first thought you could handle it and did not want to get your husband involved. But telling him was the right thing to do. He needed to be aware; to protect your marriage and enlist his support.

Your husband was in vulnerable position as the companion husband of an international student. His status in the USA was contingent on your

## Luisa

Like, I know my marriage is not being compromised because I didn't have any feelings. But it was like, 'You have a family.' Cause he would bring his sons to the school cause their school was across the street from this place. So, after school they will come and stay with him until it was time for him to go home. 'You have a family, and this is that.'

So, he wrote me a letter apologizing what he had done. He said that his feelings should not interfere with my dream, that I was very smart, very brilliant person.' Because that's another thing that he said. He was not physical. He was like, 'You are so, smart. You're one of the smartest person that I've ever met and it's kind of impossible to have people that are smart and that, of course, they always brought up the physical thing that you are so, pretty. You're this and you're Latina.' And then he started talking, at the time I didn't feel it so, inappropriate, but then I realized like, 'Yeah, he was inappropriate.' Like, everything he will say, it

## Maria

It was very forward and positive that you reminded your older married with children Research Supervisor and Academic Advisor his responsibilities as a husband and father of two young boys. By disclosing the conflict to your husband and enlisting his emotional support you protected your marriage.

However, negative this experience was it really helped you get in touch with your feelings and strengthen and value your own marriage.

The Letter of Apology from your research supervisor was long due; and in a way it was an admission of wrongdoing in his part. But his constant shifting the blame on you because you were young, pretty, sexy and all those inappropriate comments were wrong, unethical, and selfish. All those inappropriate comments were sexual harassment.



## Luisa

And if there were any social events, I met a guy, like, another graduate student joined a different lab in the same place, and he was from Uruguay. We felt like we had known each other since forever just because we could speak Spanish. So, this guy was so, sweet, and we are, this is how I see most of the Latino population. We are very...I don't know we express ourselves very much, like, through hugs, kisses and of course, my advisor will see that, and he will come like, 'Huh, you were having a lot of fun the other day.' We're like, it was nothing. It was just, it's everyone [from South America].

I was in the middle in a serious and very compromised and very time-consuming situation. I couldn't say any of that. So, the first thing that, I think it was the next day, when I talked to him about that and I asked, 'Can I stay? Or like, can we just put this aside and there's nothing that I'm doing that can help you with your feelings for whatever. I just want to pursue my thesis. I just want to graduate.' And he said that it was okay.

When with his work, I wanted him, I was like

## Maria

Dr. Luisa, as a Latina from South America, I understand cultural behavior among young people of opposite sex. Hugs and cheek kisses between close friends, classmates, or colleagues, are the norm for greetings, and they do NOT have a sexual connotation. This is NOT considered inappropriate behavior for International Latinas. However, in the United States classmates or peers do not behave this way, especially if they are married to others. In the host country or University, we have to respect and go by the cultural behavior of the visiting country or University. We cannot demand they understand ALL cultures. Avoiding even "*giving the appearance*" of inappropriateness is a good moral virtue.

Asking your Research Supervisor if you could both put this aside and focus on having a professional relationship was the right thing to do. Expressing your goal of starting your dissertation and graduate was important. Asking his permission to stay in his lab was not needed but it was an honest request.


 Luisa

When with his work, I trusted him. I was like, okay, let me try to do this from the back. So, what I tried to do kind of ask him, this whole situation, that I tried to minimize my contact with him. My office was the office where the graduate students were sitting, which was next to his office. I would start to minimize contact. And I would go to the lab, my office, do the job in the lab. And I didn't continue interacting with him, and any time I had a question, when I made it the lab, like an advisor.

But it was very, very difficult because it changed the whole relationship. Because oftentimes I think that it was often my side that I felt that some comments, I would take them [comments] personal when they might not have been personal. But that's the way I took them. But it was not very...it was a very difficult time for that. And I...so but then by me trying to stay away from that situation, that created another issue with him and in the fact that I wasn't willing to go and talk to him.

He said that I was trying to be too defensive and

he was not pleased with that because everybody


 Maria

Deciding to limit your interaction with him may have interfered with your STEM PhD student and Research Assistantship responsibilities. You were perhaps oversensitive to his comments, but it is very understandable how his previous behavior created an oppressive and negative atmosphere for you at the lab.

Your Research Supervisor seemed to need excessive control of all students not just you, and this can be a sign of insecurity. When supervisors overexert control, they can become abusive or abuse their power. It could also be a form of retaliation against you. Or he could have made a general rule for all doctoral research

Luisa

At the time that all this happened, a lot of his students had left the building. So, there were only two other people in the lab, maybe one or two that would come in the lab. So, I felt like, you know? I'm not gonna go talk to him every single day. So, I went, and I talked to him as I felt it was necessary, which he didn't like at all. Sometimes he was saying that I was insubordinate, that I was not listening, and I wasn't being a good servant because I didn't want to connect with him at the professional level. That I was not engaged, that I didn't want to engage with the conversation, with the small group conversation. So, it was very, very, very difficult because, and every time, like, I tried to, I didn't want to keep bringing up the issue. I didn't want to say, 'Hey, I just didn't want to share with you because of what happened.' But I would just stand and do my work that Monday through Friday. He was not happy with that. So, anyway I tried, he would just go with my...use my own guidance. I didn't even have to go and ask and tell him that I'm going to go to the lab to

Maria

Domestic STEM PhD students would rather transfer labs or even programs rather than staying in a negative oppressive environment. I can understand why they left. On the other hand, because you depended on him to maintain your visa as an International Female STEM PhD Student put you in a difficult and vulnerable position. To make matters worse, most STEM PhD students domestic and international have different academic advisors, research supervisors and Principle Investigators (PI's), faculty and Dissertation Chairs. This one (1) Faculty member played too many important roles in your experience as a STEM PhD female student. Using your own words: "*He was everything*" to you as a STEM PhD female student. Hence, this gave him extra power to control you, isolate you, harass you and threaten your status to impede you to report him. I am surprised no one in the Department or the University noticed and advised you to change academic advisor; faculty in various courses; research supervisor and or dissertation chairs. Higher Education is highly

Luisa

But he kept, for a while he was kind of serious and our conversations were kind of very short.

But then he started kind of forgetting and getting comfortable again. And I just felt like I just felt that I had to deal with it. I just, I'm not gonna fight with this guy. I need to graduate. I just need to get out of this place, but I need to finish my requirements.

So, it was like a complaint. It was very, very uncomfortable because there were places where, there were instances when there were, like, activities that involved many of the other persons in the lab, which were very, very uncomfortable. She [another female graduate student in the lab] didn't know any of this situation because we didn't tell her. But there were places that there were some activities when everybody went golfing [at some conferences].

He just wanted my attendance at a conference.

He had invited me; you should be fine, you should go. I didn't want to go but I didn't want to make it look like oh, there's something going on. I didn't want him to think that I could not be

Maria

Your Research Supervisor, Academic Advisor, and Dissertation Chair decided to continue to abuse his power even after you made it very clear that you had no interest whatsoever getting involved in a personal relationship with him.

You had told him you wanted only a professional advisor-PhD Student relationship.

You made him know that you were only interested in finishing your dissertation and graduate. You pleaded with him to let you stay in his lab until you completed your research, defended dissertation, and graduated.

Your pleas fell in deaf ears. However, you avoided confrontation due to the fact that you and your dependent husband needed

International Student and Companion visas to remain in the USA.

The other female research assistant PhD student in his lab; was not aware of your conflict with the research supervisor. Your research supervisor insisted you traveled with him to all the conferences he was involved in and participated in all the social activities outside the


 Luisa

We went to a meeting in Washington, DC. We caught a whole dose of it. It was a mess. I didn't want to be with him. I went with my friend, and we were together. Well now he decided that he had to take us and that we had to drive with him, be friends with him, to be alone with him in his car. It was very, very uncomfortable.

But I didn't want to get my husband involved. I didn't tell my husband about the situation, like, right away. But I think it was very uncomfortable. There were a few times that it was really 'Just the quit. Just leave everything and go, find my husband. Tell me.' And he's like [her husband], 'No. You need to talk to him [the research supervisor]. He cannot interfere with your life. You just go talk to him and knowing that I know all of this, that if he...' I don't know. My husband was not trying to get him in trouble. You don't want to get him in trouble. My husband, He was like, 'You're not alone here.'


 Maria

This was inappropriate behavior on his part, he seemed stalking you.

Abusing Alcohol, even during professional or academic endeavors can lead to misbehavior.

Most Faculty and Students' Handbooks address the dangers of allowing this to happen. Both the academic advisor and his male colleagues made uncomfortable comments which offended you.

On the other hand, you already knew he engaged in this type of behavior and could have abstain from attending this social events, while taking part of the academic part of the conferences.

Domestic Faculty may not understand cultural behaviors between heterosexual Latinos classmates from other countries. A similar situation had already happened, perhaps you could have avoided that too.

Declining to drive with him in his car could have been an option. You and the other female research assistant could have made separate travel accommodations or once there get to places on your own.

Telling your husband and securing his emotional

## Luisa

You cannot let those ruin your life.' So, he was the one that kind of kept me going. At the end I just decided to deal with him. I really was not good. It was not comfortable. I spent a lot of time, a lot of hours at his office just because that was the only way we could ask during my thesis, the advisor on my thesis, the preparation of my dissertation. We spent hours and hours.

Because I know on my writing skills were not the best at the time, so he didn't like anything I wrote. But then so he had a student next to him talking about what I was doing just to make sure that I did know what I was doing. And then he would write it. Like, this is not working. I don't like, I guess you need to learn how...I was right and I'm telling you, my writing skills are not bad. If you're bad, I think he needs to see you for if you need to be in his office with this.

And for the things for my presentation, I have appreciated, like, big time, to have practice making sure that I did very good presentation.

Because I had to go give presentations at private schools. I had to make the presentations at the

## Maria

Your husband wanted you to be assertive in not allowing your academic advisor and research supervisor to ruin your academic life. That was smart. Your husband supported you and empowered you not to give-up despite the inappropriate behavior.

It is unclear if you really needed all those edits and time alone with him. But dissertations in general do require from most Doctoral students regardless of the field extensive research, writing and corrections. It is not unusual for dissertations to take several years. The fact that he brought another student with him was perhaps to avoid misunderstandings or a sign of inappropriateness.

Regardless, your Research Supervisor, academic advisor and Dissertation Chair did prepare you well for dissertation presentations and defense.

## Luisa

But I think that it was a little bit too much. It was too much interaction. It was endless hours with him in his office. Sometimes my husband would come to pick me up, to see what was going on and he would see my husband, he never cared.

Like, sometimes he looked surprised, like, what is he doing here? But he never said anything.

And he didn't ask, like, 'Oh, I have to go now because my husband is here. It's getting late. I think we can continue tomorrow.

' Like, then he would always say, 'Okay, well, if you don't want to finish this presentation. You don't want to complete this thesis. It seems like you don't care.' So, it was very difficult. It was very difficult and, but it was, I guess it was, yeah, a few moments in which I thought that I could not do it anymore. So, I was ready to quit.

I was ready to go back home.

But at the same time, it was the fear. One of the things that helped me and that made me stay there is there were not ability that I had, that I spared at the moment. Cause as an international student, I have a visa and I only had a visa as

## Maria

I can understand why you and your husband felt uncomfortable with you spending long hours with him in his office. There was the antecedence of his inappropriate behaviors, and his real intentions were unclear.

This was awful, he really was trying to make you feel bad about your value and worth as a scientist.

Making you feel guilty and implying you did not want to finish your dissertation was wrong on the part of your Dissertation Chair and PI. I can see why it created a hostile lab or research assistant work environment for you.

I did not expect "*Fear*" to be the ultimate factor which forced you to stay and complete your dissertation.

Nonetheless, you explained it well. The fear of having to return to your home country without your PhD. The fear of giving up your academic goals and Neurology, the field you love. The fear

Luisa

So, for me it was difficult, but it is the mostly fear. Because I couldn't see myself just wasting three, four, years of my life trying to pursue this degree and to let it go to because of him. Cause for me it would have meant having to go back [country of origin] to a very difficult time and very difficult place to do research in the neurosciences, which that is what I wanted to do. And that's what I learned to do. And that's when I did my professional effort, it was to go through and finish a degree. So, for me I think it was just that the fear helped me to persevere with him. It was not fun. It was not good, because he was very thankful. I know, I didn't ask, I didn't speak for him [did not report him] because I felt even though it was not my fault, I felt ashamed. And sometimes with big thoughts, like, some topics he was telling me, and it was very offensive because he made me feel like I was responsible for that., that I was responsible for being pretty, for trying for new things, for dressing nicely. He just, everything that I did, he judged me. If I wore high heels, that was like a

Maria

I can understand why you and your husband felt uncomfortable with you spending long hours with him in his office. There was the antecedence of his inappropriate behaviors, and his real intentions were unclear. Making you feel guilty and implying you did not want to finish your dissertation was wrong on the part of your Dissertation Chair and PI. I can see why it created a hostile lab or research assistant work environment for you. He made you feel ashamed despite the fact that it was his fault. He abused the power has a research supervisor- research assistant relationship. He made you feel guilty by the way you dressed; the way you looked; it was severe sexual harassment and predatory behavior. I did not expect "*Fear*" to be the ultimate factor which forced you to stay and complete your dissertation. Nonetheless, you explained it well. The fear of having to return to your home country without your PhD. The fear of giving up your academic goals and Neurology, the field you love. The fear of not finding a job upon




 Luisa

So, for me it was difficult, but it is the mostly fear. Because I couldn't see myself just wasting three, four, years of my life trying to pursue this degree and to let it go because of him. Cause for me it would have meant having to go back to [country of origin] to a very difficult time and very difficult place to do research in the neurosciences, which that is what I wanted to do. And that's what I learned to do. And that's when I did my professional effort, it was to go through and finish a degree. So, for me I think it was just that the fear helped me to persevere with him. It was not fun. It was not good, because he was very thankful. I know, I didn't ask, I didn't speak for him [did not report him] because I felt even though it was not my fault, I felt ashamed.


 Maria

Dr. Luisa you had invested a lot in your STEM PhD and made a lot of sacrifices to get to the point you were.

You loved the field of Neurobiology and the scientific work you learned in the United States. Persevering and making your best professional efforts were what brought you success.

Sometimes, forgiveness is the best option. When we forgive others, we give ourselves more options. We forgive for ourselves, for our own sakes. The offender may never repent, ask for forgiveness, and continue with the same pattern of behavior. But forgiveness releases anger and does not allow room for bitterness or self-destruction.

The offender (s) may try to blame you, for his wrongful action. They may not want to take responsibility to avoid losing their job or avoid having to resign from their position of power. If found at fault or admit it is their fault, they may be found liable and be forced to pay for damages in cases of potential lawsuits. Self-centered

## Luisa

So, it was very intrusive, and I just got used to it and I think I was in depression. I got depressed but I didn't seek counseling. I didn't want to get up. In the morning, it was really hard. I didn't want to go to the lab. I know I had my studying to do. Every time I needed to go to him, my stomach hurt. Like, I said that I need to be picked up at this time and I needed to just go. Because with him it was very unpredictable because some days, we could have a good, like, professional talk, but some days he would be a whole mess and he would start screaming. And he didn't disguise his behavior very well. So, no matter what he did that was flawed, he always unpredictable.

And he didn't have time because I just want to be what it needs to be. I know that you're capable to do anymore from just talking to you. So, I just want you to be regular. So, I just want you to be stronger. So, I just want you to come out of the shell. Because I'm very shy. I mean, I'm very shy with everything. I learned to come out of my shell a little bit just to protect myself a

## Maria

Dr. Luisa, as Latinas from South America in our cultures psychological counseling or "talk" therapy and even group therapy is not that common except for Argentina [which boasts of having the greatest number of counselors and therapists in the world!]. But for the rest of countries, our "communitarian societies" with large extensive families, with great number of friends and systems of support, faith-based or religion support "counseling or therapy is practically non-existent except for serious psychiatric patients. This is because our Latina South American culture is always there to provide loving care and emotional support. The United States is a very caring society. Nonetheless, it is an individualistic society and for the most part each individual is made responsible to seek and ask for support. Because you did not go for counseling or therapy you may still have lots of unresolved issues that need to be addressed. I would encourage you seek a good "talk therapist".

Your research supervisor was unpredictable;

**Akilah**

I found Akilah on the website of a private faith-based university where she is currently working as a full time physics assistant professor. Akilah was born in a country in Asia to a Hindu family that practices the Hindu religion. Akilah had parents but was raised mostly by her paternal grandparents with whom she was very close. She has one sibling who holds a master's degree. Akilah's first language is Malayalam, although she also learned to speak Hindi and British English. Akilah is married and is the mother of two children, one of whom she gave birth to shortly after receiving her PhD in physics. She was pregnant while writing her dissertation. Akilah is highly educated. For example, prior to coming to the United States, she obtained a BS in physics, chemistry, and mathematics; an MS in applied electronics and an MPhil in photonics. All three degrees were granted from her country of origin. In the United States, she obtained a third master's degree in physics followed by her PhD in 2011. During her PhD studies, Akilah experienced the death of her beloved paternal grandmother to whom she was very close.

I emailed Dr. Akilah, and she kindly agreed to participate in my study, signing the participant consent and emailing me the completed survey for demographics. We first met at a private conference room in the library of the university where she teaches Physics and conducts research. I conducted two lengthy interviews with Dr. Akilah. Additionally, there were follow-up phone conferences.

Akilah's grandfather influenced the chosen profession of most of the children in his family who felt inspired by him. This is quite common in Akilah's country of origin and in Akilah's religion (Hindu) and socio-economic class. For this reason, Akilah was first interested in literature, an area in which she was gifted.

But when I was a kid, I sort of remember, cause I was the first grandkid for my father's house and my mother's house. And my grandfather was a musician. And so, everybody

was so into music, arts, and things like that. And I really enjoyed it, and I didn't have any other world than music and arts. So, my passion was either to, you know, focus my study in music or in literature. That was my passion. So that kind of reflected in my high school, or in my middle school everything exams and everything. I never studied for my literature exams or my arts exams. Whenever there was writing, I never prepared. I would just go directly and then take the exam and it was golden every time so I didn't have to worry about it.

On the other hand, science was a struggle for her at the beginning:

So, science was kind of a nightmare for me cause I struggled, cause I took it easy, but then I realized that 'Okay, this is kind of a struggle for me. I really have to understand what's the reason. Where can I improve?' And then I started concentrating more and talked more to my teachers. And then I understood that there is a methodology to approach it and if we do it correctly, then it's not intimidating anymore.

There were no scientists in her family to guide her. Akilah reached out to her teachers.

One teacher in particular was an early mentor for her in science. This childhood mentor influenced her future career in science:

And so step-by-step it was a process. But step-by-step it took some time. But then I started, you know, understanding it. There was no reference, nobody in my family to help me if I struggled with something. So, with all this I have to reach out to my teachers. My teachers were so compassionate. I still remember one of my teachers. She didn't have any kids, so she kind of adopted some of us because with my parent's permission she took me to her house. And she made breakfast, lunch, dinner, and everything. And then she made me stay with her for some time and then she walked me through all the, you know, the beauty of science and arts and everything and that was the turning point where I started thinking about it, you know, where should I really focus? And that gave me a really good idea about, you know, I can deal with literature. My literature teachers and my music teacher, everybody just says, 'You can do this as a side, but you have a future in science as well, so do, you know, find a way. Just do. You know, go forward, and accomplish there. That'll be really bright.' And I thought about it, and I'll be, first person will be me if I accomplish something in science. And then I have a lot of cousins and everybody in my family. So, I could maybe pave a pathway for them to proceed as well.

Akilah decided to study science, she wanted to be a model for others in her family and really excelled in difficult subjects:

So, I kind of decided to do more in science and I think that was the beginning. But then when I got my Master's...first I got my Bachelor's in physics, chemistry, and mathematics, and from there I got a Master's in applied electronics around physics. And

another, we call it MPHIL, Master of Philosophy. In one of the branches of physics, it is called photonics. P-H-O-T-O-N-I-C-S. That's all about laser of light and things like that.

After graduation, Akilah had the opportunity to work in an important research institute, where her colleagues motivated and inspired her to study abroad:

And after my degree, after my MPHIL degree I got an opportunity to work as a research and development assistant at the really popular laboratory in [country of origin]. It's called [Name of famous Research Institute]. And I worked there. Initially I did a project there with one of the advisors, scientists. And then following that, I got an opportunity to work there as the research and development assistant at the same lab. And then I got to make a lot of friends. Their dreams were different. You know, their family circumstances were rolling them into a dream like that to go to foreign countries and get their degrees. But in my mind, it never crossed because nobody in my family had ever been abroad. [snaps fingers] But talking more to my friends, I'm like, 'I should do that as well.'

Akilah's most important personal attribute is perseverance. This attribute helped her persevere to find ways to prepare for and plan on how to obtain her PhD in the United States:

And then thinking more and more, I started talking to more visiting professors coming to that laboratory for talks and everything. And then I found the ways and to take exams like TOEFL, GRE and I get an idea about doing those things, and I started preparing. I didn't tell anybody about this because it was kind of so embarrassing that people will laugh at me cause it's never gonna happen.

Akilah experienced doubts about being able to fulfill her dreams of getting her PhD abroad, but after her marriage to an engineer, she came to the United States. "And it was in 2005 I believe I got married and like a dream come true, then my husband got a job here in [city of residence], USA. So, I followed him and accompanied him." The 1st year in the United States, Akilah felt lonely and isolated. Her newlywed husband was supportive, but he was very busy in his new job. "So, it was like, so close within four walls of my apartment. Nothing else, just the books and that's it."

Akilah and her newlywed husband had to wait to obtain their first credit card to buy their first computer, so she could search for PhD programs in the United States. "Then you will be accessible. I mean, you will get access to computers and things like that. 'Till then I was dark

cause I didn't see any computer or anything in here.” Additionally, Akilah had to wait several months to exchange her dependent visa status to an international student visa. “And finally, I mean, it took a couple of more months for me to go through the formalities and then change my visa from dependent to student.”

Because Akilah was unfamiliar with the admission process in a state university in the United States, she applied for a master's degree in spite of the fact she already had two master's degrees from her country of origin:

And finally, I got into the program for the Master's, and from there I waited one more year and I reapplied. No. Actually, my application was there, but they considered my application for the PhD and then they gave me admission to the PhD.

Akilah also had to reach out to the administration and admissions' staff of the state university where she wanted to enroll to be able to understand the application and admission process. “And then after that I talked to the admin people, like the formalities that I have to go through.”

It is a very lonely and difficult process for international female students to learn to navigate the legal, financial, and educational system shortly after arriving in the United States. This process can be particularly difficult for those international female STEM PhD students who do not have family members or friends in the United States. Understanding the admission policies in her state university was not an easy process. There were 2 separate applications to complete, one for the graduate school and one for the physics department. Akilah felt overwhelmed: “And I knew it was a lot because there was nobody to talk to, nobody to get advice or anything.” Akilah was highly motivated, and this helped her to overcome all the initial barriers. “But it was the dream. I mean, it was my passion that was pushing me through. And I never was ready to give up.”

Akilah felt discriminated against by her fellow female senior lab mates in the same lab who were not helping her and refused to work as a team with her, which actually jeopardized her safety in the lab. Physics PhD students who conduct research that utilizes lasers have to work on teams or at least with partners because they work in the dark and a laser can cause serious physical injuries by accident:

But when I chose my advisor in the PhD program, while I was doing my co-research, I didn't get as much support as I expected. And there were a lot of discriminations from my senior lab mates, my female doctoral students. They were not supportive. They were not helping me learn anything which they learned before me. So even though I have to work on the same equipment, it's like a day-long experiment sometimes and it's in the dark laser room because when laser works you have to shut down all other lights. So yeah, I forgot to tell you. My PhD was on nanoparticles, characterizing those nanoparticles using lasers. So different types of lasers. When a laser was on, you have to shut down all other lights. So, it's dark and it's that full lab, total dark. So, you really have to get used to that to identify, you know, each and every stuff there, so you don't fall on anything, you don't disturb the optics in there. So usually, you work as a team. But then when I worked in the lab, no one was there to help me. And so, I had to figure it out, everything by myself, and my advisor at that time, cause he's—I'm not blaming him. He's so used to the senior people because they were there even before me. So, whatever they tell him, he kind of believed it and so I had to prove it to him.

Akilah had to learn the hard way in the lab. By trial and error which was very time consuming and difficult:

It was a time-taking procedure. And with my data, my promising research to make him believe in it. And I was able to do that, but it was a really difficult time to conquer everything by myself.

But it made me a stronger person, a better person. I learned everything by myself. And I still remember my last 3 years even though my PhD was in physics, half of the time, my research was in the chemistry lab because they had the hooded, you know, experimental area where you can safely use the chemicals and everything... So, my PhD is in physics, but I see a lot of chemical formula and math and everything.

So even though I have the right particles, I have to find the right way to scatter them uniformly. That was another challenge. I had to try out different methodology to do that. And then comes the real experiment with the laser. And that took several days as well. So, I mean, it was a difficult job. But, when you think about it, when you look back, even though it took time, but you did something. You achieved something. And I always tell my students, this is what I did. And I was, cause in my lab, my fellow lab mates, my senior lab mates, their particles were 300 times bigger than my particles. So, they were not actually nanoparticles, but I made them synthesize the real nanoparticles.

Akilah not only developed the perfect formula, but she also proved her senior research female lab coworkers were wrong and found fault in their formulas. Akilah helped other students although she lacked some confidence at first. She paved the way for other female physics PhD students who followed, and her professor got a lot of publications:

I proved that they had a formula sheet with a glitch in it, but they were never able to figure out the mistake. So, they kept on keeping with the formula sheet. But I proved that their calculations are wrong, and that's why they're not able to get the result which they wanted to. And my advisor didn't believe me when I said that. Finally, when I got my particles, I told them that, 'Hey, I got it because my formula is correct.' And then he got a chance to look back and he found that I was right. So, I mean, I was actually helping myself and them. So, whoever came after me, they took my formula, and my professor got a lot of publications after that as well I believe. So, yeah.

She was not, cause I still remember—when it comes to the fundamentals of physics, cause there were, like, undergrad students, they were working in the lab for their undergrad research. So, they used to take classes in quantum mechanics, or the core physics subjects. So, whenever they have problems in doing the physics problems, they come to either me or her. I think primarily to her because she is the senior member. But she was not able to help them. And then she's like, 'Oh, I forgot that. Tom, could you help me?' And then she will direct them to me. And then, I'm not bragging, but most of the times I was able to do the problem. It could be due to the hard way I learned things, you know? It took a while for me to figure out things all by myself, and those things you will never forget. And that could be the reason. I knew it. Every time people would come to me asking questions, especially when I'm not ready, I will always have the fear—oh, will I be able to help them? Or am I going to be embarrassed by not knowing the answer? But fortunately, I was able to help them in all occasions. That could be the reason because that created a really good impression.



Akilah's research supervisor forced her to work weekends on Saturdays and Sundays in addition to her long weekdays and nights in the lab, and throughout the summer. These unfair lab working conditions took place even during her pregnancy. Domestic physics research assistants were not required to work extensive hours and/or weekends and long summer terms. Akilah was told by her research supervisor that this was because she was an international female PhD student. Akilah was discriminated against by her research supervisor, perhaps due to stereotypes and misperceptions of international students.

And then being an international student, my advisor used to tell me always that an international student needs to put at least three times the work that a domestic student does. And he always had, you know, kind of shown the partiality as well. Cause he never asked the students from here to work on Saturdays and Sundays. But he asked me to come on Saturdays and Sundays, telling me that if I don't do it, I won't graduate. And at that time, I never kind of took it personally because I thought, 'Maybe he is correct.' Yeah, I used to come on weekends, but I noticed that students from here, they never came on weekends. And it actually gave me a quiet atmosphere to come into the lab. It's all mine, and you know, find peace and work on it. So, I took it positive.

At the end, Akilah came to realize that she had been discriminated against due to her status as a female International STEM PhD student and intimidated due to her provisional visa.

Towards the end, I was tired. I was like, 'Why is he so partial?' You know, but yeah, it was all learning opportunities. You come to see people learn about them, understand that that's actually not the way it's supposed to be at the end.

Akilah did not report her research supervisor or her domestic senior female Lab partners. "The right time to respond might have already passed. And then you try working on with other people, but you will learn it." Her research stipend and financial grants were always dependent on what domestic students did not use or applied for. Akilah was excluded from financial grants due to bias because she was an international student. When her financial support ran out, Akilah diligently applied for a scholarship in the Education Department. However, in addition to her research work, she had teaching assignments as a teacher assistant:

I had a research scholarship. Talking about that, now I remember it. I was always the second preference for my professor cause he always wanted to make sure that the students from here are happy. And if there is any money left, he will give it to me. So, there was one time that I found out that I'm running out of money. And I never asked my parents, or I didn't to help me or anything. So, I applied for a scholarship at [Name of University]. It's a one-year scholarship for teaching and learning. So, they picked through a pool of doctoral students from different disciplines. So, among B12, teaching fellow—that's what they call it. University teaching fellow. There were 12 of us. I was the only person from STEM I believe. So, it's a one-year program with \$25k for the whole one year to pay for tuition and everything. But it gave me a wonderful opportunity to make me a greater teacher.

Akilah developed coping mechanisms to deal with the unfair treatment by her senior female research lab partners and her research supervisor and did seek counseling, even though it was not part of her culture to do so. In her country of origin, there is a stigma related to mental health that prevents people who need counseling to seek help.

It was tough because people who you work with, their perspectives could be different. And you will not be able to convince them always about your visions, your dreams, your insights. So, silence helped me a lot. Smile helped me a lot. Coffee helped me a lot. I don't know if I prayed, but I had the belief in my mind that things were gonna be okay, if not today for sure, for tomorrow. And I honestly, I even talked to—cause one of my friends in the teaching and learning scholarship program, he was doing his PhD in counseling. So, through him, I talked to the counselors and found out that there were a lot of resources that can help me, advise me to make things right. Sometimes it could be me. That way that I think could be not the way it's supposed to be. So, they helped me to kind of clear the fog I should say and forget about what happened but find a way how you're gonna live your life today.

Especially if you come from a different country, you will always have this feeling that whoever goes to counseling, they have one nut loose or something. You know, they have some psychological issues and that. But everybody has psychological issues, but they don't want to disclose it. For me it's really helped, and for me and my personality, I wanted to talk about it—not to everybody, but at least to somebody so that I will feel better. I might not be looking for their opinion in it, but I wanted somebody to listen. So that is always helpful. So, yeah.

Akilah felt homesick, especially during the loss of her beloved grandmother. Akilah felt closer to her grandparents than to her parents. She was very close to her paternal grandmother who doted on her as a child because Akilah was the first grandchild.

It's actually my grandparents that are closer to me than my parents. So especially when my grandmother, my paternal grandmother being, you know, I being her first granddaughter and grandchild, I believed that she is more affectionate to me.

I don't know the fact, but [laughs], so every time I had an issue in my childhood, I usually go to her. And she was a smart woman. I wanted to believe that because most of the times she doesn't know what I'm talking about. But she will hold me really close to her and say the final thing that, 'Look, everything is going to be alright.' And maybe she doesn't even know what I'm talking about, but it gave me a lot of courage that, 'Hey, she said it's gonna be okay.'

Akilah experienced the loss of her beloved paternal grandmother during her PhD studies:

And so, after coming here, my grandmother was still alive, but then I came to know that she is sick. And she was sick, and she was not even the same person that I used to see cause her, you know, kind of diminished. And it was like, she was in really bad shape. I didn't want to see the picture or anything.

But when I lost her, I was here. Even now when I run into problems, and I miss her because there is nobody to say that it's gonna be alright. But now I say it to myself, 'Yes, it's gonna be alright.'

One of the most devastating personal losses for international students is experiencing the critical illness and/or death of beloved family members while students are abroad. This grief becomes very difficult to bear, especially when international student are unable to go to their home country to visit ill or dying relative or mourn with other family members due to visa restrictions and/or financial impediments and doctoral studies. Akilah was overcome with grief at the prospect of losing her grandmother and to this day, she misses her but feels spiritually connected to her.

And I feel her in me. Yes, in that way I'm still homesick cause I miss her, and I miss my grandfather. But yeah. It's so funny that, you know, some days you will have, you know, night dreams about something else, and at the very end you will see, I mean, I see my grandmother coming, walking or something like that. And I give a call to my aunt the next day checking with her, 'Is everything okay over there?' And then there will be something happened, and then I get that whole feeling.

Akilah feels that spiritual connection with her deceased grandmother. “And so, I mean, it’s just maybe my feeling, but I believe in that energy, it exists somewhere. Maybe, you know if there is a wavelength match, you will feel it.”

Akilah also had very positive memories of professors who understood her struggle with the “American” English language and helped her and inspired her. Akilah had taken English language courses for many years. However, she had learned the “British” English language and was used to a different accent.

And you know, I still remember my first semester here when I was a grad student. And the accent was different, cause in [country of origin] we are so kind of liked to the UK English, so I’m so used to hearing those.

But here it’s different so the way they say things. It’s different. And my professor, three of them, two of them, and the third one I didn’t have much, you know, interactions with but two of them, they were really nice to me, and they were really understanding.

Akilah did not understand what an American professor was talking about during class.

When the professor announced quizzes, she did not understand him and did not prepare for them:

And I still remember one professor who was an American. He was a mathematical physics professor. And he used to announce the quizzes. And as I didn’t understand what he’s talking about, I was never prepared. And then in the next class when I’d come, everybody is ready for the quiz, and I’m like, ‘I didn’t hear it. Maybe I didn’t understand it.’ And then I was like, so left out. [laughs].

Akilah was unprepared to take quizzes because she did not understand the ‘American’ English spoken by her professor. She built up the courage and went to speak with him to explain her dilemma and the response from her professor touched her heart.

And one day I decided to go talk to him. I told him that, you know, ‘I come from a different country, and I don’t understand what you are talking about. Could you please be patient with me?’ He came to the class next day saying, ‘Hey, all the quizzes that I gave to you so far, I’m gonna cancel it and start from the beginning.’

The empathetic response from her professor inspired Akilah to become a compassionate professor herself. To this day, Akilah is very close to this professor, who later served as a member on her dissertation committee:

And I looked at that human being and then, you know, the way he teaches, the way he is sympathetic too. And he is the reason why I am a professor today cause it was on that day, I still remember that moment I was thinking, 'I wanted to be a professor like him to make a change to my students, you know, help them understand, help them learn, help them move forward and give some light in their lives, light of knowledge.'

During her follow-up interview Akilah provided good suggestions to improve treatment of international students:

I was wondering, or I was thinking maybe it would be a good idea to have like a uniform or general procedure that all students will be treated the same irrespective of where they come from or what their culture is. But if somebody knows, like say for example, an advisor knows what the student's cultural background is, then there could be some biasing. And I don't want that to happen because it won't help anybody to pursue their pathways of success. So, it would be a good idea to have common regulatory rules or something. And also, to make sure that the university follows or somebody to follow through that each and every student is being treated the same.

Yeah, you know, instead of just going to graduate school office if they have any issues, but if the graduate school office volunteers to come forward and check, especially the PhD students. They go through a lot of stress and they're deciding to survive the grad school is a lot of stress. You know that, especially when they come from a different country, and they have no family here or they have no close relatives within the short span of time. So, it would be really important to make sure that they are at peace so that they can do their best completing their PhD.

Akilah also had great suggestions to improve the admission administrative process for international STEM PhD students and the need to place more value on international students:

So, there were several times. It's not just the advisor/student thing, but rather than that I had to take a lot of issues including the administrative office person. So, there were a lot of documents that were missing, and they didn't submit that on time. Even my university graduate school didn't have my applications or paper works and everything. It was somewhere in between the administrative office and the graduate school. So, I as a student had to take an issue to make sure that everything was in place. And it took a lot of my time. I was wondering since I come from a different county and I don't know the way things work, and things were all in limbo because I didn't even know. There was a supposed to be in what they were supposed to do was that I was wondering if they're in

need of special care? But at the same time, they all need to be. I don't know how that all works. But the university can come up with a policy I think to help with that issue ... In terms of application, some paperwork better coordination in addition to having a policy that would implement equal treatment for all the students.

To improve the acculturation process, help female STEM PhD students deal with discrimination or any other problems, and ensure good mental health and balance, Akilah suggested awareness and nation-wide counseling services to disrupt the stigma of mental health problems:

Especially for international female students to have counseling available 24/7 or whatever. I was ready to go there, but I know a lot of other students who had problems who were keeping everything to themselves and maybe they don't know where to go or there was nobody to give them the right guidance. I think it should be part of the curriculum. There should be more awareness. Nation-wide I think it would really help if the students are aware of different counseling opportunities or the services. It needs to be easier for students to access those services and it shouldn't fear anything to go over there because at the end they're going to feel better. And that's one thing.

Akilah was excluded from funding due to her international student status. Akilah believes in more-inclusive STEM PhD funding to include full funding opportunities for international PhD Stem students to ensure their academic success:

Yeah, especially in the STEM field, there's a lot of restrictions. There were several government opportunities which I couldn't apply for because I'm not a permanent resident or American Citizen. Does that make sense? If it is duty or restrictive accounts like that, but there needs to have some more flexibility or everybody to be a part of the research, cause when I came here, I came here to improve my passion and I don't have a plan to go back to my country. I want to use the knowledge and apply it here. So, for me it was difficult to see that discrimination, that being an international student, I could not apply for that money. Maybe compared to others who got the funding, the work they put for it and the work that I do is way greater. And in the way when you see the workload, I put a much greater effort so as to bring more results. That kind of made me uncomfortable because I wished I got that opportunity but just because of being an international student, I couldn't apply.

Akilah provided an educational comparison of both her Asian country of origin and the United States. She also spoke of gender inequalities for female STEM PhD students in both countries. Both had advantages and disadvantages. Akilah explained how, in her country of

origin, there are better opportunities to get a PhD. For this reason, more females have more STEM PhDs. Unfortunately, after marriage, most women become just housewives and stay-at-home mothers due to cultural traditions and a very paternalistic society. She hopes for equal gender roles in her country or origin:

Yeah, in my country there are more opportunities and more PhD programs. I was more new to the way the system worked here, especially, you know, the application side. And that's what I want the PhD system in my country to change and excel because it will be really great if they can focus a little bit more on the application side rather than the theoretical. So, I wanted to say just as an example, I took a lot of classes here which I already completed in my country. But the way they teach here is totally different from the way I learned as a student in my country. And there it's more theory than application. Say, for example, when it comes to exams and all, we have to focus on theory in my country, but here I don't even have to write all the theory in words. But I still have to know it in order to apply in exams and in the labs. And that actually extends my knowledge. And that's why I really appreciate the PhD system here. It makes them to, you know, it actually enhances your intellectual ability, problem-solving. And that's one thing that's lacking in my country.

And also, in [country of origin] students are treated in different ways, especially when it comes to gender. And it's a male-dominant oriented society and you won't see a lot of females, though they get PhDs, though they get Master's, females are actually—there are more female graduate students than males. But in order for them to persevere in what they gained or what they learned in their degrees, it's really tough because a lot of them just being [resigned or settled down] down to housewives or mothers or whatever. Though the males don't have greater education or higher degrees like females here, they're still dominant in their professional careers.

And females, just because their workload in their home to raise their children, the major part has to be done by having to change, learning to share equal responsibility. And they should be taught their education institutions how to do it and what they are doing. And it has to be empowering and we have to fuel it rather than telling them the idea that it doesn't matter however, whatever degree you get—at the end you are going to end up as housewives. Or your majority major responsibility is to raise your children and be a good housewife. That needs to change. And the student be encouraged from the beginning, from the middle school, and then they get into their PhD program or MS, they need to know what they are up for. And they need to have better vision and that's the core thing they have to do.

## **April**

I first contacted Dr. April by email after reading her impressive Curriculum Vitae and her research on her webpage at the public university where she works as an Assistant Professor of Microbiology and Immunology and conducts research. Dr. April was extremely supportive. She agreed to participate in my study, became my “Gatekeeper,” and referred me by word of mouth to other potential participants.

I first met with Dr. April in her research lab. It was a high security lab that required special clearance for me to come and interview her. Dr. April met me at the entrance of the lab. I conducted the first interview in a small office-like space adjacent to her lab. A follow-up lengthy interview was conducted as well, with a lot of collaboration by phone conferences and online.

April was born in a developing country in South America to a Catholic family of low socioeconomic status. Her first language is Spanish. Neither of April’s parents had a college degree, but this did not keep them from motivating their children to pursue an education. April’s father was self-educated, and he became an avid writer and poet. The family struggled financially a lot, but her parents made sure all children had the school supplies they needed and provided them with an education. When April was in her first year of college in her country of origin, her father died. April’s mother then became the main bread winner, and with no college degree in a paternalistic developing country, April’s mother struggled financially to provide for her 3 children.

April holds a BS in biology from a state university in her home country (1996) and a PhD in microbiology and immunology from a public university in the United States (2002). She has two siblings, an older brother who lives in their country of origin and a younger sister who also obtained a STEM PhD in the United States and remained in this country. April inspired,



motivated, and financially supported her younger sister's STEM PhD. April's most important personal attribute is resilience.

April currently works as an associate professor at a state or public university in the United States. She is married to an engineer from her country of origin whom she married during her STEM PhD studies. April became a permanent resident of the United States and she claimed her husband, who now has the same residency status as April. April and her husband are the proud parents of two American-born children: a son who was born during the time she was writing her dissertation and a daughter who was born after her PhD graduation while she was completing her post-doctoral studies.

April's *testimonio* describes her struggles as a high-risk female STEM PhD student in the United States. It describes financial difficulties, acculturation barriers, difficulties finding affordable housing, and health insurance. She described crisis and marginalization by being separated from her family and fiancée. Her motivation to study science came from her parents, who considered education a priority:

So that kind of became my motivation to do well and to perform to the best of my abilities, knowing all the sacrifices, you know, that my mom or my dad had to do. You know, we didn't have a lot of money. We didn't have fancy clothes or anything, but something for sure is that if we needed something for school, we always got it. And so, I did very well in high school. And when I was looking into careers, I loved biology since I was in high school. Oh, I remember when we were learning about the cell and I used to draw the cell, you know, with white chalk and talk to my friends about all the organelles. It was just something that, it was just kind of natural for me to learn and to read about. And so that was the major that I chose for college.

April's interest in research and her selection from a research institute with branches all over the world paved the way for her to come to the United States:

And I became very interested in research in my second year in college. With those experiences, there was very limited resources in [country of origin] to do research. But I was actually able to connect with a group [name of international research institute]. Outside the University is a private research institution. And they actually supported these

national programs in [country of origin] trying to look for talented students that will have kind of a profile to do research. And so, I ended up being selected to be part of that group. And that was basically the door that opened basically so many different opportunities for me to actually be here now.

And so, it was through this institution that is called [name of research institute] that I was able to basically with the director, that I still remember Dr. [name] called. She called me, you know, to let me know that I was invited to do my thesis at this institution. And so, I had a mentor to work with. And you know, that was a really good experience because I learned about graduate school there. I learned about what I needed to do to apply for graduate school. Basically, that institution was the link for me to get an opportunity to come to graduate school here in the United States.

April came to the United States and was first greeted and supported by a Chinese post-doctoral student from [name of international research institute] Branch in Beijing. It was a blessing for April during the critical acculturation period:

Right. And then so after that with [name of international research institute] basically being my sponsor, I was able to come to the United States and that's another thing that I learned, you know, on this process that there's always people that just cross your path to help you. And so, there was a doctor, actually, that she came also from [same international research institute but in China] in Beijing. She was doing her postdoctoral training here and she basically offered her house to me when I came because I didn't have a place. I didn't know anybody here in the United States. And so, I lived with her until I found, you know, a place on my own. And that was also very crucial because it's not only a challenge and a difficulty, you know, leaving your family. But the whole setting, you know, in academics, everything is new. Everything is different.

April felt blessed having a very supportive mentor and academic advisor once she started her PhD in microbiology:

So, she was also a big help and a blessing for me to have during that transition. And once I started at the university I also was blessed with a wonderful mentor from my graduate studies. She was very supportive of all my activities, not only in the lab. But, you know, she understood all the struggles that I went through and that I had to overcome because financially it's pretty hard when you're in graduate school and you don't have family to help you.

April struggled with very limited finances and finding an affordable safe place to live.

She made a lot of sacrifices just to survive financially:

I ended up living with roommates. But that didn't work out because personality differences. So, the first year—ah, my first year was so hard. I moved, like, four times because I couldn't find the right environment until at the university, I found a little flyer. And I went there, and it was basically this beautiful lady, that she lived by herself, that she rented the roof in her house to students or residents that were doing their work at the hospital. And so, I was actually able to find a room to live with her in her house. And that was something that I could afford because, you know, it's different you having to pay \$700 for rent and then just renting a room that was much more affordable. And I was able to get a car. So just being very conscientious about those limitations was very important. So, I know that finances were a problem, and so I started you know, just being very careful with the money that I had and, you know, if I don't have money to go to the movies, I don't have money to go to the movies. It's as simple as that, right?

April built systems of support peers and faculty who helped her. April was allowed to show vulnerability without being type casted:

And I was able to cope with all of that with the people that I had around. I was really able to find people that I trust and that I could tell them all my difficulties. And they helped me. You know, I used to babysit for one of the girls that worked in the lab cause she knows that I also needed money. So, you know, sometimes she'll offer me ... I used to also take care of, like, when my mentor when she would go out for a business trip or something. You know, she would ask me to watch her house or just be home so that her son will not miss the bus. You know, things like that. And, you know, they did that I'm pretty sure on purpose so that they could give me a little bit of money for those services. So, I think, you know, just having that group of people that I could trust. And if I fell down, I could cry without feeling ashamed and they understood what I was going through. That was very important.

April also kept in touch with her family and her boyfriend long distance, and her faith was important to help her persevere:

Right, yeah. We were separated for 3 years. And so, it was really difficult [to be without her family and boyfriend] even from the distance that they used to write me letters or send me emails. You know, keeping my encouragement up, and that was big for me because, you know, I know they were there. You know? All the time. And they knew all my activities. They knew how my schedule was when I had an exam. You know, they sent me a little note, "Wishing you the best." And if I do well, they'll celebrate, you know, with me from the distance. So, you know, the combination of everything and also, I think my faith. You know, my mom and my dad, they're people of faith. I grew up with that in me and I remember there were days where I had to get up at 4 in the morning cause I had so much to do and study for my courses, do the work in the lab. I used to pass by the chapel from the university hospital.

April relied on her Catholic faith, which made her resilient:

And I made basically a routine just to go there every morning just for a few minutes. And, you know, just like, “Oh, God. Help me through today.” You know? Cause there were days that I felt so alone and so overwhelmed like, I don’t know if I can do this for 3 more years, 4 more years that, you know, a PhD requires. And when things go well it’s okay. But there are times where I don’t know if I did good in my exam. I don’t know if I’m going to have enough money for this. You know, like you doubt yourself sometimes you just want to be able to deliver to the expectations, right? And so, I used to go to the chapel and just, you know, put myself in God’s hands.

April faced hard decisions that weighed on her. April stopped going back home to her country of origin after the third year, because her departure to come back to the United States was difficult for her emotionally:

Everything started, you know, getting better. And I think my confidence went up, too. I’m like, “You know what? I’m actually gonna be able to [finish my PhD in Microbiology]. And I was doing really well with my research. I used to go back every year for the holidays for Christmas home. So, I did that my second year. My first year and second year, right? But every time I had to come back, it was harder to leave everybody there, you know? To the point that, you know, I told my mom, and I told my husband now, but we were still dating, that I was not going to come home again until I graduated because it was just so painful to leave them. And so, what we did is that my husband came the following summer because I wasn’t planning to go home, right?”

April’s then boyfriend came to visit her during the summer; they became engaged and eventually got married. April had a great support system. Her husband was able to come to the United States with the help of April’s mentor, who hired April’s newlywed husband to work as a technician in her lab:

So, he came in the summer to visit me and, you know, once he saw, you know, the environment that I was seeing—you know, how much I had to study, he knew about my research. And I told him, “Oh, my God. If you go...” You know because it was so nice to have him here.

You know, for a few weeks. And we actually started looking—at the time, he was an assistant professor back home. And we started looking for opportunities for him, right? He’s a chemical engineer. But we were looking for things in science, too. And so basically, he went back home, but we ended up—I ended up going home again and we got married. And then we came back together.

In my third year. So, we got married and my wonderful mentor actually hired him as a technician so that, you know, we could have a little bit of stability. And so, he worked basically in the same lab that I was doing my graduate work. And I was able, you know, to graduate. And that's what I tell you. You know, like, if you have people around you, they become extremely generous and, you know, without that kind of support it would have been really difficult. And so, I was able to graduate.

April took the initiative of emailing a doctor to ask him if he could be part of her dissertation committee, this paved the way to her post-doctoral training:

And so, I remember, you know, composing an email to contact this faculty member. And, I mean, I spend hours just writing, like, five lines, you know, asking him to be a part of my dissertation committee. Well, a long story short, he agreed. He said, you know, he'd be glad to participate in my committee. And so, for my actual defense he had to come for my final evaluation. So, I had the opportunity to meet him. And that day of my evaluation I was, you know, asking him for, you know, kind of like suggestions, input about post-doctoral positions. And then he said, "Come visit my lab." And I was like, "Oh, my goodness." So, I interviewed in a different lab, and then I went, and I visited his lab. And he offered me a job to do my postdoctoral training with him. And from that, you know, here we are.

So again, everything that happened during graduate school became really important for defining the trajectory ahead of me. And again, one door opens, another one opens. And I think, you know, the whole environment that was around me—really good people that care about me—myself being able to trust those around me. My dedication, you know, discipline, too. Because there were things that I knew I couldn't do. I had to focus on my studies to be able to graduate. You know, all of that played I think an important role in the success. You know, I used to feel like, "What am I doing here?" You know? It's like, it would be easier if I just go back home, right? Cause every day sometimes felt like a struggle, but you know, at the end of the day, you take every day at a time. You have faith and everything starts kind of falling into place, right? Once my husband came, that was a life changer, you know.

Moreover, April had to overcome what seemed like unsurmountable barriers including separation from her family and boyfriend, financial difficulties, and transportation barriers:

Yes. Leaving home. Leaving my family. Leaving in a way kind of everything behind, right? English was a barrier. The finances. Yeah, we had a stipend. Yes, we have to TA. And the thing is that I remember when I first applied for credit cards. I was denied because I had no history here. So, it took me the longest time to get a credit card. And I was so happy when I actually got one because I felt that's how I felt I could go home, you know? Like, if I could, you know, use a credit card to buy my ticket. And I remember my first credit line was, like, \$400. That wouldn't even buy me half of my ticket. But again, I

took it, and you know, talking to the girls in the lab, you know, they told me, “Okay, this is what you do with your credit card.” Cause we never had a credit card in my family. So, she couldn’t help me. And so, you know, the person in the lab told me, “Okay, just pay something. But make sure that you pay it all back so that your credit, you know...” I did that, and then, you know, like within 6 months they increased my credit line to \$1,000. And I’m like, “Okay, this is good. This is, like, a lot of money.” Back then I felt like that was a lot of money. So, you know, all of those struggles with the people around, it was such a blessing because I was able to, you know, to take advantage of all the knowledge that they were able to give me.

When I didn’t have a car, you know, I remember a good friend that I made during my graduate studies, you know, we used to study together for our courses and I remember, you know, one time when she realized how was it, you know, that I didn’t have a driver’s license? “You don’t have a driver’s license?” “No, because I don’t have a car.”

And so, she was like, “Okay, you can use my car so you can take the exam.” And I said, “Yeah, but the problem is that I don’t know how to drive.” And so, the very first time that I went back home, I told my mom, “Mom, I need to learn how to drive.” And I remember I got home, and she had already signed me up for driving lessons. So, imagine, I learned how to drive in three weeks. And then the expectation now is that I come here and take the exam and be ready. So that was really hard, but you know, my friend, she used to take me in her car so that I could practice. I failed the exam three times, okay? And the problem is that I think this person—it was always the same person. And the first thing that he asked me to do was parallel park. And I couldn’t parallel park, so—

So, I thought that I was never going to get a driver’s license. That was so frustrating. But, you know, I did it. I don’t know how without a car, really. But just, you know, borrowing a car here and there. It happens, so—

So then after I got my driver’s license, then, you know, I got my car. I basically learned how to drive after I bought the car. But I used to get up very early so that there was no traffic cause I was terrified. But, you know, in a matter of a few months, you get comfortable.

And the beginning I did [took the bus]. When I was living with some of the roommates, I lived within walking distance. But again, it didn’t work out, so when I was living with [name 0:42:09], you know, the lady that rented me the room from her house, it was a little far, so I did have to take the bus. So that was challenging sometimes because of the schedule, and it was not good. I missed the bus a few times.

And, you know, you’re working in the night. And, oh, you know, it’s when those things happen that, you know, you get home and you think, “What am I doing here?” But again, your strength comes back, and you find the light and a nice [inaudible 0:42:47] from the family. And then, okay, it’s okay. I’m okay. I’ll be more careful so that the bus doesn’t leave me. But once I got the car, that changed everything.

Oh, because I was not restrained by anything, really. I could go to the grocery store. Oh, cause that was another thing. And going to the grocery store, you know. It was a challenge. And I remember the very first time I was so happy. Okay, I'm going to the grocery store and I'm like, "I cannot carry all of these bags with me." So, you know, little things become difficult, and I have to be very careful about the things that I could buy because they didn't have a way to get everything. But again, as people got to know me, you know, they used to invite me. "Okay, I'm going to the grocery store." So, "Okay, I come with you." And then they'll drop me off at home so that I could do a decent grocery shopping.

April also faced academic challenges and English language barriers:

All the courses were challenging. But I used to record all my professors, and I studied a lot. I mean, that's all I did. And that was my mindset. You know and making all of the sacrifices. Or my family's home. I have no time here for fun or for anything but to study. So, I study if I was not in the lab, I was studying. I was in the library, or I was home studying. And even during the weekends, I get up sometimes some friends, "Oh, let's go to [nearby city]" Or let's go to... And I'm like, I'm sorry. I have so much to do. I can't. You know, like I couldn't even enjoy anything because I know I have so much to do. But it paid off because all the time that I spend, you know, on my studies, you know, figuring out from my tapes—you know, listening back to my lectures, I had to make sure that I understood everything. And so, it was a lot of dedication, but I knew that was the way to be successful, you know? I'm like, this is not...cause I knew I had the disadvantage not being fluent in English, right? Still having difficulty listening, right?

And the different accents from different professors because there were professors from other countries that had [foreign] accents. So, when you're not very fluent even your listening is, you know, it's very challenging. But with all the time that I put into all the courses, again, I graduated from graduate school I had a 4.0 GPA.

But the support she received from her mentor and academic advisor and the support from her peers contributed to her success:

The relationship that I did with my mentor was I think key for that because I was not afraid of her. I tried to be very strong, you know, in front of her but I have to tell you the truth. I broke up in 2 years a few times in front of her, you know, with different things that happened. So, I don't know. I kind of felt that I don't have anything to hide to her. So, if there was a problem, I would come to her and I'll say, "Hey, for this course, I have this professor. I'm kind of struggling a little bit understanding this. Do you think there's anything that I can do?" And you know, she'll tell me, "Okay, maybe you know, find this different book or just go talk to her."

Also, with my friends, you know, I was not very hesitant to ask for help, basically, because I found people around me approachable. And it became clear to me that if I don't seek the help that I need, nobody's going to help me. You know? So, I think that

resourcefulness helped me a lot, too. And, you know, being able to take comments, it's hard when people critique you, but I don't know. I used to get really down and kind of sad about, you know, when you put so much effort and then you think you did really well and then you get a list of things that you did wrong or that you could have done better.

April provided the following insight for future generations of international female STEM PhD students in the United States:

I don't consider myself any special or, you know, I would say if I can do this, anybody can do it. But I think something that helps me is that I'm a goal-oriented person. You know, maybe too much to the extreme. But I think that helped me. You know, like, I have a goal. And I want to do this and I'm gonna get there, you know? So, when I came here, my goal was, "I'm going to graduate and I'm going to get my PhD." Right? That was my goal. You know, it's like, "How am I going to get there?". Again, it's kind of figuring every step of the way, but I'm not gonna quit and I'm going to get there, and I'm going to do it well. And so, I think for me setting up goals was always very important. Like from even, we used to have lab meetings every week. And so, we had a lab meeting this week. I did my presentation. And then for the next week I already had goals. Leaving that meeting, I set my goals for the next week, you know?

Maybe without realizing, but you know, like, organizing and breaking down tasks help me get to my goals, right? But all of that also requires discipline. Because if I say that I'm going to do this I have to do it. And even if I want to sleep late, but the experiment has to, you know, the experiment needs 12 hours, I cannot sleep late.

These were April's recommendations for current and future female international STEM PhD students:

You know? So, it requires that discipline and dedication and persistence and not giving up. I would tell them that...I will give them the confidence that they can do it. I would tell them that it is very important, though, to have even though it's far away and even though they're in a different country, they need to find someone that will help them and support them, okay? So, if they have their family, they need to keep in touch with their loved ones.

And they need to find the resources that they need. I mean, if they don't have them already, they cannot be shy about finding help, you know? Cause the reality is I give them the confidence that they can do it, but it's also very important to accept the fact that you cannot do this alone.

And it will be a mistake, actually, to think that you're just going to be able to handle all of this on your own. I mean, you need people that can help you with so many little things, you know?



But the most important part is just being sane and, you know, being able to dedicate your effort. But you need to be healthy in your mind, you know? You need to be able to understand that, okay, I can deal with this sacrifice and not dwell for weeks and months because this is too hard. I mean, so it's really—the support of the family even if they're far away very important. And making sure that they can find help and resources around the help them cause this is hard to do it alone, you know? And if someone doesn't help you, somebody else. Someone else is going to help you, right?

But definitely that they shouldn't give up and there's always a way to be successful. Confidence. With trust, you know, trust in others is really difficult, especially when you're new in a place. You don't know who you can trust. But again, if you trust yourself, the decisions that you make, you know that you're going to find good people to help you, right? And that's the faith, right? I mean, the faith is that you don't know how things are going to come out, but you have faith that they will come out.

So, it's a challenge, but I think that, you know, I'm really inspired, and I would do my best to inspire their self-confidence on this and that they can actually do it. And I think, I mean, if you were to, you know, look back and my family—who my dad was, who my mom was—very humble, you know. We had, you know, very limited resources. Probably nobody in the world would have think that “Oh, my God. That this kid...” So, right, anybody could do it, right? So again, sometimes I tell my students, “I'm really not that special. Anyone could do this. We just need to realize that we cannot do it alone.”

We need help and we need to help each other. You know, hopefully with that we have more women will actually not only jump into this but stay in the business.

I don't know why. But unfortunately, you know, science is dominated by men. So, you know, you kind of get used to that. In meetings you're going to be lucky if there's another female in the committee or...

Right? You kind of get used to that. But at the same time from my mentors, you know, they've been very respectful and actually pretty good at promoting women. So, I think we can do better definitely in, you know, closing the gap of, you know, female/male, especially at the faculty level. But also, you know, at higher positions. You know, chairs and deans...presidents.

But I do believe that there's a lot that we need to do, especially in mentoring. You know, like, both male and female mentors, you know, to help female graduate students to really be successful and to provide them with the resources to be successful. I do think, again, that we need to do better. And yeah, there are times where, uh, you get frustrated. But I have kind of like my family as the relief, you know, that I can talk to them, and they can support me. And then, you know, I come back with the stress of ... and I'm learning too. I mean, even to this day there are situations where...then you realize, “Oh, I should have said this.” But in general, it's been a nice environment for me.

April also recognizes the need to have balance between studies, research, and family:

Well, for us we made it work. It was a challenge because we had our first son in my last year of graduate school. And basically, that did not put me on a delayed path. You know, my goal was, “I’m going to write my thesis.” And that’s basically what happened. When I had [name] I was writing my actual dissertation. And so, it actually worked out pretty well because I was up all night. But I was writing, and I used to, you know, the baby wake up. You know, I feed the baby and continue writing. And so, I moved to my post-doctoral training and, you know, [name] was a baby still. But that’s where the support of my husband comes into play because without that...so you have to be a team basically. Cause I couldn’t do it alone, you know? And so, we basically shared every responsibility.

And then for our second one I was a little bit more hesitant because I knew what it requires. So, we did wait a little bit until [name 01:10:57] was a little older so then we didn’t have two babies to take care of. But I think that’s where, you know, it comes being organized at home, too. You know, we were very systematic about the activities we did with the kids. You know, we were lucky that since they were very little, we had a bedtime and they went to bed by 8:00, you know, they were sleeping so that then I could use the rest of the night for my studies and, you know, catching up. But to me it’s really difficult to separate home and work. When I’m at home, I work all the time, you know.

And the kids know that I’m writing grants and I’m writing papers. And they know that I need quiet time. So, when they’re little it’s harder, so we used to plan activities so that they go to sleep early. We’ll do things with them, but it was always, “Okay, mommy needs...I have homework to do. I’m going to put this timer. Until it beeps you cannot, you know, mommy needs this time.” And you know, they grew up knowing that.

### **Collective Testimonial Narrative Themes**

In this chapter, I provided the complete *Testimonios* of three participants of my study: Luisa, Akilah, and April. According to Jones (2008), *testimonios* are educational and personalized lived experiences shared with the researcher with the goal to empower others by challenging the *status quo*, authenticating gender, race, cultural, and/or class stereotyped experiences (Arocho, 2017). In this chapter, I focused specifically on the lived experiences of my participants within the contexts of gender, race, culture, and class. Furthermore, I explored the participants’ university policies or lack of policies that may have contributed to the participants’ perceptions of alienation, oppression, discrimination, and/or sexual harassment. I sought best practices for universities to address cultural dissonance.

These are the themes and key findings that were informed exclusively by the *testimonios* of the specifically selected participants.

### ***Human Capital***

Human capital encompasses knowledge, skills, and personal attributes. (OECD, 2001. p. 18). All eight participants in this study were high academic achievers in their home countries. The three participants who provided their *Testimonios* sought specialized specific STEM and/or health science programs from a PhD or doctoral program in the United States:

During that year I started looking into graduate schools. Because I started thinking that going back to [country of origin] was going to continue to be very difficult, I wanted to find a way to stay here and graduate school seemed to be a good idea and I liked it, when I came here, I saw science at a different level. What I did in [country of origin], it was very basic. It had nothing to do with the type of research I saw here, we were very limited with the resources we had. The thesis I did for my college degree was very, very simple and when I came and saw all the different techniques and technology that you could use and apply got me really fascinated with that.” (Luisa)

So, I kind of decided to do more in science and I think that was the beginning. But then when I got my Master’s...first I got my Bachelor’s in physics, chemistry, and mathematics, and from there I got a Master’s in applied electronics around physics. And another, we call it MPHIL, Master of Philosophy. In one of the branches of physics, it is called photonics. P-H-O-T-O-N-I-C-S. That’s all about laser of light and things like that. (Akilah)

I came here and it took a while, like, 2 to 3 months or something because we were international. And then I started browsing the University’s nearby in the labs and the professors who do work similar to my interest. And then I started emailing them. And then [name of university] was the only university I knew at that time. And I found a professor who did research and lasers and nanoparticles, things like that. So, I made an appointment with him and then I went and visited him, talked to him. And then after that I talked to the admin people, like the formalities that I have to go through. (Akilah)

And I knew it was a lot because there was nobody to talk to, nobody to get advice or anything. But it was the dream. I mean, it was my passion that was pushing me through. And I never was ready to give up. (Akilah)

And so, it was through this institution that is called [Name of Famous International Research Institute] that I was able to basically to connect with the director, that I still remember Dr. [name] called. She called me, you know, to let me know that I was invited to do my thesis at this institution. And so, I had a mentor to work with. And you know,

that was a really good experience because I learned about graduate school [in the United States] there. I learned about what I needed to do to apply for graduate school [in the United States]. Basically, that institution was the link for me to get an opportunity to come to graduate school here in the United States. (April)

### *Cultural Dissonance*

All eight participants in this study, including the three participants who provided their Testimonios, experienced a cultural incongruity and discontinuance from the participants' home culture and lived experiences to their host culture in the United States. Luisa felt cultural differences contributed to cultural misunderstandings by her research supervisor:

I was like, you know what? And it was around the same time my husband wanted to go back. I was like, you know what? Maybe this is a sign. Maybe it's just a sign that I shouldn't be in this place. I should go back and I'm just gonna quit. I'm just gonna leave it as it is because it was really hard, you know, with my advisor. He could not, he was not understanding my culture where I came from. And he was getting, he got too personal and at one moment he told me that he was attracted to me. And that changed the whole situation. He was a married guy, and he really misunderstood a lot of my behavior and the way how we [Latinas from South America] work.

Like, I was married. My husband wasn't here and remember that even the first year. and everything that kind of started, he was building up things in his mind without me knowing. As a [Country of Origin in South America] woman, when I got married in [Country of Origin in South America]. I wear my wedding ring on my right hand, not on the left one. And I don't have a diamond.

So, for that people [faculty and research supervisor] did not know that I was married, but all my friends knew because you know, when we start making friends, like, 'Hey, are you dating?' I'm like, 'Oh, no. I'm married.' '[gasp] Where's your husband?' I'm like, 'Well, my husband is in [Country of origin].

Due to cultural differences in the STEM educational system of her home country as compared to her host country, the United States, Akilah was unfamiliar with the admission process in the public university in the United States. Therefore, she applied for a master's degree in spite of the fact that she already had two master's degrees from her country of origin:

And finally, I got into the program for the Master's, and from there I waited one more year and I reapplied. No. Actually, my application was there, but they considered my application for the PhD and then they gave me admission to the PhD.

Understanding the admission policies of her public university in the United States was not an easy process. There were two separate applications to complete, one for the graduate school and one for the physics department. Akilah felt overwhelmed: “And I knew it was a lot because there was nobody to talk to, nobody to get advice or anything.”

April had to move several times due to cultural and personal differences with her roommates:

I ended up living with roommates. But that didn't work out because of personality and cultural differences. So, the first year—ah, my first year was so hard. I moved, like, four times because I couldn't find the right environment until at the university, I found a little flyer. And I went there, and it was basically this beautiful lady, that she lived by herself, that she rented the roof in her house to students or residents that were doing their work at the hospital. And so, I was actually able to find a room to live with her in her house.

### *Discrimination*

Akilah felt discriminated against by domestic senior female co-researchers in her research lab, which jeopardized her safety in the lab while working alone in the dark with lasers, especially during her pregnancy. Additionally, Akilah felt discriminated against by her research supervisor:

And there were a lot of discriminations from my senior lab mates, my female doctoral students. They were not supportive. They were not helping me learn anything which they learned before me. So even though I have to work on the same equipment, it's like a day-long experiment sometimes and it's in the dark laser room because when laser works you have to shut down all other lights.

So yeah, I forgot to tell you. My PhD was on nanoparticles, characterizing those nanoparticles using lasers. So different types of lasers. When a laser was on, you have to shut down all other lights. So, it's dark and it's that full lab, total dark. So, you really have to get used to that to identify, you know, each and every stuff there, so you don't fall on anything, you don't disturb the optics in there.

So usually, you work as a team. But then when I worked in the lab, no one was there to help me. And so, I had to figure it out, everything by myself, and my advisor at that time, cause he's—I'm not blaming him. He's so used to the senior people because they were

there even before me. So, whatever they tell him, he kind of believed it and so I had to prove it to him.

I proved that they had a formula sheet with a glitch in it, but they were never able to figure out the mistake. So, they kept on keeping with the formula sheet. But I proved that their calculations are wrong, and that's why they're not able to get the result which they wanted to.

And my advisor didn't believe me when I said that. Finally, when I got my particles, I told them that, 'Hey, I got it because my formula is correct.' And then he got a chance to look back and he found that I was right. So, I mean, I was actually helping myself and them. So, whoever came after me, they took my formula, and my professor got a lot of publications after that as well I believe. So, yeah.

[My senior female lab mate was not supportive]. She was not, cause I still remember—when it comes to the fundamentals of physics, cause there were, like, underground students, they were working in the lab for their undergrad research. So, they used to take classes in quantum mechanics, or the core physics subjects. So, whenever they have problems in doing the physics problems, they come to either me or her. I think primarily to her because she is the senior member. But she was not able to help them. And then she's like, 'Oh, I forgot that. Tom, could you help me?' And then he will direct them to me.

Akilah's research supervisor discriminated against her due to her international student status as compared to domestic or American students. Her research supervisor forced her to work non-stop on weekends and extended summers even during pregnancy:

And then being an international student, my advisor used to tell me always that an international student I need to put at least three times the work that a domestic student does. And he always had, you know, kind of shown the partiality as well. Cause he never asked the students from here to work on Saturdays and Sundays. But he asked me to come on Saturdays and Sundays, telling me that if I don't do it, I won't graduate. And at that time, I never kind of took it personally because I thought, 'Maybe he is correct.' Yeah, I used to come on weekends, but I noticed that students from here, they never came on weekends. And it actually gave me a quiet atmosphere to come into the lab. It's all mine, and you know, find peace and work on it. So, I took it positive.

At the end Akilah came to realize that she had been discriminated against due to her status as a female International STEM PhD student:

Towards the end, I was tired. I was like, 'Why is he so partial?' You know, but yeah, it was all learning opportunities. You come to see people learn about them, understand that that's actually not the way it's supposed to be at the end.

Akilah did not report her research supervisor or her domestic senior female lab partners:

“The right time to respond might have already passed. And then you try working on with other people, but you will learn it.”

In terms of financial compensations and grants, Akilah also felt discriminated against.

Her research stipend and financial grants were always dependent on what domestic students did not use or applied for:

I had a research scholarship. Talking about that, now I remember it. I was always the second preference for my professor cause he always wanted to make sure that the students from here are happy. And if there is any money left, he will give it to me. So, there was one time that I found out that I'm running out of money. And I never asked my parents, or I didn't to help me or anything. So, I applied for a scholarship at [Name of University].

Akilah applied for and was granted a teaching scholarship from another department to supplement her income. But she had added work and responsibilities as a teaching assistant in addition to her extended research hours at the lab.

### ***Sexual Harassment***

Luisa felt sexually harassed by her research supervisor. It started very subtly with what appeared as cultural misunderstandings based on her research supervisor's Western ideology, and it escalated to full sexual harassment:

During that first year my advisor, he invited us over to his house to celebrate something. I don't remember if it was for Christmas, Thanksgiving, something. He celebrated us and he invited us to come over with our significant others and when told us that, he kind of looked at us and nobody had anybody. Like, so, me people...oh, no. I think there was one with baby, so, she came. And when he looked at me, I didn't say, 'I'm married, but I have...', [he asked me] 'Where's my significant other? And I told him, like He's not here.' That's all I said. But I didn't say my husband is not here. So, he thought that I was alone and one day, so, we went there by ourselves. I mean, it was fine. One day, I don't know how we were talking. Like, all the people from the lab. There were, like, five students at that time. We were talking, and somebody brought up my husband. And he's like, 'Do you have a husband?!' I'm like, 'Yes. I'm married.' 'Why didn't you tell me?' I'm like, 'You never asked, and I never felt that I needed to say that I was married.' I'm like, 'I'm here to study. And even when my husband was here...' Ah, no. But when he

knew that I was married, my husband was already here. But when I was in graduate school, I was in graduate school. And I was studying. I was staying in the lab early and staying late as I needed. My experiment, I never left my experiment. And my way of thinking is like, 'I know I'm married. I know I have a life, but I cannot let that life interfere with my studies.' And nobody needs to know what's going on with my private life. They don't need to know, so, I never felt, and I never had, like, the confidence or the need to talk to him about my personal life. Like, there was never a situation for that.

Luisa's research supervisor based his wrong perception of her being single on male Western stereotypes about Latinas from South America and he seemed surprised and upset to learn that Luisa was married:

So, when he knew that I was married, I thought he was kind of joking but the more I thought about it, I'm like, 'He was kind of upset.' I was like, I don't understand why. Like, there was no, like, 'Why didn't you tell me?' I'm like, 'Because you never asked. There was never an opportunity for us to talk about it.' Like, and it's my personal life. Nobody needs to know it. 'Well, but there is no cue that you're married. You're young. You're pretty. You're this. And you don't have a wedding ring.' I'm like, 'I do have a wedding ring. This is my wedding ring.' And he was married, and he never wore a wedding ring. So, why? I didn't know.

At first, Luisa did not see anything wrong. Luisa, a South American Latina, comes from a communitarian society. In Luisa's country of origin, it is quite normal to have drinks and dance. Singles and married people, young and old, get up and dance and it is not considered inappropriate. Luisa's research supervisor, on the other hand, was very much aware that this was inappropriate behavior. He displayed another act of entitlement and power structure, that is, advisor versus student.

So, I didn't pay attention to that. I'm like, it's fine. So, on after that, we went to a meeting to Colorado. Another graduate student, my advisor and me. He took us, what was it? Skiing. So, at that time we spend a lot of time, like, the three of us together, like, outside the lab. So, we spent a lot of time when we were in the lab, in his office, talking about experiments, talking about science. But during this meeting we spend so, me, like, social time, which it was a complete mistake. Like, I'm a person. I like, well, I'm not very social, but I like parties. And we went skiing. So, we were laughing. We were having a good time. At night times, you know, there were receptions, and we have a drink. I would have, like, with the other friend, with my other lab mate it was fine. But he misunderstood everything that happened over there. And there was one time that I made a mistake and I realized that after the fact. I didn't do it with an intention. We had a glass



of wine in the table. We were talking to other people, and then I went with my friend, and we got a margarita, each of us. We got a margarita and we brought it back. And he looked at us, like, 'Oh, you're drinking by yourselves?' Because the wine, the people that were holding these meetings, they provided a bottle of wine for the table. So, everybody was drinking from that bottle, but I didn't like that wine. So, that's when I went with the other girl, and we bought a margarita for us. When he came back, he's like, 'Oh, you're drinking yourselves. You don't want to drink with me.' And we're like, 'You're drinking wine.' And he's like, 'There's no more wine.' 'Oh, do you want a wine? I can go get you a wine.' So, I went, and I got him a glass of wine. And I didn't think about it now. It was social and we stayed there and then later that night they started playing music. I love music. I love music. I love dancing. I was dancing. Like, everybody dances by themselves. So, we were dancing, but then they started playing some music that people from here, they know how to dance. Like, it's in couples. So, he grabbed me, and we started dancing. We were dancing, I didn't say anything on it. I lied to them. My husband didn't go, but he was home. Like, it's nothing. I'm like, this guy...he's way older than me. He's my advisor. There was nothing that could happen there.

Luisa's research supervisor and academic advisor made her work long hours, abusing the power structure. Luisa did not see anything wrong with that as he had the same practice with other research assistants in his lab:

Because of that, and another thing that contributed to all this mess is that I spent too much time with him. Every time I have a problem, or I had a question, I would have to sit there with him hours. Sometimes I will go 9 in the morning, and it was 5 o'clock and I was still sitting there trying to solve a question because if I didn't know, he would not give me the answer. If I will start giving a wrong idea, he will let me go all the way over there to show me that that was wrong, and then started dragging me back to the right. So, it was a long, a lot of conversation. It was not just for me. It was all the students. And we even made a rule in the lab. Like, if it is 3 o'clock, 3 or 4 o'clock don't go talk to me because he will sit and he will keep you until 7, 8. He didn't care.

Then, one day, Luisa's academic advisor and research supervisor openly expressed his feelings for her. Luisa was shocked and very scared. She tried to set the record straight with her much older supervisor, who was married with children, to no avail:

I did spend a lot of time with him. But I never saw anything like weird until he invited me to this lunch, and I thought we were gonna talk about this other girl and he just threw it to me. 'I feel attracted to you. All this time that we have spent together.' I did not know how to react to that. I was just in shock. I could not speak one word. I was like, my life is ruined here. What am I gonna do as an international student if I don't have a PI? If I don't have a place to stay in, I cannot stay in this country. I'm gonna have to go back. I'm not going to be able to graduate. That's all that was going through my mind. So, it made it

really, really difficult. So, that day I was just, the only thing that I said, like, 'I'm so, sorry. I'm so, sorry, but that is just wrong. There's no way. I don't know why you felt that way, but I cannot deal with that.' Like, 'I leave the lab.' And I told him that, 'You know? If I need to leave the lab, I leave the lab right now. But there's nothing I can do. It's not because you're married. It's not because I'm married. It's because there's nothing. Like, no. There's no possible way that I could be interested in you or that there's a possibility that there could be something here.'

As an international student who needed her student visa to remain in the United States, and her husband dependent on her, Luisa (who had already spent 3 years in her STEM PhD program) felt cornered, with nowhere to turn. Luisa set the record straight and apologized for any misunderstandings, although it was not her fault. She acted out of fear and an unsupportive climate in her department:

So, that changes my whole entire experience, because I was into my third year of graduate school and things just went downhill from there. It was really, really hard. But it was my husband, so, I didn't tell my husband right away for a while because I thought I could handle that. I didn't tell anybody because I was feeling, to me that it was a dream. Like, this is not happening to me. Like, not a dream, a nightmare! Like, this is not happening to me. This can ruin my life. So, I didn't want to tell anybody. What I did is that the next day I talked to him and was like, 'You know what? I'm sorry if I did anything that gave you the wrong impression, but I'm just here to do science, to get my PhD. Please let me know if I can still do that in your lab. If not, I will leave. I will try to find a different lab. I will try to- I know that will be hard,' but I told him, 'I will try to find a different place. But I cannot, I don't want to leave, but if I have to leave, I will leave right now because you have a family, and I don't want to ruin that.' Like, I know my marriage is not being compromised because I didn't have any feelings. But it was like, 'You have a family.' Cause he would bring his sons to the school cause their school was across the street from this place. So, after school they will come and stay with him until it was time for him to go home. 'You have a family, and this is that.'

The inappropriate behavior from the research supervisor continued despite the fact that he did write Luisa an initial letter of apology. Her research supervisor continued with the sexual harassment, however. He behaved in a possessive and jealous way and made lots of statements with sexual innuendo. Luisa's research supervisor also seemed to watch all her interactions with other Latinos from South America, which was creepy and scary. He did not know their culture and did not seem to want to understand it:

So, he wrote me a letter apologizing what he had done. He said that his feelings should not interfere with my dream, that I was very smart, very brilliant person.' Because that's another thing that he said. He was not physical. He was like, 'You are so, smart. You're one of the smartest person that I've ever met and it's kind of impossible to have people that are smart and that, of course, they always brought up the physical thing, that you are so, pretty. You're this and you're Latina.' And then he started talking, at the time I didn't feel it so, inappropriate, but then I realized like, 'Yeah, he was inappropriate.' Like, everything he will say, it had, like, a sexual context. Like, [gasps], 'Your sexy long hair.' You know, like, we all have long hair in my family in our country, so, he misinterpreted all of that wrong. Like, I was doing it on purpose. I'm like, this is how we are [in my Latina culture and South American country of origin]. This is what we do. And if there were any social events, I met a guy, like, another graduate student joined a different lab in the same place, and he was from Uruguay. We felt like we had known each other since forever just because we could speak Spanish. So, this guy was so, sweet, and we are, this is how I see most of the Latino population. We are very...I don't know we express ourselves very much, like, through hugs, kisses and of course, my advisor will see that, and he will come like, 'Huh, you were having a lot of fun the other day.' We're like, it was nothing. It was just, it's everyone [from South America].

Luisa's research supervisor behaved in a possessive manner toward her:

So, it created some problems because he was not very happy with what I was doing. Around the same time, I engaged in a project with another PI that they were collaborating, and it was going pretty well in that lab, but he decided that he didn't want me to continue with that. So, I couldn't do it because it was taking too much time out of his lab. So, he was not fine with that. So, it was very uncomfortable. It was very, very uncomfortable. I try not to talk about the issue, and we didn't talk about it. But he kept, for a while he was kind of serious and our conversations were kind of very short. But then he started kind of forgetting and getting comfortable again. And I just felt like I just felt that I had to deal with it. I just, I'm not gonna fight with this guy. I need to graduate. I just need to get out of this place, but I need to finish my requirements. So, it was like a complaint. It was very, very uncomfortable because there were places where, there were instances when there were, like, activities that involved many of the other persons in the lab, which were very, very uncomfortable. We didn't know any of this situation because we didn't tell her. But there were places that there were some activities when everybody went golfing [at some conferences]. He just wanted my attendance at a conference. He had...you should be fine, you should go. I didn't want to go but I didn't want to make it look like oh, there's something going on. I didn't want him to think that I could not be around him.

Luisa finally told her husband the problem she was facing. Luisa's husband supported her and empowered her not to give up despite the inappropriate behavior:

But I didn't want to get my husband involved. I didn't tell my husband about the situation, like, right away. But I think it was very uncomfortable. There were a few times

that it was really ‘Just the quit. Just leave everything and go, find my husband. Tell me.’ And he’s like, ‘No. You need to talk to him. He cannot interfere with your life. You just go talk to him and knowing that I know all of this, that if he...’ I don’t know. My husband was not trying to get him in trouble. You don’t want to get him in trouble. He was like, ‘You’re not alone here.’

‘You cannot let those ruin your life.’ So, he was the one that kind of kept me going. At the end I just decided to deal with him. I really was not good. It was not comfortable. I spent a lot of time, a lot of hours at his office just because that was the only way we could ask during my thesis, the advisor on my thesis, the preparation of my dissertation. We spent hours and hours.

There were many times Luisa wanted to quit, but she just could not see herself wasting so many years of her life, and there were no PhD STEM programs in her country of origin, and in the United States she could not transfer all her doctoral credit hours. Luisa’s research supervisor made her feel ashamed by abusing his power structure in the advisor-advisee relationship. Luisa realized it was sexual harassment; blaming her for how he felt because of the way she looked and dressed. It was predatory behavior at its best:

So, for me it was difficult, but it is the mostly fear. Because I couldn’t see myself just wasting 3, 4, years of my life trying to pursue this degree and to let it go because of him. Cause for me it would have meant having to go back to [country of origin] to a very difficult time and very difficult place to do research in the neurosciences, which that is what I wanted to do. And that’s what I learned to do. And that’s when I did my professional effort, it was to go through and finish a degree. So, for me I think it was just that the fear helped me to persevere with him. It was not fun. It was not good, because he was very thankful. I know, I didn’t ask, I didn’t speak for him [did not report him] because I felt even though it was not my fault, I felt ashamed. And sometimes with big thoughts, like, some topics he was telling me, and it was very offensive because he made me feel like I was responsible for that., that I was responsible for being pretty, for trying for new things, for dressing nicely. He just, everything that I did, he judged me. If I wore high heels, that was like a huge thing for him. Like, ‘Why would you do that? You wouldn’t look so good.’ I’m like, it made me uncomfortable, the whole situation. It was how I dressed. It was how I talked. If I did my nails if I didn’t do my nails. All of those things, he always had a comment.

Luisa was afraid of reporting him for sexual harassment for fear of retaliation and an unsupportive department:

I was too afraid because he had the ability to toss everything away from him. And I saw that with a lot of people. So, he was a person that he didn't have maybe good relationship with his colleagues. He was very famous in that place for being really hard on the students. So, he had had reporting from a lot of students, but none of them lasted in the lab. And everything was because there was something wrong that he was seeing. He never took responsibility, a little bit for anything he did. Worst of all was when I joined the lab, there were like, seven, eight people in his lab. Nobody, they know his standards than he did. And it was because of him that they left.

Luisa did talk to one of her committee members, however. He listened and heard Luisa.

It was a relief for her that someone believed her and offered support and advice:

And I think, I sometimes I feel like a lot of people kind of had the idea that something was going on. But nobody said anything. Nobody said anything. I also talked to one of the other members of my dissertation committee. I was his best friend over there. I was very afraid when I talked to him, but not about his situations, about my situation of leaving the lab. And that was at the time and point that I needed to leave, that I knew I was in a good position to leave, but then my PI didn't want to let me go. So, I went to talk to him [the dissertation committee member] and he said, like, 'You need to get out of this place. You need to go. He's not gonna let you go, and you need to go. So, this is your opportunity.' He did tell me, like, 'If you go now, you'll find a place and it's very good for you.' The thing that he did say, and I know a little bit about is, like, knowing my research at that lab group, may not be published. Or he [her research supervisor, academic advisor, and dissertation chair] can give it to somebody else. If somebody else comes to the lab and decides he wants one more thing, I can do the main authorship for that paper.  
(Luisa)

Luisa felt her dissertation took longer due to this situation and then it delayed the time for her degree completion:

It took me 6 years [to complete my PhD]. It took me 6 years because the way the whole situation when...I don't even remember the days, but I think it was 3 years—in dissertation. I worked with him when I joined the graduate school. I worked with him from day one. I just started in fall 2006 and I graduated on May 2012. So, it was a long time.

Luisa was allowed to graduate and receive her PhD in neurobiology due to specific policies of her university that required only one publication for graduation, which she had.

However, Luisa's research supervisor retaliated against her for leaving his lab and not reciprocating his feelings by refusing to publish her dissertation and other important research

articles. Despite the fact that neither her research supervisor nor her university published Luisa's dissertation and other research projects, she is happy and proud she persevered and obtained her PhD in neurobiology: "Yeah, I did make it. I made it through the dissertation. So, keep going. I finished my PhD."

But looking back, she now believes she was taken advantage of by her research supervisor because she was a vulnerable female with international PhD student status and visa. However, at the time, Luisa did not report him. She was afraid of retaliation and afraid she and her husband would lose their visa as an international student and her dependent. She also felt she could be blamed based on the culture of an unsupportive department toward previous sexual harassment complaints:

Yeah. I think that too [I was taken advantage of due to my Female International Student Status]. I think this was bad. I didn't know any better, and yeah. I didn't want anybody to know that, and I didn't want anybody to see me with him [from a different lens—or like, another stage [because nothing really happened, but I know I would be blamed].

### ***Gender, Cultural, and Class Microaggressions***

Microaggressions for *testimonios* have been described as "brief and commonplace verbal and behavioral indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial slights and insults toward people of color" (Sue et al., 2010, p. 278). The international female students from South America who are Latina and Hindu Asians who were pre-selected for *Testimonios* are considered in terms of race as non-white. All the *Testimonio* participants were female, and all were considered coming from low-income socioeconomic class.

**Gender Microaggressions.** Luisa felt mistreated by her research supervisor due to her female gender based on gender stereotypes about women:

One day, I don't know how we were talking. Like, all the people from the lab. There were, like, five students at that time. We were talking, and somebody brought up my husband. And he's like [her research supervisor], 'Do you have a husband?!' I'm like, 'Yes. I'm married.' 'Why didn't you tell me?' I'm like, 'You never asked, and I never felt that I needed to say that I was married.' I'm like, 'I'm here to study. And even when my husband was here...' Ah, no. But when he knew that I was married, my husband was already here. But when I was in graduate school, I was in graduate school. And I was studying. I was staying in the lab early and staying late as I needed. My experiment, I never left my experiment. And my way of thinking is like, 'I know I'm married. I know I have a life, but I cannot let that life interfere with my studies.' And nobody needs to know what's going on with my private life. They don't need to know, so, I never felt, and I never had, like, the confidence or the need to talk to him about my personal life. Like, there was never a situation for that.

So, when he knew that I was married, I thought he was kind of joking but the more I thought about it, I'm like, 'He was kind of upset.' I was like, I don't understand why. Like, there was no, like, 'Why didn't you tell me?' I'm like, 'Because you never asked. There was never an opportunity for us to talk about it.' Like, and it's my personal life. Nobody needs to know it. 'Well, but there is no cue that you're married. You're young. You're pretty. You're this. And you don't have a wedding ring.' I'm like, 'I do have a wedding ring. This is my wedding ring.' And he was married, and he never wore a wedding ring. So, why? I didn't know.

April perceived some of the men in STEM felt superior to women:

Some of them were. Yeah, there's always men that in every aspect of my research on every step of my studies from my PhD studies and after during my post-doctorate, when I was doing my graduate studies and during my post-doctoral training I was in contact and I had some male students, professional faculty that yeah, they have big ego. They think they are superior and that they think that they are on top of the world, that they're always right. But you know, I never let that bother me because I know even from talking to my mentor that that was the environment in science.

So, I was kind of like, prepared for it. And even with talking to other students, you know, they'll say, "Oh, such and such..." You know, he thinks he's great so be ready, you know, because he may be asking you a bunch of questions or something. That's just the way he is. You know, he thinks he's always better than everybody else. So, I actually, you know, listen to that and I made the effort to come very well prepared that whoever will be throwing questions at me, that I was able to answer them appropriately. So that was kind of my approach to it knowing that we would always have personalities like this in this business. But that was not something that affected me negatively. If anything, I took that the other way. Okay, bring it on. I'll be ready for it.

April shared that science is still a male dominated field where there is lots of work to be done:

I don't know why. But unfortunately, you know, science is dominated by men. So, you know, you kind of get used to that. In meetings you're going to be lucky if there's another female in the committee or ...

Right? You kind of get used to that. But at the same time from my mentors, you know, they've been very respectful and actually pretty good at promoting women. So, I think we can do better definitely in, you know, closing the gap of, you know, female/male, especially at the faculty level. But also, you know, at higher positions. You know, chairs and deans ... presidents.

But I do believe that there's a lot that we need to do, especially in mentoring. You know, like, both male and female mentors, you know, to help female graduate students to really be successful and to provide them with the resources to be successful. I do think, again, that we need to do better. And yeah, there are times where, uh, you get frustrated. But I have kind of like my family as the relief, you know, that I can talk to them, and they can support me. And then, you know, I come back with the stress of...and I'm learning too. I mean, even to this day there are situations where...then you realize, "Oh, I should have said this."

April had great ideas on how to support females in STEM PhDs programs and careers:

Women in STEM -What can we do to support them? You know, in general, I think sometimes some of our institutions are not family friendly and I say that in the way that if we had kind of like a daycare system, like, embedded in the academic institutions, make a system of really high quality. That was probably something that will attract women because the reality is that we are going to have to balance with family and PhD STEM studies and or STEM jobs. And therefore, I think that that will be something important. And if I know that my kids are being in a place that they have, like daycares in Universities and I don't have to worry about that, I'm gonna perform better in my studies, research and or STEM job.

Another thing is I think we need to prepare women for a leadership position as soon as they start graduate school. So, leadership is something that, oh, we cannot see far away but it just—something that it belongs to the male counterparts. And I think in general females are not as good men working as men are. I would probably put a lot of effort in providing opportunities for females to realize the potential, to gain confidence, to learn about leadership. And I think that will be really impactful there in bringing up their confidence and being able to stay, finish the programs and then continue into higher roles.

I think that leadership component was lacking a little bit. Also, we need to I think prepare females better in understanding that males and females yes, we're different. We think different. But at the end of the day, we can complement each other very well. And so, I think it's just that awareness that female ideas are very powerful, and they are much needed in these environments that are, we can say male dominated.



**Cultural Microaggressions.** Akilah feels that there should be policies to ensure there is no discrimination due to cultural background or country of origin and those international students are treated equally as domestic students:

I was wondering, or I was thinking maybe it would be a good idea to have like a uniform or general procedure that all students will be treated the same irrespective of where they come from or what their culture is. But if somebody knows, like say for example, an advisor knows what the student's cultural background is, then there could be some biasing. And I don't want that to happen because it won't help anybody to pursue their pathways of success. So, it would be a good idea to have common regulatory rules or something. And also, to make sure that the university follows or somebody to follow through that each and every student is being treated the same.

The points of view from different cultures is also very important, especially when we are trying to solve problems in a society that it is becoming more and more diverse.

Luisa feels that international Latina students, especially from other countries, are sexually harassed by white male faculty more often than white domestic females in STEM:

'You're one of the smartest person that I've ever met and it's kind of impossible to have people that are smart and that, of course, are pretty. You're this and you're Latina.' And then he started saying inappropriate things, but we would say them in a way that sounded like something normal, so I often times did not say anything because I thought that if I did, it would mean that those things were important for me, and they were not. He would talk about my 'sexy long hair.' which was strange to me because we all have long hair in my family in our country, so, I think he misinterpreted all of that wrong, because he thought I was letting it grow to impress him. He judged me for everything I did.

Sometimes I also think I'm too weak because oftentimes I get emotional when I think about it, when I talk about it because it was hard. But it made me tough in a way and it opened my eyes. I mean, [inaudible phrase 0:43:37]. Because I see here, just how harassment is very, very common. It's very hard and very common towards the Latino population just because of the nature, the way how we are if they [white male faculty] don't understand it.

**Class Microaggressions.** April is a good example of class microaggression. She came from a low economic seriocomic class in a developing country:

So, growing up, basically something that it was kind of like emerged in home, at home in my family was kind of like the resiliency that my mom and my dad had, you know, to make sure that we had an education. So, they both struggled a lot. And neither of them was actually able to complete a college degree. But that was not a limitation for them to

do the best they could to actually make sure that we had a better education than what they had.

So even though, you know, my dad didn't attend a college, he did complete high school, though. He was always very passionate about education. I remember growing up with him telling us, "I'm not gonna leave you money or houses as an inheritance, right? I just want to make sure that you understand that your education is what's going to be able to give you progress." And so, I grew up hearing that, hearing that all the time. You know, how important education was for him. He was actually very well educated for not attending college.

So that kind of became my motivation to do well and to perform to the best of my abilities, knowing all the sacrifices, you know, that my mom or my dad had to do. You know, we didn't have a lot of money. We didn't have fancy clothes or anything, but something for sure is that if we needed something for school, we always got it.

And also, I think with all of this, my dad died when he was very young, and I was in my first year of college when he passed. And so that was definitely, I have to say, my strength because, you know, I feel like I didn't want to disappoint him. Even though he was not there, I really wanted to do well because he couldn't go to college. And there I was in my first year in college, so I felt like, you know, I think I need to do this for myself and for all of us.

April's mother, a young widow, had to work hard to support herself and her three children, but she always supported April during college:

My mom was always very supportive for my studies. And, you know, she used to tell me, "You're so smart." You know, sometimes when I get frustrated because, you know, I had a bad grade or something, she's like, "Don't worry. You'll get over this." And she always supported me with the little money that we had, you know, I never had money to buy my own textbooks, so I had to make copies of everything. And everyone was just gonna say, "Okay, here." You know, 5,000 pesos, which is very little. So, if you need copies, you can make copies and you don't have to spend so much time at the library.

So, she was always very supportive of me of studying English. And yeah, after my dad passed, yeah, we became very close. And she had a very hard time with transitioning to a life without him. She was very young, too, at the time and my brother and I, we were teenagers basically. So that wasn't very easy for her. But I don't know. She did the best, but she could. She was always, you know, asking us how things were going, what we needed. And, you know, trying to provide us with the resources. She was very proud when I started my thesis at a famous research institute. You know, I remember she calling her sister to tell them. You know, she has always been very supportive of my career.

And once I started at the university (in STEM PhD in the United States] I also was blessed with a wonderful mentor from my graduate studies. She was very supportive of all my activities, not only in the lab. But, you know, she understood all the struggles that I went through and that I had to overcome because financially it's pretty hard when you're in graduate school and you don't have family to help you.

You know, I learned from my mom to be organized. I mean, I remember my mom writing on a little notebook, you know, how much money we have, how much of the electricity, how much is the water, right? A budget.

And so, I kind of started doing the same. So, this is the stipend that I'm getting. I didn't have a car, so I had to figure out a way to save to buy a car because I realized that without cars, it's such a big challenge. So, what were the things that I needed, right? So, I need my tuition. I need, you know, food. I need for my textbooks. Okay, so I started doing a budget. And then I realized, you know, there's no way I can afford an apartment. There's just no way I can afford an apartment. So, I was living, you know, with Dr. [name 0:18:33] at that time. And then, you know, I started talking to other students. You know, "Where do you live?" You know, "How much is your rent?"

So, the first year—ah, my first year was so hard. I moved, like, four times because I couldn't find the right environment until at the university, I found a little flyer. And I went there, and it was basically this beautiful lady, that she lived by herself, that she rented the roof in her house to students or residents that were doing their work at the hospital. And so, I was actually able to find a room to live with her in her house. And that was something that I could afford because, you know, it's different you having to pay \$700 for rent and then just renting a room that was much more affordable. And I was able to get a car. So just being very conscientious about those limitations was very important. So, I know that finances were a problem, and so I started you know, just being very careful with the money that I had and, you know, if I don't have money to go to the movies, I don't have money to go to the movies. It's as simple as that, right?

You know, I used to babysit for one of the girls that worked in the lab cause she knows that I also needed money. So, you know, sometimes she'll offer me ... I used to also take care of, like, when my mentor when she would go out for a business trip or something. You know, she would ask me to watch her house or just be home so that her son will not miss the bus. You know, things like that. And, you know, they did that I'm pretty sure on purpose so that they could give me a little bit of money for those services. So, I think, you know, just having that group of people that I could trust. And, if I fell down, I could cry without feeling ashamed and they understood what I was going through. That was very important.

I don't know if I'm going to have enough money for this. You know, like you doubt yourself sometimes you just want to be able to deliver to the expectations, right? And so, I used to go to the chapel and just, you know, put myself in God's hands and ...

Yeah, we had a stipend. Yes, we have to TA. Right. But it, you know, it was very tight, you know? And the thing is that I remember when I first applied for credit cards. I was denied because I had no history here. So, it took me the longest time to get a credit card. And I was so happy when I actually got one because I felt that's how I felt I could go home, you know? Like, if I could, you know, use a credit card to buy my ticket. And I remember my first credit line was, like, \$400. That wouldn't even buy me half of my ticket. But again, I took it, and you know, talking to the girls in the lab, you know, they told me, "Okay, this is what you do with your credit card." Cause we never had a credit card in my family. I mean, I didn't even know if my mom knew what a credit card was.

So, it's a challenge, but I think that, you know, I'm really inspired, and I would do my best to inspire their self-confidence on this and that they can actually do it. And I think, I mean, if you were to, you know, look back and my family—who my dad was, who my mom was—very humble, you know. We had, you know, very limited resources. Probably nobody in the world would have think that "Oh, my God. That this kid ...". So, right, anybody could do it, right?

So again, sometimes I tell my students, "I'm really not that special. Anyone could do this. We just need to realize that we cannot do it alone."

Akilah believes that because most international female STEM PhD students work hard and contribute to scientific research just as domestic students, and they choose to remain in the United States as STEM faculty, that they should be allowed to apply for government or federal financial loans, financial assistance, and grants:

Yeah, especially in the STEM field, there's a lot of restrictions. There were several government opportunities which I couldn't apply for because I was a permanent resident or American Citizen. Does that make sense? If it is duty or restrictive accounts like that, but there needs to have some more flexibility or everybody to be a part of the research, cause when I came here, I came here to improve my passion and I don't have a plan to go back to my country. I want to use the knowledge and apply it here. So, for me it was difficult to see that discrimination, that being an international student, I could not apply for that money. Maybe compared to others who got the funding, the work they put for it and the work that I do is way greater. And in the way when you see the workload, I put a much greater effort so as to bring more results. That kind of made me uncomfortable because I wished I got that opportunity but just because of being an international student, I couldn't apply.

## Summary

In this chapter, I introduced to the readers how I met the participants for the first time and then shared their *testimonios*. Three participants were pre-selected for *Testimonios* based on

having experienced discrimination, oppressive environments, unfair treatment, or were considered students at risk. They all overcame their barriers and negative experiences, successfully graduated, and obtained a Doctoral STEM or health science degree. They all became agents of change. In this chapter, I provided the new Collective Testimonial Narrative Themes derived exclusively from participants' *testimonios*. In the next chapter, I provide data analysis, synthesis, and interpretation.

### **Data Analysis, Synthesis, and Interpretation**

The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international female doctoral students who succeeded in their PhD programs in STEM fields or completed a doctoral program in the health sciences in the United States.

The data analysis presented in a previous chapter transformed my raw data into my research findings. The chapter on *testimonios* explains why and how I used *testimonios* as a methodological tool to arrive at injustices and oppression experienced by the 8 participants. The data analysis presented in this chapter is interpretive. It includes the data analysis, synthesis, and interpretation of my research key findings, seeking meaning and understanding, in a more holistic approach. The goal is to seek what information I have now and what it means. I sought to understand what I had found by comparing my key findings both within and across groups and by comparing my study's findings with those of other studies, according to current literature (Bloomberg & Volpe, 2016).

Moreover, each qualitative genre provides a perspective on reality that is specific to that genre. In this phenomenological descriptive study, I analyzed data for noteworthy statements grouped into "meaning units," with the goal of producing a thorough description of the phenomenon by developing themes of meanings. The meaning units were enumerated and grouped into shared themes which produced thick descriptions of the experiences of the international female doctoral students. In turn, these produced the true meanings or "essence" of the lived experiences of 8 international female doctoral students who succeeded in completing their doctoral programs in the United States in STEM or completed a dual PhD and/or professional program in the health sciences (Moustakas, 1994).

Bloomberg and Volpe (2012) posited: “There are no formulas for determining the significance of findings or for interpreting them, and there are no ways of perfectly replicating a researcher’s analytical thinking (p. 234).” I collected various type of data and grouped the data into themes and identifying patterns. I learned to accept ambiguity; I learned by doing, even struggling and “fighting” with the data. Now, I have an opportunity to communicate to others what I think my findings mean and integrate these findings with literature, research, and practice or implications for higher education. Additionally, I present guidelines on how to analyze, interpret, and synthesize, my study findings in the hope that other novice researchers may be able to transfer my guidelines to their qualitative descriptive phenomenological inquiries. I provide careful step-by-step documentation of my analysis giving access to my procedures to future researchers. Hopefully, my study can become a model for other studies—a contribution to the research community at large, following Bloomberg and Volpe (2016).

Bloomberg and Volpe (2012) posited that “qualitative research involves the move from a holistic perspective to individual parts (analysis) and then back to a holistic look at the data (synthesis)” (p. 243). In a previous chapter on *Findings*, I split the data to “tell the story” of the lived experiences of the international female doctoral students in STEM or the health sciences in the United States. In this synthesis, I combined all the aspects of key findings from how the research questions answered the findings, my interpretation of all the findings from all the methods in data collection, and the connection of the key findings to the literature. I have transcended beyond data to information and new knowledge. In the chapter on *Findings*, I remained as objective as possible and tried to provide the most accurate analysis of the findings I could. In the present chapter, I become subjective; my voice and opinions, along with the literature, take precedence. My goal was to tell a very rich story with great details, keeping in

mind the context that linked the participants and their experiences, activities, and processes to a larger more integrated phenomenon. Synthesis was not a linear process; however, it was ongoing throughout the entire analytical process. Finally, my analysis dealt with arriving or obtaining “the meaning or essence” of the phenomenon and communicating it into the larger picture.

(Bloomberg & Volpe, 2016; Moustakas, 1994)

As the researcher, I was the instrument, the inquirer, the analyst, the interpreter, and the privileged writer who had the honor to tell the stories of these great scientists and researchers about those times when they were doctoral students (Bloomberg & Volpe, 2016). But this is only with my view, my voice, and personal lens. I acknowledge that there are many possible ways in which other researchers could have analyzed and interpreted the same raw data.

That is the beauty of qualitative research. I drew from my background in science, and at the suggestion of my wonderful dissertation chair, I explored the world of Art-Based Research. The scientific approach was very disciplined, rigorous, and methodical, and utilized critical thinking. The artistic approach gave me the freedom to explore, and to use creativity and originality to produce new ideas. Based on the aforementioned goals and in the road map for analysis, synthesis, and interpretation I presented in *Findings*, I now introduce the organization of this chapter: Interpretation of Key Findings organized by how the main research question and sub-questions were answered, Inferences for Higher Education for each topic, Literature Connections, and Summary.

### **Data Analysis, Synthesis, and Interpretation of Key Findings: Factors Supporting Success**

In addition to the main research question, this key finding addressed Subquestion 1:

What factors do participants perceive enabled them to complete their program of studies and graduate in a timely manner?



Families really provided what was needed (resources broadly defined, including emotional support) specifically for each student to persevere. Family support and encouragement to study and major in STEM fields was provided since childhood. During their PhD STEM and doctoral programs in the Health Sciences, families really provided what was needed. Many participants wanted to honor deceased family members by getting their STEM PhD:

April was particularly encouraged by her father:

So even though, you know, my dad didn't attend a college, he did complete high school, though. He was always very passionate about education. I remember growing up with him telling us, "I'm not gonna leave you money or houses as an inheritance, right? I just want to make sure that you understand that your education is what's going to be able to give you progress." And so, I grew up hearing that, hearing that all the time. You know, how important education was for him. He was actually very well educated for not attending college.

Family encouragement is a very important factor for first generation college students who come from underprivileged families in underdeveloped countries. Luisa graduated from High School and applied to college, excelled in biology, and graduated from college:

But the only thing that I remember, most of the things that I remembered about him telling us, like, 'You need to be good, and you need to study. You need to study. You need to study. So, I was only in 6th grade when my dad passed away. So, all I needed to do was study. All I needed to do was to be good with my mom and listen.

Families' use of cultural traditions for keeping deceased family members present played a prominent role in their support systems. Akilah (Participant 09132017) felt closer to her grandparents than to her parents. She was very close to her paternal grandmother who doted on her as a child because Akilah was their first grandchild:

I don't know the fact, but [laughs], so every time I had an issue in my childhood, I usually go to her. And she was a smart woman. I wanted to believe that because most of the times she doesn't know what I'm talking about. But she will hold me really close to her and say the final thing that, 'Look, everything is going to be alright.' And maybe she doesn't even know what I'm talking about, but it gave me a lot of courage that, 'Hey, she said it's gonna be okay.

Prior familial experience in science or STEM fields influenced participants' future in science careers:

I come from a family in [country of origin withheld to ensure participant's confidentiality] where you either have to be a scientist or doctor or engineer that they'll expect you to succeed or that's the expectation for most the families I should say. And for example, within our family are my cousins, brothers, and sisters - we had 58 positions in our family, including surgeons in every specialty. So, all my cousins are doctors. And many specialists among the doctors. It's a very [country of origin deleted to ensure participant's confidentiality] thing to go in sciences and engineering and acquire human capital in those disciplines. (Tanvi)

Three participants wanted to follow their older sister science path: Rose (Participant 03212018) was encouraged by her older sister who was the first female in her village to attend college: "Yeah, it was something like that. It really wasn't very common." Both of Rose's parents were also sources of encouragement despite the fact that neither one finished high school:

My mom, actually, I think she didn't even complete elementary school and my dad, I think he just got his middle school degree, but he was a very open-minded person. He was like a director of one company in the town that I was living. And my mom, she was reading a lot of books and things like that. She was all the time trying to encourage me.

First scientists in their families were inspired and motivated by teachers and peers:

And my grandfather was a musician. And so, everybody was so into music, arts, and things like that. And I really enjoyed it, and I didn't have any other world than music and arts. So, my passion was either to, you know, focus my study in music or in literature... I didn't tell anybody about this [getting a PhD in Physics in the United States] because it was kind of so embarrassing that people will laugh at me cause it's never gonna happen (Akilah)

And I became very interested in research in my second year in college. With those experiences, there was very limited resources in [country of origin withheld for confidentiality] to do research. But I was actually able to connect with a group. Outside the University is a private research institution. (April)

### *Inferences for Higher Education*

All participants reported their family support as extremely important for overcoming barriers, remaining in their programs of study, and persevering in gaining their degree. Program directors and faculty advisors should be aware of the important role family plays in the success of international female STEM PhD students.

Nevertheless, not all international female STEM PhD students receive family support. Moreover, many family members remain in their country of origin; others cannot afford to provide financial support; and in most cases, the family separation may include several years and across long distances. Hence, academic advisors, faculty, mentors, dissertation chairs, and/or committee members, peers, and research co-workers become “the extended family members” for all the international female PhD students in STEM or Doctoral programs in the Health Sciences.

Regardless of specific traditional religion or spirituality, faith gave strength and provided endurance to all participants during crisis. Akilah relied on the *Holy Book of Hinduism*, the *Bhagavad Gita*, for guidance during her PhD studies in Physics in the United States:

But my grandparents always told me that believing in yourself because the Gita, the kind of holy book. We have a lot of Veda, you know, the epics and everything, but one part of it is the Bhagavad Gita”.

The Holy Book for Hindus, the *Bhagavad Gita*, provided Akilah with the most important basics of her faith and was a source of spiritual guidance:

It’s the, what do you call it? The hymns. So, it has a lot of those things, but it’s all written in Sanskrit. But one of those things that says that your body is the temple. And you, yourself, your soul when it merges the God. So, keep the temple clean, means keep your body healthy, clean, pure, free from the negative thoughts and everything. And then your God is going to be happy.

April made it a routine to stop by the chapel in the university hospital where she studied for her PhD and conducted research in Microbiology and Immunology and commit her PhD studies to God:

And, you know, just like, “Oh, God. Help me through today.” You know? Cause there were days that I felt so alone and so overwhelmed like, I don’t know if I can do this for 3 more years, 4 more years that, you know, a PhD requires.

Devoted members of different religions sought spiritual guidance and felt guided by their God or Higher Power. Many felt divine intervention which helped them succeed despite all odds.

Mira, an international Hindu student from Asia, relied on her faith since childhood:

Yeah. I mean, definitely it was very strong as we were growing up. And, you know, so we definitely, you know, performing our daily prayer rituals, you know, which I still do. It’s just part of my daily activities. And definitely, you know, like, praying when things are not going right, you know, so praying for some divine intervention.

Regardless of specific religion/spirituality, all participants asked their God or Higher Power for protection and safety.

*And when things go well it’s okay. But there are times where I don’t know if I did good in my exam. I don’t know if I’m going to have enough money for this. You know, like you doubt yourself sometimes you just want to be able to deliver to the expectations, right? And so, I used to go to the chapel and just, you know, put myself in God’s hands and... And everything, you know, it kind of worked out. (Pilar)*

Rose, a strong traditional Muslim, stated that her most important factor for success was her faith. “Yeah. I can say that it’s the most important factor is my faith.”

A remarkable finding is that across religions, faiths, spirituality, and systems of beliefs is that all 8 participants believed in Angels, spiritual beings and “souls” or life and conscience beyond death. An overwhelming majority felt they could communicate with deceased family members by means of prayer or meditation. They could “feel the presence of” or “tap into that source of energy.”

Pilar has been a woman of faith since her early childhood. She is a Catholic and she strongly believes she has guardian angels who have guided her throughout her life and during her PhD: “I mean, I believe in Faith. I mean, I am a spiritual person.” “Faith was important. Yes, faith was also important.” “I am Catholic, and I believe that I have angels.” Pilar is also a firm believer in angels since childhood. She strongly believes these guardian angels have protected and guided her to the right path: “My dad died when I was young, 12 years old. So, I said— That’s my angel.” “My guardian angels. I have very good angels over there because they guide me to the right path.”

The importance of faith despite the specific religion or spirituality cannot be stressed enough. Faith for all international female STEM and health science doctoral students provided strength in times of weakness, an anchor when venturing in uncharted waters in a foreign country, protection from calamities and unsafe situations, direction when feeling lost, wisdom when making important decisions, healing of body and mind, divine intervention in times of crisis, comfort even in the death of a beloved family member, and hope for the future in times of despair. Universities in general should encourage and allow student associations of all different religions and faiths to congregate and have fellowship. Providing different chapels, churches, mosques, temples, synagogues, and quiet spaces for prayer and/or meditation on-campus for international students with transportation problems is an asset.

Encouraging respect and tolerance for different faiths through lectures, workshops, and discussions are extremely important to avoid discrimination, isolation, or aggression against international students of different faiths. Interfaith services, trying to find some common ground, or providing opportunities for joining forces to help those in need or community service can help unite people of different faiths.

### *Support From Academic Advisors and Others*

Support from academic advisors, research supervisors, faculty and mentors are the number one factor for retention and student success for international female STEM and Doctoral Health Sciences students in the United States.

There's actually one. She used to be a graduate advisor and the person who I got a class from her. Yeah, she was a very nice person. I mean, she wasn't really my mentor directly but yeah, she was all the time talking about how we can be successful because she was so passionate. She was organizing math day events for high school girls. (Rose)

All 8 participants recognized with gratitude the support and help received from their academic advisors, research supervisors, faculty, and mentors. Academic advisors were instrumental in guiding the international female doctoral STEM and Health Science students not just on the courses they needed to take but played a major role in motivating them, providing resources for them, and opening doors for opportunities such as attending research symposiums, conferences, and networking to advance in their fields.

And also, I think I can say that my advisor, he was actually, he had a lot of funding, so he was able to send me to a lot of conferences. So, each time, whenever I went to another conference, I was feeling myself—I was so proud of myself. You know, I'm doing this. I'm really doing a lot of presentations before, and I think probably that was a very important thing that really helped me a lot to find a job. (Rose)

Research supervisors helped the international female students with specific techniques in the lab; taught them how to conduct research from scratch; safety in the lab; how to use equipment and reagents; were instrumental in helping write, publish, and present their research; and in the majority of cases provided their main source of income by means of research assistantships. Many served as dissertation chairs. Faculty and mentors ensured these students' academic success by providing academic tutoring, teaching specific skills, suggesting books, research articles, and materials.

So, if there was a problem, I would come to her and I'll say, "Hey, for this course, I have this professor. I'm kind of struggling a little bit understanding this. Do you think there's anything that I can do?" And you know, she'll tell me, "Okay, maybe you know, find this different book or just go talk to her." (April)

Faculty and mentors provided invaluable support for acculturation, learning English as a second language, referrals to resources within the university, and the community. Faculty and mentors helped participants obtain scholarships; apply for grants; and or teaching assistantships.

So, there was one time that I found out that I'm running out of money. And I never asked my parents, or I didn't to help me or anything. So, I applied for a scholarship at [name of university] It's a one-year scholarship for teaching and learning. So, they picked through a pool of doctoral students from different disciplines. So, among K-12, teaching fellow—that's what they call it. University teaching fellow. There were 12 of us. I was the only person from STEM I believe. So, it's a one-year program with \$25k [\$25,000 dollars] for the whole one year to pay for tuition and everything. But it gave me a wonderful opportunity to make me a greater teacher. And my mentor or doctor—was the one who helped me apply and obtain the scholarship. (Akilah)

Faculty and mentors helped students prepare for qualifying exams, served as dissertation chairs, and/or as committee members.

And I'm so proud when I think about it because I had two other collaborators from different universities. One of them, he is still working in one of the universities in [Name of State]. He volunteered to be a member in my committee. He was not eventually on the committee, but he sat as the external advisor. And he paid himself to come over for my defense. My other professor was not even working at that time, but he flew all the way from [name of State] and he wanted to be another external advisor. (Akilah)

Most importantly, they were caring and compassionate. All participants confided in them, even in very personal crisis such as breaking long romantic relationships or engagements or enduring the tragic or unexpected death of a close family member.

But I must say I had that relationship in my major professor whom I could talk to. She helped me to talk out and gave me copies of Life Lessons. They were really helpful. So, it was more of a colleague relationship. And I remember one time my major professor says the difference between you and me is just all these years of intellectually, emotionally, academically experience. So, she bestowed a lot of respect on me, intellectual respect. And I did not want to turn her down, so I tried my best and I came out of my personal, emotional breakdown okay. It could have been worse. I could have left the thing, but she kept me on track. (Tanvi)

Participants asked the advice of faculty and mentors before making important personal decisions such as getting married or having a baby.

The relationship that I did with my mentor was I think key for that because I was not afraid of her. I tried to be very strong, you know, in front of her but I have to tell you the truth. I broke up in 2 years a few times in front of her, you know, with different things that happened. So, I don't know. I kind of felt that I don't have anything to hide to her. (April)

Faculty and mentors provided priceless advice even in legal matters, such as applying for a spouse visa, getting permission to work part-time, or applying for a drivers' license.

**Inferences for Higher Education.** The support and help received from their academic advisors, research supervisors, faculty, and mentors constitute the most important contributing factor for retention of the international female STEM PhD and Doctoral Health Sciences students in the United States. Hence, STEM PhD and Doctoral Health Science academic advisors, research supervisors, faculty, and mentors should ensure they provide the most efficient and effective services to this vulnerable population. The above-mentioned professionals in Doctoral STEM and Health Science programs should be well trained in cultural, linguistic, and religious diversity, responsive multicultural education, and specific issues related to international students. They will be the first to hear about the specific barriers or needs affecting these students and should be able to guide them, offer support, and/or refer them to the specific departments or programs both within their universities and/or their communities, which can help the international female STEM PhD and Doctoral Health Science students.

### ***Supportive Role of Peers***

Most STEM PhD students obtained help and support from their own peers:

So, it's really your own peers. You know, like, peers that you are sort of familiar with. And I had so many [PhD Students from country of origin] graduate students in our program, and then Chinese graduate students. So, you know, again, you have to sort of—of course, among the graduate students [PhD Students from country of origin] it's kind of



easier, you know? To sort of assimilate, right? With the Chinese students, I had to sort of build that relationship, understand their culture a little bit. But I think in the graduate school, everyone is so driven to, you know, in their work that there was never a time when people didn't want to help you. (Mira)

All of the participants reportedly received support from their peers. This support was provided not only in academics but also in acculturation, overcoming loneliness and cultural shock, and learning how to network and socialize in the United States. Friendship with peers improved the English-speaking skills for all participants. Peers edited their papers, corrected their writing and grammar, taught them how to pronounce specific words, listened to their tapes and acted as translators when they knew the native language of the international female STEM PhD students.

Peers taught the international students female how and where to take the bus. Peers provided rides when international students needed transportation, took them to practice driving to enable them to pass their driving tests, and helped them with driving instructions, navigation, or bus routes. Peers took them and picked them up from the airport, bus, and train stations during their travels. Peers gave them shelter, hosted them temporarily, and provided hospitality for the international female STEM and Health Sciences doctoral students in their own homes, especially during the holidays or vacations when the university dorms were closed or in times of transition to another apartment. Peers took them grocery shopping; and to shop for essential things:

Without that, and a friend from here—the friend that I lived with when I was in San Antonio doing my master's and everything, she used to go to [City where I lived and studied during my Doctoral Program] every 15 days and she took me to buy groceries and everything before I got the car. And then I got the car, and I was not needed. But I really have a very good support system. And that support system was built when I was doing my Master's. (Pilar)

Peers taught international female students how to obtain their first credit cards and increase their credit scores.

And the thing is that I remember when I first applied for credit cards. I was denied because I had no history here. So, it took me the longest time to get a credit card. And I was so happy when I actually got one because I felt that's how I felt I could go home, you know? Like, if I could, you know, use a credit card to buy my ticket. And I remember my first credit line was, like, \$400. That wouldn't even buy me half of my ticket. But again, I took it, and you know, talking to the girls in the lab, you know, they told me, "Okay, this is what you do with your credit card." Cause we never had a credit card in my family. (April)

It was through networking with their domestic and other international STEM peers and classmates that most international students learned how and where restaurants, pharmacies, hospitals, post offices, banks, and main grocery stores and shopping malls were located. Their peers also taught them where places of worship for their specific faith were located and when they shared the same religion, they attended services and religious studies together. Their peers introduced them to important mentors and faculty, and were very instrumental in helping them join academic, religious, and professional organizations.

In terms of academics, the STEM female PhD students and Doctoral students in the Health Sciences relied on their classmates to clarify assignments for them and helped them as tutors in their weak areas in academics. They formed and joined study groups with domestic students and/or other doctoral students of STEM and the Health Sciences, which improved their grades and helped them pass the qualifying exams. It was through other Doctoral Candidates that some of the international female STEM PhD and Health Science Doctoral students found a topic to write their dissertation, learned how to put a proposal together, design the methodology for their dissertation, and defend the proposal and dissertation. Their peers were very instrumental in helping them apply for and be accepted to Post-Doctoral Programs.

Regarding financial need, their peers gave the participants advice on how and where to apply for teaching and research assistantships, as well as part-time, night, or summer jobs on campus. Their peers provided short term small loans and many of the international female STEM

PhD students worked as babysitters, pet sitters, after-school childcare workers, elderly care workers, and housekeepers for their peers and their families as a source of extra income. April stated: “You know, I used to babysit for one of the girls that worked in the lab cause she knows that I also needed money.”

Likewise, during their pregnancy and after having their first babies, it was their peers who provided much needed relief with assistance during pregnancies, childbirth and/or babysitting and child-care once the babies were born. In terms of conflict, unsafe situations, death in their families, political instabilities in their countries of origin, and illness, their peers provided emotional support and guidance. The international female doctoral STEM and Health Science students turned to their peers when having family problems with their husbands, having to break up with fiancées and boyfriends who were not supportive of their doctoral studies or deciding to postpone marriage or dating.

A trusted peer, whether in class or research lab, provided a listening ear and non-biased support with misunderstandings with research supervisors, perceptions of sexual harassment, and/or discrimination, conflicts with faculty, dissertation chairs, or other misunderstandings with peers in class or other doctoral research students working in their labs. Peers were there to celebrate their engagements, weddings, job promotions, child births, publishing, presenting in conferences, and receiving awards. Peers grieved and cried with them in times of sorrow and despair, especially during the death of a close family member. For students who did not have relatives, extended or immediate family members, other STEM PhD students from their home countries provided help with acculturation. In the absence of relatives and peers from their countries of origin, international STEM PhD or post-doctoral STEM students provided needed support to get adjusted to a new country and culture.

**Inferences for Higher Education.** The second most important source of support in universities for STEM PhD and doctoral health science students is their peers, classmates and/or research coworkers. International Student Centers, program directors, department chairs or deans, academic advisors, student affairs, faculty, and mentors should create plenty of opportunities for the international female STEM PhD and doctoral health science students to get to know the domestic and/or other international doctoral students, interact with them, collaborate in joint projects, form part of study groups, conduct research, work on research papers, and publish presentations as a group at conferences. These mixed groups can prepare for qualifying exams, network, and socialize. The international STEM PhD and doctoral health science students should be encouraged to join religious and faith-based organizations, professional organizations, and sports or clubs for much needed balance and recreation.

### ***Balance***

Balance plays an extremely important role in retention of female International STEM and doctoral health sciences students.

Well, for us we made it work. It was a challenge because we had our first son in my last year of graduate school. And basically, that did not put me on a delayed path. You know, my goal was, "I'm going to write my thesis." And that's basically what happened. When I had [name of first child] I was writing my actual dissertation. And so, it actually worked out pretty well because I was up all night. But I was writing, and I used to, you know, the baby wake up, you know, I feed the baby and continue writing. And so, I moved to my post-doctoral training and, you know, [name 01:10:17] was a baby still. But that's where the support of my husband comes into play because without that...so you have to be a team basically. Cause I couldn't do it alone, you know? And so, we basically shared every responsibility. (April)

All of the participants stated they had rigorous and disciplined study habits. Four of the participants shared that their husbands delayed studies and/or work plans to accommodate and support the participants' PhD studies. The majority of the participants (five) shared household chores. Only two participants received help from family members during childbirth; two

received help from close family members or their communities babysitting and/or raising small children. And two of the participants took time off from work at different stages of their PhD studies. Only one of the participants took longer to complete all the required courses and two could not participate in most PhD activities and meetings due to work commitments.

Half of the participants had to delay their dissertations for various reasons like work, research, or the birth of a new baby. Two participants postponed dating and/or getting engaged. Four participants had to balance other major commitments such as competing in a sport as a professional athlete, work as a research associate and/or teaching assistant, and dual majors or PhD/professional degree. In the United States, most domestic female STEM and doctoral health science students leave the scientific fields in what is known as “the leaky pipe syndrome due to imbalance in work and/or study family” (Blickenstaff, 2005; Cannady et al., 2014; Gurski, 2016).

**Inferences for Higher Education.** Both domestic and international female students in STEM PhD and doctoral health sciences face many responsibilities and there is an obvious imbalance between their extraneous research work, difficult courses, teaching and/or research assistantships, and their conflicting roles in the age bracket in which most of them are getting married and/or starting a family. However, this imbalance is aggravated by the lack of family support for international students whose family remained in their country of origin and the financial challenges they face without access to federal student loans and even private loans from a bank in the United States. Furthermore, those who are married may face serious financial burdens when their husbands are their dependents and are not allowed to work in the United States.

STEM departments and health science programs for doctoral students should be well aware of the difficulties these women face. Providing flexible research and work schedules and allowing them to take the minimum number of courses required to maintain their doctoral status and international student visas would be helpful. During pregnancy and while nursing their babies, they should be given the opportunity to teach online if they are teaching assistants, take a leave of absence from their lab work for maternity leave, and/or take on-line courses from home. Postponing or delaying their very demanding dissertation will help ensure they complete their dissertations and graduate.

### ***Resilient Participants***

Those participants who became most resilient were part of a high-risk group that predisposed them to failure, and or experienced unsurmountable obstacles. They did not have the appropriate academic skills or background:

But it turned out that, you know, because I didn't have a Bachelor's in electrical engineering, taking graduate school classes in electrical engineering was extremely challenging and I didn't foresee that. So, there was a lot of learning on my own. And, you know, just kind of having those difficulties. It's hard to achieve, like, overcome that (Ana).

The political and socio-economic circumstances of their home countries dramatically changed, making it impossible to visit:

But it was just so physical just to get in and out of the country that making those decisions became a lot harder because they became really expensive. And then, this uncertainty of, like, knowing if I'll be able to leave or not. Unfortunately, you know, those circumstances made it very difficult for me to make those decisions (Ana)

They had no funding from their department and struggled financially:

Let me tell you about one of the main challenges was funding. So again, I had a great advisor in terms of moral support and really believing in my ideas, but he never fund me for anything. He never had funding and having to TA while getting a PhD is very challenging... And in some ways, it was always uncertain. Like, every year I had to renew my contract, so I will have to figure out ways to fund myself during the summer.

And, you know, so that definitely put a rather strain...and it was just time-consuming.  
(Ana)

Participants also experienced self-doubts:

Doing, like, when things are hard, maybe there's a reason for it. Maybe I don't belong here. Maybe it's just not for me. So, I guess imposture syndrome was also something when things get rough, you question yourself—is this for me? (Ana)

All participants were very resilient in the face of adversity, obstacles, personal conflicts, and/or academic challenges. All participants learned to manage the stressors responsible for their barriers and succeeded in conflict-resolution by self-directed means. All participants reached out and increased social connections. They sought out and obtained advice, treatment, and/or support, learned life skills, sought opportunities for significant participation, and set clear and consistent goals. The great majority, seven out of eight, set clear boundaries.

**Inferences for Higher Education.** Student life, student affairs, student disability services, health clinics, counseling service, international student services, English language centers, writing and tutoring services, library and technology service, and faith-based and religious organizations should reach out to these international STEM PhD and doctoral health science students. This could be done during orientation, student fairs, welcome back to school, and other campus events to ensure these students become very familiar with all the resources available for them and learned to use them and ask for help.

### *Perseverance*

The participants were able to persevere due to personal, social, and institutional factors.

I knew I could do it. I could do it and I knew my husband would be with me and he chose me, and he knew that I could do it. And I think we did it, and when I graduated, I told him, 'This is our degree. Because you helped me.' If I didn't have him, I think that would've been also another situation because doing this by yourself, it really, really, really difficult. So, I have to also say that his support was critical for me from my perspective. He was very understanding of my long days, my long nights in the lab. He made my life so much easier. He would come with me to the lab and even help me

sometimes with my experiments. He has always had a lot confidence on what I can accomplish. Working independently in the lab showed me that I could really be successful in this field. (Luisa)

All participants persisted, succeed, and graduated with their STEM PhD and/or doctoral professional program in the health sciences in the United States. Personally, they were able to persist by means of specific coping mechanisms, supportive husbands, postponing pregnancy or getting help during pregnancy and childbirth, and or raising small children, all of which were imperative for success. Socially, family members or strong systems of support helped participants to persist. University or institutional factors included support from student affairs, libraries, technology, English language centers, financial aid, business office, registrar, international student services, counseling, advising, health clinic helped students persist. Institutional factors included support from faculty, mentors, and academic advisors. STEM PhD departments and doctoral health sciences departments, student life, student affairs, health and counseling services, and supportive services such as faith-based organizations contributed as well.

The relationship that I did with my mentor was I think key for that because I was not afraid of her. I tried to be very strong, you know, in front of her but I have to tell you the truth. I broke up in 2 years a few times in front of her, you know, with different things that happened. So, I don't know. I kind of felt that I don't have anything to hide to her. So, if there was a problem, I would come to her and I'll say, "Hey, for this course, I have this professor. I'm kind of struggling a little bit understanding this. Do you think there's anything that I can do?" And you know, she'll tell me, "Okay, maybe you know, find this different book or just go talk to her." (April)

And it will be a mistake, actually, to think that you're just going to be able to handle all of this on your own. I mean, you need people that can help you with so many little things, you know? (April)



**Inferences for Higher Education.** Specifically, this study aimed to inform universities, faculty, student support staff, and students on the best practices for retention, graduation, and ensuring academic success of this important underrepresented population. Moreover, these international female students STEM PhD and/or doctoral students in the health sciences in the United States are multidimensional in their experiences, identities, and backgrounds. For these complex reasons, they may require very specific interventions or assistance tailored to their very specific needs. The implication for practice and its application will be discussed in detail under recommendations toward the end of this chapter.

### *Transformation*

Participants underwent a process of transformation to create their new Doctoral and scientific identities.

I continued with the job, so from there I jumped to assistant professor. In 2006 when I graduated, they offered her [Her Research Supervisor and boss] a job back in [city] here at this job. And, but she is that kind of professional human being that says, “That’s very good for me as I’m going to give with Dr. [name]’s institute and everything. But she talked with the president of the university, at that time Dr. [name]. And she said, “I will...” I mean, I’m very honored to accept your invitation, but I need my full research team with me. If I can bring all my research team, I say ‘Yes,’ And they agreed. And that’s why we’re here. (Pilar)

I met my partner over there. He was working with NASA at that time. So, and the type of work that he did, it was impossible for him to move to [city], so we stayed in the [city] and I commuted. (Pilar)

Their personal identities changed as well. Even their husbands, partners, or fiancées underwent a personal and professional transformation. Participants learned to change boyfriends, stop dating or break-up long term personal romantic relationships who were not supportive of their academic goals. Even female and close friends who did not share or understand their academic endeavors had to be distanced.

The majority of participants indicated that they became self-reliant. Participants learned to fill the gap between STEM courses, research, and dissertation work by self-directed methods. All reported increased self-esteem and feeling empowered. All participants came to a new and more realistic cultural awareness and appreciation of their host country. All became permanent residents and/or citizens of the United States. Many of their husbands gained that status too.

**Inferences for Higher Education.** Just like parents see their children grow, mature, and become independent, faculty, academic advisors, research supervisors, program directors, and university staff will watch the “transformation” and growth of their students. The international female STEM PhD or doctoral health science students will develop new personal and professional identities. Personally, many will become engaged, marry, and/or become mothers. Others may decide to postpone those roles for later. But all will learn resilience, persistence, and many life skills. They will learn a new language and gain a better and realistic understanding of their host country.

Many will seek career opportunities and decide to remain in the United States, achieving permanent residence status or become American citizens. Others may return to their countries of origin or find a job in the global market. Their professional lives will be shaped by the educational experiences and opportunities received by their departments and universities. Their potential to give back as alumni and new members of their distinguished, selected professions is immense. I cannot think of a more noble profession or endeavor than to proudly shape, mold, and directly be part of ensuring that the future scientists, engineers, mathematicians, and health care professionals of the United States and many other countries are well trained and have strong ethical and moral values. And this mission can be applied to all the other fields and doctoral programs.

## **Literature Connections**

In the Literature Review, I sought to acquire new perspectives and develop a conceptual framework. In that chapter, I identified a gap in the body of literature that deals with international doctoral students. Furthermore, I identified a larger gap in the literature that addresses international female doctoral students. There is a dearth of literature on the experiences of international female students in the STEM PhD or doctoral programs in the health sciences in the United States. This absence of literature propelled my interest.

### ***Participants' Backgrounds and Connections to Literature***

The experiences of the international female STEM and doctoral students in the health sciences in the United States was studied within the context of their culture, gender, and religion. In the Literature Review, I discussed culture. In *Testimonios Connections to Literature* I discussed culture and cultural microaggressions and quoted the participants in this study affected by it. Religion, faith, and spirituality were also discussed in *Literature Connections of Analysis* by Moustakas, and quoted participants in this study. In this section, I discuss gender as all participants in this study are females and the intersectionality of their experiences as STEM PhD and doctoral students in the health sciences in the United States.

### ***Gender—Recruitment of Women to STEM***

Recruiting women to STEM fields has historically been a lengthy and difficult effort (Blackburn, 2017). Failed recruitment endeavors have been attributed to multiple causes (Wang & Degol, 2016), comprising among others: poor elementary classrooms environments (Han, 2016); inadequate academic advising (Lee, 2008); deficient institutional policies (Bottia et al., 2015); and isolating social factors (Cho et al., 2009; Lyon, 2013; Thackeray, 2016).

Conversely, studies show that acquiring a STEM identity since childhood (Bieri Buschor et al., 2014; McCarthy & Berger, 2008), having encouragement and support from families (Burge, 2013; Lee, 2016; Lyon, 2013) access to good mentors and academic advisors (Bruning 2015; Byars-Winston 2014; Bystydzienski et al., 2015 ), contributes to their STEM admissions; retention and success. Also important, participating in gender-inclusive video games and other games, when children like Ana did in this study:

So, I know I really enjoyed playing with Legos and doing things that would challenge me, like astrology set or games that would, like, ask you questions. I really enjoyed the games that challenged me to look at things in different perspectives. So, I think that contributed to my interest in STEM degrees and my sense of discovery I think was something that—the games that I was exposed to through that. (Ana)

According to Bonner (2015), Borghetti (2014), and Gilliam et al. (2017), all of these descriptors are of significance in the selection to follow a STEM career path even before registering in college.

### ***Motivation to Pursue a STEM Career***

In the review of current literature under *Recruitment Women in STEM Motivation to Pursue a STEM Career* is the most common recurring subtheme (Blackburn, 2017). According to Franchetti et al. (2010), this is due to the fact that there are a lot of interested parties inside and outside academia making strong efforts to recruit females to STEM programs. The United States as a nation has an interest in remaining a global leader in science, technology, and innovation (National Science Foundation, 2017). All the STEM and health science programs have vested interests in having a new pool of doctoral students continue with their research and or become faculty members (NASEM, National Academies of Sciences, Engineering and Medicine, 2020); private companies and industries

need highly specialized and trained scientists, mathematicians, and engineers (Bottia et al., 2015).

The findings of contemporary literature revealed that women are driven to enter STEM and health science programs to follow their individual interests and passions (Le & Robbins, 2016). In this study, Akilah and Ana are good examples:

And finally, I got into the program for the Master's in Physics in the United States [graduated] and from there they considered my application for the PhD and then they gave me admission to the PhD. It was always my desire to gain more knowledge. But it was the dream. I mean, it was my passion that was pushing me through. (Akilah)

But I just really felt like civil engineering had a bigger appeal because I really wanted to go outside and being able to see structure, the construction. You know, and things like that. I really liked that about the field. So, I switched from chemical to civil engineering, and then I was reading about smart structures, which is the ability to be the doctor of a bridge was really fascinating to me. So being able to detect the health of a bridge before it collapses, or I could provide maintenance. I thought that was really cool, and that really attracted me to go to grad school. (Ana)

To help others or humankind in general will benefit their countries and communities (Diekman et al., 2015; Diekman et al., 2017; Edzie 2014; Fuselier & Jackson, 2010). In this study, Rose wanted to help humanity by fighting diseases and Tanvi wanted to provide food for the hungry in developing nations. Both displayed such altruism. "My research, I was working as a natural scientist. My research was in artificial intelligence and its application with World Food Program food distribution." (Tanvi)

My motivation, the first day that I went into his office and talked with him about the opportunities, I really wanted to do something, so it helps humanity. You know, it helps to cure the cancer or things like that. (Rose)

And where they can work with different populations as a social service (Su & Rounds, 2015), Mira and Pilar voiced these sentiments:

So, I went to London for a year and got a diploma in community health. To me it was really a very enriching experience because I was participating in that course about 20, maybe people around the world. The only two people from the Americans who are the

two girls that travel—the other work associated traveled with me. We were the only two from the Americas. The others were from Europe and Africa and Nepal. And so, it was something that it was for me amazing. So, I really enjoyed that experience. I came back [to country of origin] after a year and we created the Preventive ... first it was the Community Health Department. So, I was the chief of the Community Health Department at that moment. And then it becomes the Preventative Medicine Department at the institution. (Pilar)

The field of pharmacy was also sort of up and coming at that time. So, this was way back, say, 20 years ago when I was in high school. So, I sort of applied for admission into pharmacy school. And because of my grades and all, I was accepted. (Mira)

### **The STEM Pipelines**

Berryman (1983) first coined the term “the STEM pipeline,” but this nickname explaining the broader picture of STEM recruitment as a succession of longitudinal steps has recently regained power in the literature (Doerschuk et al., 2016). Petersen (2014) suggests that both formal and informal K–12 classroom experiences engaging in STEM activities; building strong self-efficacy [such as participants quoted under Persistence in Literature Connections to Key Findings of Data Analyzed by Moustakas], and access to volunteer and mentor opportunities [such as participants quoted under Support from Academic Advisors, Research Supervisors, Faculty and Mentors in Literature Connections to Key Findings of Data Analyzed by Moustakas], results in an easy and steady flow STEM pipeline.

Preferably, young women become involved with STEM in both elementary and high school. Then, they choose to register as STEM majors in college and universities, attend graduate school, and then flow straight into STEM professions (Blackburn, 2017). This was the case of all participants in this study [for participants’ quotations please refer to Persistence in Literature Connections to Key Findings of Data Analyzed by Moustakas].

### ***The Leaky Pipe Syndrome***

A metaphor utilized quite often to describe the underrepresentation of females in science, technology, engineering, and mathematics (STEM) careers is to suggest a ‘leaky pipeline’ transporting students from high school through university and continuing to a career path in STEM. This pipeline leaks students at numerous phases: students who communicate interest in science professions sometimes change their minds when applying to university or college programs and selected other disciplines of study (Blickenstaff, 2005). Others begin their post-secondary programs in a STEM field but change majors before obtaining a degree. Finally, some students leave the pipeline after graduation and obtaining a STEM degree when they choose another discipline as a profession (Blickenstaff, 2005).

One fascinating aspect of these leaks is that females leak out in greater numbers than males do. The effect of variance in leaking is to form a sex-based filter that removes one sex from the flow and leaves the other to reach the end of the pipeline. No person along the pipeline who holds a position of power has deliberately decided to sieve or remove women out of the STEM flow, but the accumulative effect of many distinct yet associated factors result in the sex underrepresentation of women in STEM currently detected (Blickenstaff, 2005). The STEM pipeline metaphor has been censured (Blackburn, 2017; Cannady et al., 2014; Miller & Wai, 2015) and its correctness doubted (Blackburn, 2017, Ceci et al. 2014). Current studies advocate for focusing the recruitment attempts to specific fields of STEM (Blackburn, 2017; Heilbronner, 2009), specifically in physics, engineering, and technology pipelines because these fields experience the bigger gender gaps (Blackburn, 2017, Lehman et al., 2017; Sax et al., 2016; Su & Rounds, 2015). In this study, Ana Luisa and Mira observed their peers experiencing “the leaky pipe syndrome” for various reasons:

They [other female international students] were on their way to getting their Master’s, you know, their PhDs. And they were paying it out of pocket, but there was a point where

they just couldn't afford it anymore and they left. So, I have friends who, you know, they went back to their own country with two publications, but they didn't get the PhD. So, it's almost like they wasted their time quote unquote to go through all these processes and just not finishing it. It was really heart-breaking to see, but I know that I would have to make that decision, too, if I wouldn't have gotten the funding (Ana).

He [Luisa's Research Supervisor] was very famous in that place for being really hard on the students. So, he had had reporting from a lot of students, but none of them lasted in the lab. And everything was because there was something wrong that he was seeing. He never [admitted] a little bit for anything he did. Worst of all was when I joined the lab, there were like, seven, eight people in his lab. Nobody stayed in his lab; they [PhD students] know his standards and what he did. And it was because of him that they left. (Luisa)

But if I think of a cohort of about 8-10 students, there was just one student who had come for the PhD program but finished as a Master's. Other than that—I don't know. For her situation, I think she became pregnant. You know, she was married. She became pregnant and she kind of left it [the PhD program]. (Mira)

Sometimes it could also be that, you know, people come [from foreign countries to get a STEM PhD] for that but maybe their intention is not really sort of to complete it [STEM PHD]. It's just sort of a gateway to gain an entry here. And as soon as they kind of, maybe they get a master's and they have some kind of a job offer, you know. They say, 'Okay.' The lure of an immediate gain versus, you know, a gain in the future—a higher gain in the future—you know, the former sometimes wins over. (Mira)

### ***Indirect Pathways to STEM***

A substitute to the methodical approach of the STEM pipeline consists of the indirect pathways that students take, which display a vast interest in the literature (Cannady et al., 2014). Wang and Degol (2013) defined this indirect pathway as “the STEM pathway is composed of a series of choices and achievements that commence in childhood and adolescence” (p. 305).

It is not sufficient to foment early curiosity in STEM areas (Seaton, 2011) or make certain young students have a robust confidence in their mathematics skills (Nix et al., 2015; Perez-Felkner et al., 2017) in advance of students contemplating a STEM career path. Colleges and universities must follow up on these students' indirect pathways with unbiased gender enrollment communication efforts (Krome, 2016), appealing to existing and potential STEM



students that they will have every chance to succeed with strong communications supporting diversity and inclusiveness in terms of gender, race, culture, and various socioeconomic classes (Osei-Kofi & Torres. 2015). Considerable financial assistance, educational resources, and inclusiveness in academic and social networks must be readily accessible to help students transition, especially for URM populations (Bystydzienski et al., 2015; Rosa, 2013). In this study, Tanvi received such support to her independent and indirect career path, which helped her have a smooth transition to her PhD STEM program.

I should say motivation did not come from professors—it's just I applied. I got into PhD program. So, there was no mentor or influence in that sense. But study-wise, environment-wise, there were no issues at all. No. Yeah, it was pretty okay, more than okay. So, I may be really a typical student for you or a student subject for you who had a very good education process. I wasn't very maladjusted, or I never felt any gender discrimination or felt any bad environment to be, quite frankly. Again, I may be a very different subject and I don't think I ever experienced what people think about it. It's not that I'm not sensitive and I'm not emotional. In fact, I'm a very emotional person.

I had assistantships throughout. On top of that I had fellowships. And I got out of PhD program I had a job offer and no debt too because I was getting 0.5 FTE and my tuition was all waived. So, I didn't have to pay any tuition throughout the PhD, so it was a free education for me. On top of that I had a stipend and I had fellowships too. It was a very generous stipend. And I had health coverage from the university. (Tanvi)

### **The Gendered Culture of STEM PhD Programs**

Very pertinent to this study is research on the social institutional cultures present in STEM PhD programs in the United States (Cabay et al., 2018), Gunter and Stambach (2005) described university science departments as masculine institutional cultures based on the social and personal interactions typical of masculine standards, located in settings that advocate a “detached” and “rational” approach to knowledge and learning. In this study, April described science as a masculine department: “But unfortunately, you know, science is dominated by men.”

Ana described her civil engineering department, mostly male:

I was gonna be the first woman graduating with a PhD in structures since 40 years ago. They made an article that it's been 30 years since a woman got a PhD at [Name of Public State University] with a structures focus. But some people may say, "Oh, structures is probably the hardest in civil engineering." They don't get a lot of PhDs, particularly women.

Women who enroll in male-dominated STEM fields face constant stereotypes that increased alienation, which may activate fears of negative social assessment due to their gender (Cabay et al., 2018; Good et al., 2012; Kiefer & Sekaquaptewa, 2007; Logel et al., 2009; Smyth & Nosek, 2015; Walton et al., 2015). For female students, university STEM programs are particularly gendered institutions given the great proportion of males in positions of top hierarchy (Britton et al., 2012; Cabay et al., 2018; Fox et al., 2011; White & Ivie, 2013), especially at the doctoral level where a great percentage of female students and faculty drops (White & Ivie, 2013). In this study, Akilah felt alienated: "When I chose my advisor in the PhD program, while I was doing my co-research, I didn't get as much support as I expected. But then when I worked in the lab, no one was there to help me." Luisa also felt alienated by her male research supervisor:

Around the same time, I engaged in a project with another PI that they were collaborating, and it was going pretty well in that lab, but he decided that he didn't want me to continue with that. So, I couldn't do it because it was taking too much time out of his lab. So, he was not fine with that. So, it was very uncomfortable. It was very, very uncomfortable. (Luisa)

Even after having demonstrated high competence as undergraduates, or at the master's level women experience lower academic self-concept and low sense career commitment in male-dominated environments that lack significant mentor support and or are inconsiderate to family responsibilities (Ülkü-Steiner et al. 2000). They perceive others as doubting whether their achievements are due to preferential treatment rather than merit, while attributing their failures to

personal incompetence. Research studies referred to these perceptions of PhD women students in STEM as “the Impostor Syndrome” (Simmons, 2016)

### **The Impostor Syndrome**

In 1971, *Ms. Magazine*, in its inaugural issue, interviewed Matina Horner, a brilliant young professor of psychology from Harvard who narrated her inner nightmare during what are now called qualifying exams:

Look, when I was up for my prelims, I went into a state of anxiety like nothing I’d ever known before. I carried on so I frightened my husband and finally, in desperation, he yelled at me: “For God’s sake, maybe women shouldn’t be in graduate school!” Now, what was I afraid of? I had designed my own prelim; I knew everything I was responsible for. There wasn’t the remotest possibility of failure; and yet, I was shaking, throwing up, screaming I was stupid and now they’d all know I was stupid. (Quoted in Gornick, 1971, p. 52)

Horner spent much of her research career in what she named “the fear of success.” Current literature describes such feelings as “The Imposter Syndrome” and helps to justify the low representation of women in STEM disciplines, administrators in academia, boards of directors in corporations, and leadership in general fields (Simmons, 2016).

According to Chakraverty (2020), highly skilled and knowledgeable achievers who do not feel their own hard work and determination lead to their accomplishments may experience the impostor syndrome or phenomenon. This is characterized by the concept that one has misled others into overcalculating their abilities, not ascribing one’s achievements to their own aptitudes, and living with a constant fear of being exposed as a fraud.

In this study, Ana, the only female in a PhD civil engineering program, experienced this syndrome as well:

And it’s like, so I did, you know, and that also comes with an imposture syndrome. Doing, like, when things are hard, maybe there’s a reason for it. Maybe I don’t belong here. Maybe it’s just not for me. So, I guess imposture syndrome was also something when things get rough, you question yourself—is this for me?

In present times, graduate students pursuing PhD or master's degrees are experiencing mental health issues quite frequently. A quantitative survey across multiple countries and fields (including STEM) revealed that graduate students will experience six times as many mental health issues such as anxiety, depression, and post-traumatic stress compared to the general population (Evans et al., 2018; Simmons, 2016). In this study, Ana experienced such feelings:

So, when you start undermining your own achievements or even if people tell you they're really good, you feel like they're doing it out of pity, or I just got lucky. I got a fellowship, right? It was not because I deserved it but because I got lucky about it. You get to have these different feelings and it's a thing. And you know, you over-work. You know, you have a fear of failure. You know, even if you get an award, you feel like they just gave it to you because they need more minorities [of a specific ethnicity or race]. You know, like, they're trying to fill a quota. If you get a position, like even if you land an academic position, you say, "Oh, it's because they're really trying to get more minority professors." So, it's like, "No. That's not really the case. You work hard. You got your publications. You should be at the table making those decisions. You are." So, this imposture syndrome is something that is very real, especially for minorities.

Females in STEM perceive they are held to higher standards than males (Concannon & Barrow, 2010) and the expectation of being negatively assessed increases their probabilities of leaving the STEM doctoral programs (Beasley & Fischer 2012).

The impostor syndrome (synonyms: impostorism, imposter phenomenon, impostor/imposter syndrome) is a perception about oneself held by a subsection of possibly successful high achievers with lots of merit, who feel their accomplishments were obtained by fraud, by fooling others, and by good fortune instead of their own hard work or proficiencies (Clance, 1985; Clance & Imes, 1978., Simmons, 2016). These mistaken notions of themselves are self-destructive because they are followed by the fear of being exposed as frauds with beliefs of incompetence and being unworthy of the very success, they worked so hard to obtain (Harvey & Katz, 1985; Simmons, 2016). Such perceptions or persuasions lead to failure and low self-efficacy and have gradually become common among master's and PhD students, particularly in

STEM (Chakraverty, 2020; Cohen & McConnell, 2019; Cope-Watson & Betts, 2010; Craddock et al., 2011; Fraenza, 2016; Gibson-Beverly & Schwartz, 2008; Jöstl et al., 2015; Simmons, 2016; Stone et al., 2018).

So, if you fail at an exam, then you're like, obviously, this corroborates the fact that I don't belong here, so I should be doing something else. So that's how I would describe imposture syndrome, especially for STEM fields and people who are under-represented minorities. The inability to internalize the accomplishments, and the persistent fears of being exposed as a fraud. (Ana)

In STEM doctoral study, where the research supervisor's recommendations can be the key to a woman's future, the power imbalance between students and faculty reveals and indicates the existing power hierarchies in doctoral STEM programs and careers in the United States. (Cabay et al., 2018). In this study, Luisa's research supervisor abused his power as her academic advisor, principal investigator, and dissertation chair. He sexually harassed her and then refused to publish Luisa's dissertation as retaliation for her leaving his lab:

I'm a good student, so he could have liked that and so he knew that if I leaved [sic] him he would be by himself. A lot of the data, like, I lost my data. My dissertation hasn't been published. To this day he has not published my dissertation.

### **Literature Connections to Testimonios, Themes, and Key Findings**

In this section, I provide the connections to current literature of the main themes and key findings extracted directly from *Testimonios*.

#### ***Human Capital***

Human capital has been defined in the Oxford Dictionary as “the skills, knowledge, and experience possessed by an individual or population, viewed in terms of their value or cost to an organization or country.” ([https://www.lexico.com/definition/human\\_capital](https://www.lexico.com/definition/human_capital))

While “*Human Capital*” has often been defined and measured with reference to acquired cognitive skills and explicit knowledge, a broader notion of human capital, including attributes, more adequately reflects how various non-cognitive skills and other attributes contribute to well-being and can be influenced and changed by the external environment

including learning. Human capital is developed in specific cultural settings. (OECD, 2001, p.18)

For purposes of this study, human capital has been described as “The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being” (OECD, 2001, p. 18). All participants selected for *Testimonies* in this study sought knowledge and skills in STEM as a form of human capital, for themselves, their families, and their countries of origin. Luisa and Akilah narrated how they first started gaining knowledge and skills in STEM as a form of human capital. From Luisa:

So, I grew up in a small family. In my family, there were my mom and my dad and three kids. So, I’m the youngest. I have a sister and my brother is the oldest. We grew up in a very modest family house. We were all very close and we were always home. And for my dad it was very important that we study. Study for my dad was the major thing that everybody should do. But my dad passed away when...he was very young, and I was only 11 years old. He developed cancer and he passed away very fast.”

“I graduated [with a bachelor’s degree in Biology] and was applying for jobs”. “I stayed working in the same lab I did my thesis, getting paid just enough to cover the transportation. But I did it because I didn’t want to stay home and do nothing.

While I was in college, I had started taking English classes because my sister encouraged me to do so, as it would benefit me if I ever had the opportunity to come to the United States and pursue further studies. So, I continued studying English after I got my college degree.

From Akilah:

And so step-by-step it was a process. But step-by-step it took some time. But then I started, you know, understanding it. There was no reference, nobody in my family to help me if I struggled with something. So, with all this I have to reach out to my teachers. My teachers were so compassionate. I still remember one of my teachers. She didn’t have any kids, so she kind of adopted some of us because with my parent’s permission she took me to her house. And she made breakfast, lunch, dinner, and everything. And then she made me stay with her for some time and then she walked me through all the, you know, the beauty of science and arts and everything. And that was the turning point where I started thinking about it, you know, where should I really focus? And that gave me a really good idea about, you know, I can deal with literature. My literature teachers and my music teacher, everybody just says, ‘You can do this as a side, but you have a future in science as well, so do, you know, find a way. Just do. You know, go forward, and accomplish there. That’ll be really bright.’ And I thought about it, and I’ll be, first person will be me

if I accomplish something in science. And then I have a lot of cousins and everybody in my family. So, I could maybe pave a pathway for them to proceed as well.

The importance of human capital and its role in the economic and social development of individuals and countries has been discussed for many years. In contemporary research, there is an increased interest in studying how social relationships and networks of support and individual or personal attributes play an important role both in economic areas and human welfare (OECD, 2001). Most countries, governments, and societies seek economic development. However, they are also interested in knowing about the impact of the economic growth in social environments. Most countries have serious concerns about inequalities, discrimination, alienation, poverty, and the general quality of life for women, children, the elderly, and all underrepresented groups. Important changes in attitudes and values are currently happening (OECD, 2001).

Becker (1993) was one of the first to use the term human capital. He described education, on-the-job training, and health as the main mechanisms of human capital, with direct effects for earnings and economic growth. The economic importance of knowledge and skills keeps growing while the social impact of learning is equally important as the economic impact. Though human capital has often been defined and measured by precise knowledge and specifically learned cognitive skills, a wider concept of human capital containing attributes satisfactorily reveals how many non-cognitive skills and qualities contribute to one's well-being and can be predisposed by the external environment that comprises learning. Hence, human capital is developed within specific cultural settings (OECD, 2001). Human capital researchers (Becker, 1993; Mincer, 1958; Schultz, 1961) had a profound impact on the formation of educational policies in the United States.

### ***Cultural Dissonance***

For purposes of this study and the previous chapter with *Testimonios*, I use the following definitions in this section:

**Culture.** Culture is a rather complex and difficult term to define. It includes customs, morals, laws, systems of beliefs, arts, and other traits of members of a specific society (Kottak, 2002).

**Cultural Dissonance.** Cultural dissonance is an uncomfortable sense of discord, disharmony, confusion, or conflict experienced by people in the midst of change in their cultural environment. The changes are often unexpected, unexplained, or not understandable due to various types of cultural dynamics (McDonald, 1998).

**Cultural Shock.** Cultural shock is a common reaction from foreign students who are learning a new language and culture. The reaction may involve confusion, irritability, hostility, panic, and estrangement (Furnham & Bochner, 1986).

All the participants pre-selected for *Testimonios* experienced cultural dissonance and cultural shock. Luisa and Akilah shared their experiences with cultural dissonance, as follows:

My husband came to the United States one year later. It became a little hard for him because as a man, it's really difficult to stay home and do nothing and not contribute financially to the household. So, it was getting really difficult to the point of being very close to go back to [country of origin withheld for confidentiality]. He was very close to go back. At that time, I didn't know what was going to happen with us. I told him that I did not know what was going to happen to our marriage because I knew the situation in [country of origin withheld for confidentiality] and there was no warranty that he would get a job. (Luisa)

I was like, you know what? And it was around the same time my husband wanted to go back. I was like, you know what? Maybe this is a sign. Maybe it's just a sign that I shouldn't be in this place. I should go back and I'm just gonna quit. I'm just gonna leave it as it is because it was really hard, you know, with my advisor. He could not, he was not understanding my culture where I came from. And he was getting, he got too personal and at one moment he told me that he was attracted to me. And that changed the whole situation. He was a married guy and he really misunderstood a lot of my behavior and the way how we [Latinas from South America] work. (Luisa)



And it was in 2005 I believe I got married and like a dream come true, then my husband got a job here in [name of city], USA. So, I followed him and accompanied him. (Akilah)

I came here and it took a while, like, 2 to 3 months or something because we were international. (Akilah)

So, to go through a lot of formalities to get the first credit card, and having the first credit card, then you will be accessible. I mean, you will get access to computers and things like that. 'Til then I was dark cause I didn't see any computer or anything in here. So, it was like, so close within four walls of my apartment. Nothing else, just the books and that's it. (Akilah)

And then I started browsing the University's nearby in the labs and the professors who do work similar to my interest. And then I started emailing them. And then [name of University] was the only university I knew at that time. And I found a professor who did research and lasers and nanoparticles, things like that. So, I made an appointment with him and then I went and visited him, talked to him. And then after that I talked to the admin people, like the formalities that I have to go through. (Akilah)

And I knew it was a lot because there was nobody to talk to, nobody to get advice or anything. And finally, I mean, it took a couple of more months for me to go through the formalities and then change my visa from dependent to student. (Akilah)

According to a qualitative study on Native Americans by Bickel and Jensen (2012), *Understanding Cultural Dissonance to Enhance Higher Education Academic Success*, they created an awareness of how the participants in the study used specific cultural and social strategies to advance their educational success and informed their coping mechanisms with cultural dissonance to achieve a new academic identity. A study by Martinez-Taboada et al. (2017) explored the impact of a set of psychosocial variables on the perceived academic achievement of first-generation immigrant adolescents from public secondary schools in northern Spain. Findings revealed that 46% of the variability in foreign students' perceived academic performance was substantiated by home-school cultural dissonance. The authors also explored perceptions of discrimination from teachers, the impact of acculturation orientation to separation, school adjustment, and psychological well-being in academic performance. The

authors concluded that any multicultural education context should consider psychosocial adjustment, due to its influence on academic performance of all students.

Choi et al. (2008) posited that intergenerational cultural dissonance (ICD) is obtained when a conflict occurs between children and their parents over cultural traditions and values. Tyler et al. (2008) posited that cultural dissonance is evidenced by significant differences between cultural value-based behavior exhibited at home country and behaviors observed on the host institution. With a growing population of international students coming to the United States, educators need to be quite prepared to fulfill their needs by becoming culturally responsive. There is no doubt that culture has a tremendous effect on learning, perceptions, and behavior. A culturally responsive faculty can communicate, interact, understand, and improve the STEM learning of international students from various cultures and countries. Thus, culture is an important factor in teaching and learning because learning is a cultural process determined by actions and experiences (Erickson, 2002; Lee et al., 2003; Nasir et al., 2006; Rogoff, 2003).

### ***Discrimination***

Discrimination is defined as different treatment. According to the Cambridge Dictionary, it is defined as “t̄ a person or particular group of people differently, especially in a worse way from the way in which you treat other people, because of their skin color, sex, sexuality, etc.”

(<https://dictionary.cambridge.org/us/dictionary/english/discrimination>)

In phenomenology, the terms *Other* and the *Constitutive Other* identify the other human being, in their differences from the self, as being a cumulative, constituting factor in the self-image of a person; as acknowledgement of being real. Hence, the *Other* is dissimilar to and the opposite of the self, of us, and of the same.

([https://en.wikipedia.org/wiki/Other\\_\(philosophy\)#cite\\_note-Philosophy\\_p.\\_637-1](https://en.wikipedia.org/wiki/Other_(philosophy)#cite_note-Philosophy_p._637-1)). In

phenomenology, the condition and quality of *Otherness*, the characteristics of the *Other*, is the state of being different from and alien to the social identity of a person and to the identity of the self (Miller, 2008).

Discrimination is the act of differentiating between persons based on the groups, or other categories to which they are perceived to belong (<https://en.wikipedia.org/wiki/Discrimination>). People may discriminate on the basis of age, caste, criminal record, color of their skin, disability, ethnicity, family status, gender identity, gender expression, generation, genetic characteristics, height, marital status, nationality, physical appearance, political ideology, profession, race religion, sex, sex characteristics, sexual orientation, social class, personality, and weight, as well as other categories (*“What drives discrimination and how do we stop it?”*. [www.amnesty.org](http://www.amnesty.org). *Amnesty International*)

It involves the group's initial reaction or interaction going on to influence the individual's actual behavior toward the group's leader or the group, restricting members of one group from opportunities or privileges that are available to members of another group, leading to the exclusion of the individual or entities based on illogical or irrational decision making. (Giddens et al., 2009, p. 334)

Dialogues of bias and discrimination tend to emphasize the prejudices and negative perceptions of persons toward members of other groups. As discoursed by Nieto (2004), discrimination implies adverse or damaging behaviors that may result in refusing some groups' life necessities as well as the rights, privileges, and opportunities enjoyed by other groups. Discrimination is usually based on prejudice—that is, the attitudes and viewpoints of individuals about certain groups (Hanassab, 2006; Nieto, 2004).

Akilah and Luisa corroborate this sentiment when they shared their negative experiences with their respective research supervisors:

And then being an international student, my advisor used to tell me always that as an international student, I need to put at least three times the work that a domestic student

does. And he always had, you know, kind of shown the partiality as well. Cause he never asked the students from here to work on Saturdays and Sundays. But he asked me to come on Saturdays and Sundays, telling me that if I don't do it, I won't graduate. And at that time, I never kind of took it personally because I thought, 'Maybe he is correct.' Yeah, I used to come on weekends, but I noticed that students from here, they never came on weekends. And it actually gave me a quiet atmosphere to come into the lab. It's all mine, and you know, find peace and work on it. So, I took it positive. (Akilah)

At the time that all this happened, a lot of his students had left the building. So, there were only two other people in the lab, maybe one or two that would come in the lab. So, I felt like, you know? I'm not gonna go talk to him every single day. So, I went, and I talked to him as I felt it was necessary, which he didn't like at all. Sometimes he was saying that I was insubordinate, that I was not listening, and I wasn't being a good servant because I didn't want to connect with him at the professional level. That I was not engaged, that I didn't want to engage with the conversation, with the small group conversation. So, it was very, very, very difficult. But I would just stand and do my work that Monday through Friday. He was not happy with that. So, anyway I tried, he would just go with my...use my own guidance. I didn't even have to go and ask and tell him that I'm going to go to the lab to measure water. I feel like there's no need for that. (Luisa)

Negative experiences and interactions with domestic students have been proven to have a negative effect in the emotional well-being of international students (Hanassab, 2006, Paige, 1990; Schram & Lauver, 1988). Furthermore, the stereotypes that domestic students have regarding international students may cause negative consequences for intercultural and international relationships (Hanassab, 2006; Spencer-Rodgers, 2001).

Akilah experienced discrimination from her domestic female senior lab mate as explained below:

And there were a lot of discriminations from my senior lab mates, my female doctoral students. They were not supportive. They were not helping me learn anything which they learned before me. So even though I have to work on the same equipment, it's like a day-long experiment sometimes and it's in the dark laser room because when laser works you have to shut down all other lights.

So yeah, I forgot to tell you. My PhD was on nanoparticles, characterizing those nanoparticles using lasers. So different types of lasers. When a laser was on, you have to shut down all other lights. So, it's dark and it's that full lab, total dark. So, you really have to get used to that to identify, you know, each and every stuff there, so you don't fall on anything, you don't disturb the optics in there.

So usually you work as a team. But then when I worked in the lab, no one was there to help me. And so, I had to figure it out, everything by myself, and my advisor at that time, cause he's - I'm not blaming him. He's so used to the senior people because they were there even before me. So, whatever they tell him, he kind of believed it and so I had to prove it to him.

In a progressively diverse educational environment, faculty and students must identify cultural and nationality differences to encourage effective communications (Wang & Degol, 2016). An important challenge for every university in the United States is to educate its diverse student population so that they are multiculturally competent and can productively perform in America's pluralistic society (Rong & Brown, 2001).

Hanassab's (2006) quantitative study assessed the experiences of international students in terms of perceived discrimination since entering the University of California in Los Angeles in the United States. Results indicated that 21% of students from Southeast Asia experienced discrimination in their rapport with faculty. Asians (16%) experienced discrimination by faculty; 19% felt discriminated against by university staff; and 21% felt discriminated against by their domestic peers. Six percent of Latinos from the Americas felt they were discriminated against by faculty; 11% felt discriminated against when interacting with university staff; and 21% felt discriminated against by their domestic classmates. The results also indicated that international students experienced more discrimination off campus compared to discrimination on campus. Of the total number of students who participated in the study, 42% were in STEM and 52% were doctoral students. In a quantitative study of 190 students from Latin America and Asia studying in the United States, Wilton and Constantine (2003) assessed the acculturative factors correlated to adjustment. The authors found that due to cultural factors and language, Latin American and Asian students had greater levels of stress than other international students.

Lee and Rice (2007) conducted a qualitative study on the experiences of international students at a research university in the southwestern United States. Their sample consisted of 24 students from 15 different countries. The authors focused on difficulties the students experienced that ranged from perceptions of discrimination, unequal treatment, and poor hospitality to cultural intolerance and confrontation. The authors' findings revealed that a range of international student problems suggest neo-racism as a cause. These difficulties occurred in interactions with faculty and administration, campus social interactions, denial of funding or job opportunities, and in off-campus interactions such as housing and shopping. The international students from Asia, India, Latin America, and the Middle East reported considerable discrimination while students from Europe, Canada, and New Zealand did not report any direct negative experiences related to their race or culture (Lee & Rice, 2007).

### ***Sexual Harassment***

The Equal Employment Opportunity Commission's definition of sexual harassment

([https://www.eeoc.gov/laws/types/sexual\\_harassment.cfm](https://www.eeoc.gov/laws/types/sexual_harassment.cfm)):

Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment when this conduct explicitly or implicitly affects an individual's employment, unreasonably interferes with an individual's work performance, or creates an intimidating, hostile, or offensive work environment.

Sexual harassment is a specific form of gender discrimination (Berdahl, 2007b).

According to Johnson et al., as cited in NASEM (2018):

There are three categories of sexually harassing behavior: (1) gender harassment (verbal and nonverbal behaviors that convey hostility, objectification, exclusion, or second-class status about members of one gender), (2) unwanted sexual attention (verbal or physical unwelcome sexual advances, which can include assault), and (3) sexual coercion (when favorable professional or educational treatment is conditioned on sexual activity).

One of the participants, Luisa, provided her *testimonio* of detailed sexual harassment.

Like, I know my marriage is not being compromised because I didn't have any feelings. But it was like, 'You have a family.' Cause he would bring his sons to the school cause their school was across the street from this place. So, after school they will come and stay with him until it was time for him to go home. 'You have a family, and this is that.' So, he wrote me a letter apologizing what he had done. He said that his feelings should not interfere with my dream, that I was very smart, very brilliant person.' Because that's another thing that he said. He was not physical. He was like, 'You are so, smart. You're one of the smartest person that I've ever met and it's kind of impossible to have people that are smart and that, of course, they always brought up the physical thing, that you are so, pretty. You're this and you're Latina.' And then he started talking, at the time I didn't feel it so, inappropriate, but then I realized like, 'Yeah, he was inappropriate.' Like, everything he will say, it had, like, a sexual context. Like, [gasps], 'Your sexy long hair.' You know, like, we all have long hair in my family in our country, so, he misinterpreted all of that wrong. Like, I was doing it on purpose. I'm like, this is how we are [in my Latina culture and South American country of origin]. This is what we do.

She was subjected to (a) gender harassment (verbal and nonverbal behaviors that convey hostility, objectification, exclusion, or second-class status about members of one gender) quoted under discrimination, and (b) unwanted sexual attention (verbal or physical unwelcome sexual advances). Harassing behavior can be either direct (targeted at an individual) or ambient (a general level of sexual harassment in an environment). (Sexual Harassment Definition. The Equal Employment Opportunity Commission (USEEOC n.d.a.), [https://www.eeoc.gov/laws/types/sexual\\_harassment.cfm](https://www.eeoc.gov/laws/types/sexual_harassment.cfm).) Sexual harassment is both a legal expression and a psychological concept that describes a wide variety of behaviors. Legally, sexual harassment is a form of gender discrimination illegal under Title VII of the Civil Rights Act of 1964 (U.S. Equal Employment Opportunity Commission Website, [https://www.eeoc.gov/laws/types/sexual\\_harassment.cfm](https://www.eeoc.gov/laws/types/sexual_harassment.cfm).)

Sexual harassment breaks the law when it produces a hostile environment. Harsh and persistent gender harassment or unwanted sexual attention enough to change adversarily the circumstances of employment, interfere with work performance, or obstruct a student's capability to get an education or when it is deliberate quid pro quo sexual harassment (when

favorable professional or educational treatment is conditional on sexual participation) is considered illegal under Title VII of the Civil Rights Act of 1964 (U.S. Equal Employment Opportunity Commission Website, [https://www.eeoc.gov/laws/types/sexual\\_harassment.cfm](https://www.eeoc.gov/laws/types/sexual_harassment.cfm).)

As evidenced by Luisa's *Testimonio* included below, the sexual harassment Luisa experienced was against the law, because it obstructed her ability to get a STEM PhD in neurobiology in the United States as an international student.

But I think that it was a little bit too much. It was too much interaction. It was endless hours with him in his office. Sometimes my husband would come to pick me up, to see what was going on and he would see my husband, he never cared. Like, sometimes he looked surprised, like, what is he doing here? But he never said anything. And he didn't ask, like, 'Oh, I have to go now because my husband is here. It's getting late. I think we can continue tomorrow.

'Like, then he would always say, 'Okay, well, if you don't want to finish this presentation. You don't want to complete this thesis. It seems like you don't care.' So, it was very difficult. It was very difficult and, but it was, I guess it was, yeah, a few moments in which I thought that I could not do it anymore. So, I was ready to quit. I was ready to go back home.

But at the same time, it was the fear. One of the things that helped me and that made me stay there is there were not ability that I had, that I spared at the moment. Cause as an international student, I have a visa and I only had a visa as long as I had an advisor and an opportunity to work. If I lose that, I lose my visa. I lose everything. So, what am I going to do?

Furthermore, sexual assault on the job, in the lab, at a university, or on campus is deemed a criminal act. Sexual harassment diminishes women's professional educational achievement and contributes to severe emotional and physical health problems. When females experience sexual harassment in the workplace, research lab, or classroom, the consequences include a drop in job/research or teaching satisfaction; withdrawal from their organization (i.e., distancing themselves from their work, lab, research, studies either physically or emotionally without essentially quitting); having thoughts or intentions of leaving their job, research or lab, teaching; and eventually leaving their research lab, job or teaching (NASEM, 2018).



There is a decrease in organizational commitment (i.e., feeling disenchanting or upset at the university). There may be a rise in stress related to job and/or studies and drops in performance or productivity. When students experience sexual harassment, the educational outcomes include decreased motivation, low attendance in classes, dropping courses, inability to concentrate; lack of attention in class, receiving lower grades, changing advisors, changing majors, transferring to another department or university, and/or dropping out or leaving their field of studies for good (NASEM, 2018).

When sexual harassment takes place in research environments, it can weaken core values of research integrity and ethics. The collective effect of sexual harassment is substantial damage to research integrity and a costly loss of talent in academic sciences, technology engineering, and medicine (STEM) (NASEM, 2018).

Four reasons increase the probability that women in academic sciences, engineering, and medicine will be victims of sexual harassment (NASEM, 2018):

1. Male-dominated work environments.
2. Hierarchies that converge all the power to research supervisors and make doctoral students, junior faculty, and others dependent on them for funding, research guidance, mentorship, and career development.
3. Symbolic legal compliance, policies, and procedures that are ineffective at preventing or stopping sexual harassment.
4. Unaccountable and not transparent leadership at all levels lacking intention, and/or goals needed to take the necessary actions or discipline to reduce and prevent sexual harassment.

The following text illustrates how sexual harassment affected Luisa physically and emotionally. She experienced high stress and depression in her research lab. Her graduation was delayed and her research papers and dissertation to this day have not been published as a form of possible retaliation for leaving her research lab and not giving in to the sexual advances of her research supervisor.

So, it was very intrusive, and I just got used to it and I think I was in depression. I got depressed but I didn't seek counseling. I didn't want to get up. In the morning, it was really hard. I didn't want to go to the lab. I know I had my studying to do. Every time I needed to go to him, my stomach hurt. Like, I said that I need to be picked up at this time and I needed to just go. Because with him it was very unpredictable because some days, we could have a good, like, professional talk, but some days he would be a whole mess and he would start screaming. And he didn't disguise his behavior very well. So, no matter what he did that was flawed, he was always unpredictable.

And he didn't have time because I just want to be what it needs to be. I know that you're capable to do anymore from just talking to you. So, I just want you to be regular. So, I just want you to be stronger. So, I just want you to come out of the shell. Because I'm very shy. I mean, I'm very shy with everything. I learned to come out of my shell a little bit just to protect myself a little. That's why I did show him a lot of my emotions. I cried a lot. Sometimes I try not to cry in front of him. But there were sometimes when he would be just really hard with me. And I felt he was just making me feel bad that he was supposed to go at this time with me just because he knows that I was a very brilliant student. And he knows that I was a very shy person, but that I was not appreciated above that.

A study by LaCosse et al. (2016) proved that women who simply witnessed the negative treatment of other women in a STEM setting also experienced diminished STEM outcomes.

Luisa narrated in her *Testimonio* how she was afraid to report her research supervisor for sexual harassment because he never took responsibility for harsh treatment against other female PhD students in the research lab. Likewise, the other female students witnessed the sexual harassment against Luisa during a conference and decided to leave the PhD program with just a master's degree.

### ***Gender, Cultural and Class Microaggressions***

Pierce (1970), as cited in Pierce et al. (1978), first coined the term “microaggressions” in his research with African Americans. Pierce defined microaggressions as “subtle, stunning, often automatic, and nonverbal exchanges which are ‘put downs’” (p. 66). While Pierce’s theories concentrated specifically on racial microaggressions, it is evident that microaggressions can be expressed toward any alienated group in society. They can be gender - based, class -based, sexual orientation– based, or disability- based (Sue & Capodilupo, 2008).

Microaggressions were also defined as “subtle insults (verbal, nonverbal, and/or visual) directed toward people of color, often automatically or unconsciously” (Solórzano et al., 2000). Sue (2010) posited: “Simply stated, microaggressions are brief, everyday exchanges that send denigrating messages to certain individuals because of their group membership” (Preface, XV1). It is a common term that appears repeatedly in the current review of literature on subtle common forms of biases (Sue, 2010). There are many manifestations of microaggressions. The three participants preselected for *Testimonios* gave clear examples of gender, cultural, and class microaggressions within the context of STEM PhD studies as international female doctoral students. Current social psychological research shows that at the present time, these stereotypes and biases seemed to be implicit, expressed subtly in the things that people say and do in everyday life (Nosek et al., 2002; Sekaquaptewa et al., 2019).

**Gender Microaggressions in STEM.** In STEM fields, males feel welcomed and appreciated while females are at risk of leaving these fields. Due to the fact that gender biases are common in many STEM environments, it is possible that students in these fields both experience and witness gender-based microaggressions (Ong et al., 2011; Sekaquaptewa et al., 2019); Settles et al., 2006; Williams et al., 2014). Research studies have shown that in many STEM

environments, certain signals can activate stereotypes. These signals produce an underrepresentation of females (Sekaquaptewa et al., 2019); the frequency of masculine objects in the environment (Cheryan et al., 2009; Sekaquaptewa et al., 2019); and the incidence of microaggressions. Once activated by such signals, these negative stereotypes may set in motion the processes that produce a negative effect on women's STEM outcomes and goals, as demonstrated by stereotype threat research (e.g., Spencer et al., 1999; Sekaquaptewa et al., 2019).

The following excerpts of April's *Testimonios* point to having experienced gender microaggressions from males in STEM PhD and beyond.

I don't know why. But unfortunately, you know, science is dominated by men.

So, you know, you kind of get used to that. In meetings you're going to be lucky if there's another female in the committee or...

Some of them [males] were cold towards females. Yeah, there's always men that in every aspect on every step during my post-doctorate, when I was doing my PhD studies and during my post-doctoral training I was in contact and I had some male students, professional faculty that yeah, they have big ego. They are negative or aggressive towards females. Males that they think that on top of the world, that they're always right. But you know, I never let that bother me because I know even from talking to my mentor that that was the environment in science.

So, I was kind of like, prepared for it. And even with talking to other students, you know, they'll say, "Oh, such and such..." You know, he thinks he's great so be ready, you know, because he may be asking you a bunch of questions or something. That's just the way he is. You know, he thinks he's always better than everybody else. So, I actually, you know, listen to that and I made the effort to come very well prepared that whoever will be throwing questions at me, that I was able to answer them appropriately. So that was kind of my approach to it knowing that we would always have personalities like this in this business.

**Cultural Microaggressions.** *Cultural racism* is an umbrella term under which both individual and institutional racism thrive. It is comprised of a worldview that includes an authoritative belief: the superiority of one group's cultural customs over another's (Sue, 2010).

There is a collective appreciation of superiority in White Western European systems of beliefs that contains elements of “entitlement” and “being chosen” (Sue, 2004). Individualism is perceived as more desirable than collectivism. The Protestant work ethic, capitalism, Christianity, use of the English language, written traditions, and European physical features (blond hair, blue eyes, and fair skin) are perceived as the ideal norm (Katz, 1985; Sue & Sue, 2008; Sue, 2010). Individuals or groups that follow these beliefs/values and/or have such physical features are permitted easier access to the recompenses of society (Sue, 2010).

Such systems of beliefs have an additional harmful effect. For example, chronological allusions to “taming the West,” “rugged individualism,” converting “heathens,” “helping other groups accept a single- god concept,” and bringing a Western way of life to “less developed “ and “primitive” and “uncivilized” cultures all speak to converting to superiority—the subservience of other groups, cultures, and countries (Hanna et al., 2000; Sue, 2010).

In the text below, Luisa explained how she experienced cultural microaggressions from her research supervisor who viewed her from his male Western stereotypes. Some of his cultural microaggressions also led to his sexual harassment of Luisa.

So, when he knew that I was married, I thought he was kind of joking but the more I thought about it, I’m like, ‘He was kind of upset.’ I was like, I don’t understand why. Like, there was no, like, ‘Why didn’t you tell me?’ I’m like, ‘Because you never asked. There was never an opportunity for us to talk about it.’ Like, and it’s my personal life. Nobody needs to know it. ‘Well, but there is no cue that you’re married. You’re young. You’re pretty. You’re this. And you don’t have a wedding ring.’ I’m like, ‘I do have a wedding ring. This is my wedding ring.’ And he was married, and he never wore a wedding ring. So, why? I didn’t know.

Because I know on my writing skills were not the best at the time, so he didn’t like anything I wrote. But then so he had a student next to him talking about what I was doing just to make sure that I did know what I was doing. And then he would write it. Like, this is not working. I don’t like, I guess you need to learn how...I was right and I’m telling you, my writing skills are not bad. If you’re bad, I think he needs to see you for if you need to be in his office with this.

Physical traits such as dark skin, black hair, and brown eyes; religious faiths such as non-Christian religions (Islam, Hindu, Confucianism, etc.), represent time orientation, collectivism, the importance of shared wealth, and linguistic characteristics such as bilingualism, non-standard English, speaking with an accent, use of nonverbal communications, and reliance on the oral traditions are usually seen as less desirable by society (Sue, 2010; Sue & Sue, 2008).

***Alienation.*** “Social alienation is a more broad concept used by sociologists to describe the experience of individuals or groups that feel disconnected from the values, norms, practices, and social relations of their community or society for a variety of social structural reasons, including and in addition to the economy” (Crossman, 2020). The acceptance of the cultural [and/or racial] reality of White America can result in an intense feeling of alienation or cultural and social isolation (Sue, 2010, p. 149).

The alienation can be widespread, such as being (1) detached from one’s personal identity (not knowing who one is as a racial/cultural being) and taking on the definition of yourself from the oppressor; (2) estranged from your own family, friends, and group; (3) isolated from other groups; (4) disaffected by one’s own language, history, and culture; and (5) separated from one’s humanity.

A study by Camacho and Lord (2011) in engineering focused on the climate for Asian, Latina, and White women and recorded multiple microaggressions experienced by the Asian and Latina engineering female students as opposed to the White students who reported experiencing very few microaggressions. Females of all races still remain severely underrepresented in engineering and may be considered socially alienated. The cultural microaggressions occurred at numerous levels: interpersonal, institutional, and as jokes or humor that subtly ridicule women’s place in engineering.

Trenor et al. (2007) researched the relation of ethnicity to female students perceptions and intention to major in engineering. Findings suggested a substantial variance in the manner in

which participants from different ethnic groups perceived the field of engineering. Furthermore, substantial variance in perceived social supports for achieving their engineering, educational, and career goals were found based on the number of generations in a participant 's family born or residing in the United States and enrolled in engineering in the United States.

***Microaggressions Against Asians.*** There is great diversity among Asian internationals and Asian Americans in the United States. These include larger Asian groups (Chinese, Asian Indians, Filipinos, Koreans, and Japanese); refugees and immigrants from Southeast Asia (Cambodians, Vietnamese, Laotians, and Hmongs), and Pacific Islanders (Hawaiians, Cambodians, and Guamanians). Yet, in spite of this diversity, White Americans continue to fail to differentiate between Asians and Asian American groups and often treat them as if there were no differences at all (Sue & Sue, 2008). As a result, there are common racial suppositions and beliefs in the White Western worldview of nearly all Asians and Asian Americans. Two are particularly influential in the display of racial microaggressions toward Asians: (1) negative stereotypes of Asians as foreigners and (2) positive stereotypes of them as a successful minority group.

First, the persecution of Wen Ho Lee (2001) as narrated and cited by Sue et al. (2007) is an example of how the majority of citizens in the United States perceive Asians and Asian-Americans: Asians are not to be trusted and are possibly disloyal. Second, and likewise convincing but opposite belief about Asians in America, is that they are an extremely successful minority who has "greatly achieved" in society (Sue & Sue, 2008). They are often referred to as "model minorities." Terms such as "intelligent," "disciplined," "hardworking," and "enterprising" are often used to describe Asian Americans (Morrissey, 1997; Sue, 2010). The achievement legend also adds to a belief that unlike other groups of color, Asian and

Asian/Pacific immigrants have not suffered from discrimination or racism; thus, they should not be considered an oppressed minority group (Sue & Sue, 2008). Those beliefs deny the historical and continuing racism inflicted upon Asians in the United States.

In general, when Americans refer to Asians, these are some of the stereotypes that come to mind: deficient English skills; spies; devious; back-stabbers; disloyal; penny-pinching; less than human; model minority; smart; hardworking; compliant; studious; quiet; good in math, technology and science; wealthy; passive; poor leaders; interpersonally non-social; men are unassertive and un-masculine/sexually unattractive; women are submissive, domestic, exotic, and sexually pleasing (Sue, 2003). All of these stereotypes are reflected in racial microaggressions directed against Asians in the United States: attribution of intelligence, denial of racial identity, eroticization of Asian women, invalidation of interethnic dissimilarities, demotion of cultural values/communication styles, assignment of second - class citizens, and unnoticed (Sue & Sue, 2008).

In the following excerpts, Akilah gives evidence of the racial and cultural microaggressions she experienced as an Asian from her fellow domestic senior female lab co-researchers who alienated her and refused to work with her in the research lab and possible recommendations, she gives on how she dealt with it and counseling she feels should be available for all female international students, particularly Asians.

[Regarding fellow female senior lab partners who discriminated against her refusing to work with her] And you will not be able to convince them always about your visions, your dreams, your insights. So, silence helped me a lot. Smile helped me a lot. Coffee helped me a lot. I don't know if I prayed, but I had the belief in my mind that things were gonna be okay, if not today for sure, for tomorrow.

And I honestly, I even talked to—cause one of my friends in the teaching and learning scholarship program, he was doing his PhD in counseling. So, through him, I talked to the counselors and found out that there were a lot of resources that can help me, advise me to make things right. Sometimes it could be me. That way that I think could be



not the way it's supposed to be. So, they helped me to kind of clear the fog I should say and forget about what happened, but find a way how you're gonna live your life today. Especially if you come from a different country, you will always have this feeling that whoever goes to counseling, they have one nut loose or something. You know, they have some psychological issues and that. But everybody has psychological issues, but they don't want to disclose it. For me it's really helped, and for me and my personality, I wanted to talk about it—not to everybody, but at least to somebody so that I will feel better. I might not be looking for their opinion in it, but I wanted somebody to listen. So that is always helpful. So, yeah.

I was wondering, or I was thinking maybe it would be a good idea to have like a uniform or general procedure that all students will be treated the same irrespective of where they come from or what their culture is. But if somebody knows, like say for example, an advisor knows what the student's cultural background is, then there could be some biasing. And I don't want that to happen because it won't help anybody to pursue their pathways of success. So, it would be a good idea to have common regulatory rules or something. And also, to make sure that the university follows or somebody to follow through that each and every student is being treated the same.

Yeah, you know, instead of just going to graduate school office if they have any issues, but if the graduate school office volunteers to come forward and check, especially the PhD students. They go through a lot of stress and they're deciding to survive the grad school is a lot of stress. You know that, especially when they come from a different country and they have no family here or they have no close relatives within the short span of time. So, it would be really important to make sure that they are at peace so that they can do their best completing their PhD.

### ***Psychological and Physical Health Consequences of Microaggressions Against Asians.***

There is a dearth of research on the consequences of racism and microaggressions on Asians as compared to African Americans (Hwang & Goto, 2008; Sue, 2010). Clinical trials, narratives, and a few studies show that Asians and Asian Americans do suffer extremely from the discrimination and prejudice they are subjected to (Inman & Yeh, 2007; Mio et al., 2007; Sue, 2010; Yoo & Lee, 2008). Research studies on the effects of racism in Asian undergraduate students revealed that racism-related stress has correlations with low self-esteem and interpersonal and career difficulties (Liang & Fassinger, 2008; Sue, 2010; Zane & Song, 2007). The authors think that low-self-esteem is a direct effect of microaggressions, which lowers the self-worth of Asians, making them feel inferior and “lose face” or feel ashamed. Increased hypervigilance and mistrust in others result in less interpersonal relations and diminished

socialization. Low self-esteem decreases their confidence, and they start to doubt if they can achieve their academic goals, producing negative career development implications. Racism-related stress in Asians and Asian Americans in the United States has been linked to anxiety, depression, and psychological distress (Barry & Grillo, 2003; Contrada et al., 2001; Hwang & Goto, 2008; Noh & Caspar, 2003), social competence (Zane & Song, 2007), psychological well-being (Kim, 2002), and feelings of alienation, disparagement, anger, rage, and frustration (Sue & Sue, 2008).

*Microaggressions Against Latinas and Hispanics.* Latinas and Latinos comprise approximately 18% of the United States population and are among the fastest growing minority group in the United States. They have surpassed African Americans as the largest racial/ethnic group and represent heritages from Mexico, Puerto Rico, Cuba, El Salvador, the Dominican Republic, and many other countries in Central and South America (Noe-Bustamante et al., 2020; Sue & Sue, 2008; U.S. Census Bureau, 2019). “Latina/o” is an ethnic designator, not a racial one. Thus, Latinas/os may come from any race. They are, however, grouped together by one common trait: their first language is Spanish. Compared to the general population, Latinas/os are relatively younger, have higher fertility rates, and are among the least educated in the U.S. population (Casas et al., 2002).

Latinas/os experience extensive discrimination and prejudice (Brodie, et al., 2002). As a group, they reported levels of perceived discrimination equal or larger than African Americans and much higher than reports of whites (Moradi & Risco, 2006). They experience great poverty, large numbers are unemployed, most have semiskilled or unskilled jobs, and they suffer many more health problems when compared to the general population including obesity, diabetes, tuberculosis, AIDS, and heart disease (Sue & Sue, 2008).

These are some of the stereotypes that, in general, the American people have assigned to Latinas/os: limited English, uneducated, ignorant, illegal aliens, foreigners, drug lords, drug dealers, farm workers, poor, welfare recipients, tax avoiders, domestic workers, unskilled, criminals, dangerous, untrustworthy, irresponsible, lazy, not punctual, carefree, and overly religious (Sue, 2003). All of these stereotypes are consistent with findings on microaggressions for Latinas/os: attribution of intelligence, assignment of second-class citizens, demotion of communication style/cultural values, speech characteristics, aliens, criminality, erotization of women, submission of women, “machismo” and over-aggression of men, and invalidation of Latina/o experience (Rivera et al., 2010).

Yeah. It made me stronger in a way. Sometimes I also think I’m too weak because oftentimes I get emotional when I think about it, when I talk about it because it was hard. But it made me tough in a way and it opened my eyes. I mean, [how sexual harassment is very real]. Because I see here, just how harassment is very, very common. It’s very hard and very common towards the Latina population just because of the nature, the way how we are if the American males don’t understand it [The International Latinas culture].

***Psychological and Physical Microaggressions on Latinas.*** There is also a dearth of research on the psychological and physical health manifestations of microaggressions on Latinas, just like for Asians. While a solid case argument can be stated that real or perceived discrimination may be the origin of many health ailments, a direct causal effect has yet to be found. However, it has been demonstrated that perceived discrimination is associated with many medical illnesses, such as higher blood pressure among Mexican Americans (Sue, 2010). Perceived discrimination does seem to be associated with anxiety, depression, psychological distress, and higher levels of stress (Sue, 2010). Moradi and Risco (2006) found that the variable of perceived discrimination by Latinas has a negative correlation for their well-being and personal efficacy.

*Class Microaggressions.* Social inequality happens when resources within a specific society are distributed unfairly, typically through standards of allocation that bring about specific patterns of socially defined categories of persons. It is the uneven access of social goods in society brought about by gender, age, race, religion, ethnicity, power, kinship, prestige, sexual orientation, and class. Social inequality usually refers to the lack of equality of outcome but may alternatively be conceptualized in terms of the lack of equality of access to opportunities (Caves, 2004). Socioeconomic status (SES) is defined and demarcated impartially by a person's income, education, and profession or job (Santiago et al., 2013). Social class has been discussed in economics, political science, and philosophy for centuries in the societies of many of great civilizations. This chapter discusses it as a cultural and social phenomenon experienced by international female doctoral STEM and health science students in the United States (Gabrenya, 2013).

Thus, "social class" is a subjective term that encompasses SES, as well as attitudes, values, behaviors, and beliefs, based on experiences within one's social class group affiliation(s) (Cook, 2017; Kraus et al., 2012; Smith, 2006).

*Classism.* According to Gabrenya (2013),

We are all of and in a social class. We are of the class that our parents occupy, born into it just as we were born into a nation and thrown into its culture. We don't deserve our class (or national) ascribed status, regardless of what it is (in contrast to cultures that believe in reincarnation). We are in the class that we rose to or fell to as adults, although this achieved class standing may be more expectational than realized prior to completing our educations. When we discuss class (just as when we discuss culture), we are speaking from the perspectives of our own class affiliations. (p. 1)

Classism includes biases, discrimination, prejudice, and/or oppression toward a person or group based on their social class or SES (Cook, 2017; Smith, 2006). Liu (2011) detected four forms of classism: downward, upward, lateral, and internalized. In this study and chapter, I

focused on downward classism. Downward classism happens when people of higher social class groups (i.e., MSC or HSC) explicitly or implicitly discriminate against, oppress, or marginalize persons whom they believe are LSC (Liu, 2011; Cook, 2017).

According to Gabrenya (2013), America is, in general, an anti-class society that believes all people are equal, realizing they are not; despises inherited wealth and European royalty, yet is fascinated by the “lifestyles of the rich and famous;” resents the elite’s power and privilege, yet seeks to have such power and privilege. American society is, at the same time, open, fair, and mobile; yet closed, unfair, and established. Anyone can become rich or powerful; yet few actually rise quickly to the top of the economic ladder from modest beginnings. In the end, class is all about power. Social Class is determined by social strata; “Stratification describes the differential arrangement of persons or positions within a society” (Ryan, 2005, p. 798). The division of societies into different strata creates unequal resources to opportunities and wealth. Hence, social stratification produces social inequalities (Schaefer, 2016). “Differences in social resources produce inequality of condition; that is, differences in people’s actual living standards or life conditions” (Marger, 2014, p. 25).

Social class designations, then, group persons based on their accumulation of and access to valued resources. There are many schemas (Thompson & Hickey, 2005; Warner et al., 1960), each one with specific benefits and limitations (Cook, 2017). For the purpose of this study and chapter, the social class designations used were low social class (LSC), middle social class (MSC), and high social class (HSC), which are a modified schema based on the categorizations established by Warner et al. (1960).

Class-denying statements or actions (e.g., “class does not matter”, or the “US is a ‘classless’ society”) are examples of social class-based microaggressions (Cook, 2017). Other

social class microaggressions can force people who are in poverty to be perceived as invisible (e.g., relocation of people who are homeless to another town) and can include belief systems that place blame on people of LSC (e.g., people are poor because they do not work hard enough) (Cook, 2017). Social class microaggressions can be based on social class bias as well as classism. Examples of social class microaggressions for international females in STEM can include forcing the international female student to work long hours, nights, weekends, and summers without paying over-time as research assistants; or offering these students domestic jobs in their homes such as babysitting, mowing the lawn, taking care of pets, and cleaning their houses, instead of advocating on their behalf to have access to research or teaching assistant jobs or applying for grants to include them. Individuals may not be aware of these biases; however, they can send messages that put down non-dominant groups' (i.e., LSC groups) experiences, beliefs, and values (Sue, 2010). Social class bias is distinguished from classism in this chapter to highlight the unfamiliarity which can enclose social class and result in social class microaggressions (Cook, 2017).

In the excerpts of transcripts provided below, 3 participants (Akilah, April, and Luisa) explained their financial struggles which contributed to several class microaggressions. Akilah suffered class microaggressions from her senior domestic female research lab partners and her research supervisor. Luisa experienced class microaggressions from some fellow classmates who resented having to give her rides and from her research supervisor who humiliated her and her husband when Luisa's husband went to pick her up from the research lab. April had only a very tight stipend as a Teaching Assistant (T.A.) and was forced to rent a room in someone else's home as opposed to having roommates and share an apartment, she also worked many menial jobs.

Yeah, especially in the STEM field, there's a lot of restrictions. There were several government opportunities which I couldn't apply for because I'm not a permanent resident or American Citizen. Does that make sense? If it is duty or restrictive accounts like that, but there needs to have some more flexibility or everybody to be a part of the research, cause when I came here, I came here to improve my passion and I don't have a plan to go back to my country. I want to use the knowledge and apply it here. So, for me it was difficult to see that discrimination, that being an international student, I could not apply for that money. Maybe compared to others who got the funding, the work they put for it and the work that I do is way greater. And in the way when you see the workload, I put a much greater effort so as to bring more results. That kind of made me uncomfortable because I wished I got that opportunity but just because of being an international student, I couldn't apply. (Akilah)

You know, I used to babysit for one of the girls that worked in the lab cause she knows that I also needed money. So, you know, sometimes she'll offer me to mow her lawn for pay...I used to also take care of, like, when my mentor when she would go out for a business trip or something. You know, she would ask me to watch her house or just be home so that her son will not miss the bus. You know, things like that. And, you know, they did that I'm pretty sure on purpose so that they could give me a little bit of money for those services. (April)

Big Barriers? The finances. Yeah, we had a stipend. But it was very tight. Yes, we had to TA. (April)

And the thing is that I remember when I first applied for credit cards. I was denied because I had no history here. So, it took me the longest time to get a credit card. And I was so happy when I actually got one because I felt that's how I felt I could go home, you know? Like, if I could, you know, use a credit card to buy my ticket. And I remember my first credit line was, like, \$400. That wouldn't even buy me half of my ticket. (April)  
I had to overcome all those financial barriers, because financially it's pretty hard when you're in graduate school and you don't have family to help you. (April)

When my husband came a year later, thank God, it became a little bit easier because I had been saving some money to pay my sister for all she had to help me and lent me when I first come here to rent the house, to buy a bed, and then insurance and a few other things. Thankfully, my sister allowed me to use that money to make the down payment for a car. We were able to get a car a month after my husband came because it was going be not more difficult, and more uncomfortable for the two of us to get rides from friends or even my family. So, she let me use that money, which I'm still trying to payout to buy our first car. (Luisa)

My husband wanted to study, but it was really difficult for him to study because we didn't have money to pay for anything, he saw a lot of possibilities to study but he needed to study English as well and that was very expensive too. As a graduate student I had an F1 visa, and my husband was a dependent of my visa, with the limitation of not being

able to work, so, he did not work while I was in graduate school, which was rough. (Luisa).

We lived in a small studio almost the size of this little space in here. There was just a small kitchen, and then a big space for the bed and the bathroom, and that was it. (Luisa)

Both Luisa and her husband were victims of class microaggressions from her research supervisor.

When discussing social inequality and its effect on specific racial and ethnic groups, it is critical to consider the concept of intersectionality. This term denotes the “axes of oppression” (Brown-Glaude, 2011, p. 28) that shape the lives of oppressed groups through social relations based on their social settings (Schaefer, 2016). For example, Hindu men and women may both experience religious discrimination while the Hindu women may also experience sexism that takes a cumulative effect on how they experience racism, now defined as Religion and gender racism.

Achievement in Higher Education is one lever that can augment opportunities for low-income families, especially in STEM. Regrettably, students from lower-income backgrounds often perform poorly and fail high school STEM courses, which are a necessary pre-requisite in pursuing prestigious and profitable STEM careers after high School (Rozek et al., 2019). The academic achievement disparity between students from higher- and lower-income backgrounds can be 2 to 3 times greater, significant, and pervasive as racial achievement gaps, between the White-Black racial groups (Carnevale et al., 2013; Reardon, 2011; Rozek et al., 2019).

STEM fields are progressively regarded as one way to open up career prospects in the United States. STEM jobs are projected to grow faster, provide larger income, and generate lower rates of unemployment than non-STEM jobs over the next decades (Carnevale et al., 2013; Fayer et al., 2017; Langdon et al., 2011; Rozek et al., 2019). STEM training also provides



individuals with practical skills, such as mathematics and computer literacy, which are largely marketable across a various professions and allow students to pursue various interests (Rozek et al., 2019).

Current research on STEM fields shows that students who previously socialized with a view of how to navigate the scientific career track are better equipped to steer their actions and goals in ways that are suitable for achieving academic success as a STEM scientist (Ovink & Veazey, 2011; Wood et al., 2016). Students who have not had opportunities to develop such a vision may feel out of place in the science world in terms of its standards, habitus, or the unspoken “rules of the game” (Bourdieu, 1984; Bourdieu, 1986; Bourdieu & Passeron, 1977; Wood et al., 2017).

*Testimonios*’ themes and key findings informed recommendations. Specific implications to higher education, STEM fields, and student affairs derived from *Testimonios* are discussed in the following chapter.

### **Literature Connections to Key Findings of Data Analyzed by Moustakas (1994)**

According to Patton (2015), qualitative findings are assessed by their substantive significance. I followed Patton (2015) in deciding the substantive significance by answering the following:

- 1) How solid and consistent are my findings?
- 2) To what extent and in what ways do my findings increase understanding of the phenomenon under study?
- 3) To what extent are my findings consistent with the existing body of knowledge? That is, do they support or confirm what is already known about the phenomenon?
- 4) Do they refute what is already known?

- 5) Do they break new ground in discovering or illuminating something?
- 6) To what extent are the findings useful in terms of contributing to building theory, informing policy, or informing practice? (Patton, as cited in Bloomberg & Volpe, 2012, p. 239).

In this section, I present (a) the findings that seemed to be consistent with the current review of literature on this topic; (b) the findings that appeared to be discrepant with previous research studies on this area; and (c) the findings that went beyond the literature or broke new ground in discovering the lived experiences of international female students in STEM PhD or doctoral programs in the health sciences in the United States (Bloomberg & Volpe, 2012; Patton, 2015).

### ***Findings That are Consistent With Current Literature***

Families really provided what was needed (resources broadly defined, including emotional support) specifically for each student to persevere. All participants in this study felt strongly that they enrolled and graduated in Doctoral science programs due to their family's encouragement. All participants in this study stated they received emotional support from their families during their PhD studies. As stated by some participants: Luisa explained that "We were all very close and we were always home. And for my dad it was very important that we study. Study for my dad was the major thing that everybody should do." And Pilar stated, "A lot of support. Family members have encouraged me. I saw my sister getting all that ... I mean, pursuing her academic goals. And for me it was that I wanted to do that also. And my parents supported us."

The most comprehensive current study is a longitudinal (35-year) research report published by the National Academy. The authors Rozek et al. (2017) based their study on animal

behavior research in psychology rather than on historical policy documents. The researchers found that parents have great influence because they cultivate their children's passion for STEM and explain to them the important role of STEM in society (Craig et al., 2018).

A qualitative narrative study by Craig et al. (2018) concentrated on the influence of parental involvement on undergraduate and graduate STEM students who received NSF scholarships to become biology/chemistry/physics teachers or to study computer science at an American research-peer one university. Findings showed that STEM students who were encouraged and mentored by their mothers and/or fathers, then started STEM studies and STEM-related careers through different routes, in addition to the anticipated pipeline, were successful. Students who focused on just one area of study within STEM programs, for instance in Biology, obtained their PhDs more quickly and faced fewer obstacles than students who focused on multiple STEM paths.

Having parents who are active in STEM careers has been reported to have a positive correlation with succeeding in a STEM PhD (Astin & Astin 1992; Grandy, 1994). Parental support and encouragement have been linked to Latinos and Latinas' early career choices in STEM (Arbona & Nora 2005 as cited in Crisp & Nora, 2006). STEM success of ethnic and racial minorities has been reported to be facilitated by parental involvement (Fries-Britt et al., 2010). Ana, a Latina participant in this study who obtained her PhD in civil engineering, shared the following: "My dad, he's an electrical engineer. Of course, I think he played a major factor because having a scientist as a relative, usually relative will probably influence kind of those positions."

Freeman et al. (2014) posited that almost all countries reported that parents are influential because they determined "whether positive attitudes to STEM lead to STEM study and work" (p.

4). This seems to imply that STEM identity establishment may occur in families (particularly Asian ones) before younger students begin formal schooling (Nash, 2014a, p. 40). Tanvi, an Asian participant, stated:

I come from a family in...where you either have to be a scientist or doctor or engineer that they'll expect you to succeed or that's the expectation for most the families I should say. And for example, within our family are my cousins, brothers, and sisters - we had 58 positions in our family, including surgeons in every specialty. So, all my cousins are doctors. And many specialists among the doctors. It's a very [common] thing to go in sciences and engineering and acquire human capital in those disciplines [in my country].

The Interest and Recruitment in Science, a European Union-funded project, is currently the most important international study regarding the in-school and out-of-school influences that encourage students to enroll in STEM programs (Henricksen et al., 2015). One major finding was the positive effect of families on youths entering the STEM disciplines and following a STEM career path. Cleaves (2005) addressed students' formations of secondary science choices. Amongst his findings was the impact of 'significant others' on students' choices. The term, "significant others," implied multiple pathway approaches to STEM rather than a narrow pipeline (Craig et al., 2018).

Support from academic advisors, research supervisors, faculty and mentors is the number one factor for retention and student success for female International STEM and doctoral Health Sciences Students in the United States. The close relationship between an academic advisor, research supervisor, mentor, faculty (including dissertation chairs and/or committee members) and a doctoral student has long been documented as one of the most contributing factors for persistence and retention (Barnes, 2010; Devos et al., 2017; Gelles et al., 2019; Travaglianti et al., 2001). These important academic advisors, faculty, and dissertation chairs or committee members play multiple roles in students' success, to include as a source of information, role models, motivators, negotiators with the department and other university offices (Gelles et al.,

2019., Grady et al., 2014; Johnson, 2016; Polson, 2003). Academic advisors help doctoral students navigate intellectual challenges, ethical considerations, steps in the research methodology process, and departmental policies (Acker, 2001; Gardner, 2008; Gelles et al., 2019; King, 2003; Lovitts, 2008).

One of the participants, Pilar, explained that she built her system of support during a previous internship and during her master's degree studies in the United States. Her "inner circle" included a faculty member who sponsored her visa and offered her a research job and scholarship that enabled her to get her PhD. This female mentor opened many doors for Pilar and offered her a permanent position after she graduated with her doctoral degree:

I really met the right people and they supported me, encouraged me, opened doors for me. Dr. [name withheld] from [name of university withheld] a public state university in the USA opened a lot of doors for me". And that support system was built when I was doing my Master's. So, when I came back, Dr. [name withheld] already knew me. We have a very good relationship, and we value each other, so I have support from her.

Mentorship is a special, favorable advisor-advisee relationship in which the advisor provides more than academic guidance to the doctoral student and offers psychological, social support, and career development (Gelles et al., 2019; Johnson, 2002; Schlosser et al., 2011). In STEM fields, women are underrepresented. In the words of April:

And once I started at the university, I also was blessed with a wonderful mentor from my graduate studies. But, you know, she understood all the struggles that I went through. She was very supportive of all my activities, not only in the lab. I was really able to find people that I trust and that I could tell them all my difficulties. And they helped me". And I was able to cope with all of that with the people that I had around.

Hence, the absence of positive mentors and role models can lead to barriers for success and have negative effects in career development (Gelles et al., 2019; Johnson et al., 2007; Rosser, 2004).

Gelles et al. (2019) conducted an exploratory case study to understand the relationship of ethical mentorship between science and engineering women and their advisors while conducting research. Their qualitative findings revealed that the female participants put more emphasis on fidelity and beneficence while privacy and fairness were less important to them. Inherent hopes included effective communications and comparative equalization of power imbalances. The female doctoral students lacked an awareness of what was considered acceptable behaviors as opposed to their faculty mentors who did know and had to ask their peers for what was considered normal behaviors during research in the lab context.

Blume-Kohout (2017) was asked by the Committee on Revitalizing Graduate STEM Education for the 21st Century to research master's and PhD level education, with a focus on the STEM disciplines. To this end, the author conducted a literature review on how STEM graduate students learn and the specific conditions that help them to improve persistence completion, and achieve their career goals. Among her key findings and recommendations were that constant interactions among graduate PhD STEM students and faculty mentors are contributory to students' research skill development. STEM PhD students involved in faculty-led projects and research assistantships had more interaction with their mentors. Evidence was strong and based on thousands of quantitative, qualitative, and mixed methods studies. Moreover, research development by institutions through different funding sources should be encouraged. Some of the participants in this study had positive experiences during their research and shared this view. Akilah stated: "And they were always helpful, my mentors. They were always helpful". "And then we worked a lot of papers together. So yeah, that's how they knew me." These male professors became Akilah's mentors and served on her dissertation committee:

One of them, he is still working in one of the universities in Michigan. He volunteered to be a member in my committee. My other professor was not even working at that time, but

he flew all the way from California, and he wanted to be another external advisor. He was not eventually on the committee, but he sat as the external advisor. And he paid himself to come over for my defense. So, I was so pampered to say that there were two external advisors. We didn't have to pay them. They paid for their flight to get here—and they came all the way from there to here to help me, support me. And as you're asking now, all of my committee members, like seven or eight, they were all males.

PhD STEM students seeking to work in academia may postpone extensive training in pedagogy and independent study courses to postdoctoral fellowships programs. This strategy would eliminate the negative effects of TA programs on PhD prolonged time to degree completion, while giving the doctoral students some exposure to teaching during their course of PhD Studies. The author warns that academic advisors are occasionally poor mentors. Blume-Kohout (2017) is unsure if mentor training can help. “Individual development plans (IDPs) can be a useful tool, but effectiveness requires institutional and faculty buy-in” (p. 1).

It is believed that the relationship that PhD students develop with their academic advisors is the one of the most significant relationships of their doctoral experience (Barnes & Austin, 2009; Barnes et al., 2010; Fairbanks, 2016). Academic advisors play an important role in multiple components of the doctoral journey (Barnes et al., 2010; Fairbanks 2016). One of the participants in this study, Tanvi, explained how her important relationship with her academic advisor helped her overcome difficult personal losses:

But I must say I had that relationship in my major professor whom I could talk to...So, she bestowed a lot of respect on me, intellectual respect. And I did not want to turn her down, so I tried my best and I came out of my personal, emotional breakdown okay. It could have been worse. I could have left the thing [her PhD], but she kept me on track.

Doctoral students face numerous barriers, including maintaining a positive academic advisor-advisee relationship (Barnes & Austin, 2009), complying to contradicting requests from various professionals, producing top quality work, balancing work-family demands (Anderson & Swazey, 1998; Fairbanks 2016). These barriers have a negative effect on doctoral students,

including a greater number of years to complete degree requirements, insufficient skills in research and pedagogy, and high attrition rates (Gardner & Barnes, 2007; Fairbanks 2016).

The most commonly documented barrier for doctoral students is the high attrition rates. Reportedly, 40-60% of students who enroll in PhD programs do not obtain their degrees. The completion rates vary depending on the specific area of study (Council of Graduate Schools, 2008; Fairbanks; 2016; Lovitts, 2005). Of those PhD students who do not complete their programs, one-third leave their programs during the first year; another third before obtaining candidacy, mostly due to not passing the qualifying exams; and the final third of candidates who do not complete their dissertation (Golde, 1998). Due to the important role of the academic advisor/advisee relationship, it is imperative to explore these relationships from different lenses (Fairbanks, 2016).

There appears to be opposing viewpoints from the faculty perspective compared to the students' perspectives regarding the academic advisor/advisee relationship (Barnes & Austin, 2009; Barnes et al., 2010; Fairbanks, 2016; Harding-DeKam et al., 2012). Various functions and duties are part of PhD academic advising (Harding-DeKam et al., 2012). There is not a broadly accepted definition of an academic advisor based on their job description, despite the fact that many researchers have attempted to do so (Fairbanks 2016). Specific traits of good academic advisors-advisees vary depending on the area of study (Barnes & Austin, 2009; Fairbanks, 2016; Ferrer de Valero, 2001). Moreover, the relationship can change drastically at different points of the PhD students' study program (Fairbanks 2016; Golde, 1998; Jacks et al., 1983; Spillett & Moisiejewicz, 2004; Tinto, 1993). Luisa recalled how her experience with her research supervisor and academic advisor drastically changed in the third year of her PhD in neurobiology:

But I never saw anything weird until he invited me to this lunch in which I thought we were going to talk about the other girl, but he just threw it to me. 'I feel attracted to you or



I'm having feelings for you.' I did not know how to react to that. I was just in shock. I could not speak one word. I just thought 'my life is ruined here. What am I going to do as an international student if I don't have a PI? If I don't have a place to stay to do a thesis, I cannot stay in this country. I'm going to have to go back. I'm not going to be able to graduate.'... All of this changed my whole entire experience because I was into my third year of graduate school and things just went downhill from there.

Academic advisors in the STEM PhD programs put emphasis on collaboration and availability while academic advisors in education, the humanities, and social sciences put emphasis on caring, empathetic, and encouraging relationships (Barnes & Austin, 2009; Fairbanks, 2016). Doctoral students in general described positive traits of academic advisors as making themselves available and helping students achieve their academic goals, publish research studies, and develop their skills as good researchers (Barnes & Austin, 2009; Fairbanks, 2016; Schlosser et al., 2011).

A "good fit" between academic advisor and advisee has a significant effect in PhD STEM students' retention. First year doctoral students in the sciences reported advisor-advisee mismatch as a common source for high attrition rates. The mismatch involved poor or ineffective communications, opposing personalities, and different work and methodology approaches. Nonetheless, the same issues were irrelevant for first year doctoral students in the humanities (Fairbanks, 2016; Golde, 1998).

The term *mentor* is used interchangeably with the term *academic* advisor (Barnes & Austin, 2009). There are mentors at the undergraduate and graduate level, and mentoring can occur formally and informally (Campbell & Campbell, 1997; Fairbanks, 2016; Hansman, 2009). Several studies explore the relationships between PhD students and mentors or academic advisors (Barnes et al., 2010; Fairbanks, 2016; Golde & Dore, 2001; Lovitts, 2001; Nettles & Millett, 2006). Mentors have been described as collaborators, advocates, co-researchers, life coaches, and career developers (Barnes & Austin, 2009). Academic advisors are described as

those who provide academic guidance and support students in various stages of their doctoral studies. Academic advisors have been described as coaches, counselors, and research skills builders (Fairbanks, 2016; Spillett & Moisiwicz, 2004). Institutions of higher education outline the roles of academic advisors in their job descriptions, but mentors' roles are not part of a faculty contract or a requirement for promotion or tenure (Council of Graduate Schools, 2010; Fairbanks, 2016).

The terms mentor and research supervisor are also used interchangeably. STEM PhD mentors are reported to promote research skills, academic guidance, identity development within the specific discipline, career development, and social and psychological wellbeing. Faculty, research supervisors or principal investigators, faculty from other departments or universities, senior graduate lab coworkers or co-researchers, senior PhD students or peers have been documented to provide excellent mentorship. These mentorships are very valuable as PhD students have to juggle heavy academic demands, work in the lab, teaching assistantships loads, high stress and anxiety, and conflicts trying to balance study, work, and home responsibilities. (Hadjioannou et al., 2007; Lunsford et al., 2017). One of the participants in this study, Pilar, corroborated this literature finding:

That was the title that I had—research associate. So, I couldn't devote my entire time to the doctoral degree. I was just mixing it with— work. But she gave me time to do. I didn't have any problems since I have a class in the morning or in the afternoon.

Another participant, Rose, shared how her academic advisor helped her balance her PhD Studies in Mathematics and her second pregnancy:

Because I gave birth on 2011, so I didn't really want to complete it exactly at that time, and this is what my advisor he suggested me to. He said that if you do—I mean, we can do something wrapping up very quickly, but he didn't really want it, you know? We said that let's do it a little slowly and so I was able to also wait for my second paper to be published, which was good, you know. And each semester, I didn't really want to push myself a lot. You know, I tried to take classes slowly and slowly.

Rose also received the collaboration of another mentor: her Teaching Assistant supervisor:

But, you know, I was just teaching some courses like online courses. Our course coordinator, he was just a great person. Because I was pregnant, he gave me online courses. He gave me somethings that I can do from home. So, I was kind of, for one semester I didn't even need to go to school. I mean, I was just doing everything from home. That really helped me a lot.

Research studies on international students reported opposing experiences to those of domestic students due to acculturation problems (Lunsford et al., 2017; Rose, 2005).

Furthermore, research studies on doctoral women in STEM, health sciences, and other underrepresented minorities stated that mentoring for these important minorities is imperative to help these students navigate the extremely demanding and challenging educational programs and professional careers beyond doctoral degrees (Lunsford et al., 2017; Williams-Nickelson, 2009).

Lechuga (2011) found that Latino-Latina faculty mentor–doctoral student relationships, within the disciplines of a STEM program, were described as ambassadors, allies, and master-apprentice supervisors. One of the participants in this study, Ana, supported the literature in this regard:

So yeah, so I was talking about that organization, very key in my development [The Society of Hispanic and Professional Engineers. S-H-P-E]. And they really do push the need for more Hispanic doctorates, more Hispanic graduates, more Hispanic... They talk about, especially Latinas—like, empowering Latinas and why do we have more Latinas in CEO of [engineering companies] or things like that. So, they really talk about—just, like, the sense of community. Like, to have a whole Latina track which is dedicated for empowering Latinas in engineering, which is very uncommon, right? You've seen all the professors, right? I've seen all the Latina professors. I'm like, "Oh my gosh. There's a Latina professor. Amazing." So that sense of community was definitely a support throughout my graduate school career.

### ***Supportive Role of Peers***

Many researchers (e.g., Ebinger, 2011; Martirosyan et al., 2018; Jackson et al., 2013) have assessed numerous factors that promote international students' social adjustment.

Friendship has been reported as a significant determinant to social interaction. Moreover, one of the most vital contributors to international students' psychological health is cited as social support. Current literature accentuates that acculturation and adjustment of international students in universities depends on the ability of international students to create social networks of support to include study groups, university organizations, research and publication groups, clubs, sports, and other events that can promote their social involvement at their universities (Hwang et al., 2016; Martirosyan et al., 2018). Ana is an excellent example of how university and professional organizations, faith groups, and sports promote the success of international students:

The other thing that also helped a lot was being part of SHPE, which is the Society of Hispanic Professional Engineers. And I wanted to do some of the national conferences that are targeted for graduate students, and their early career grad students are also later—like, more advanced grad students. And those workshops really talk to you a lot about professional development and other opportunities that you could get as a PhD. You know, like, not only academia, but also in industry. And, like, that's more of a general engineering organization, but it's targeted for Hispanic students. So that sense of community, it's amazing. And they call it a SHPE familia. Why? Because you have a family there.

I also had...so it was a council for graduate students who are Christians. So, we're all graduate students. We'd all kind of go to a similar situation of dealing with your advisor, research, that kind of thing. You know, teaching, being a TA. We all had that core belief, you know, being Christian and Catholic, you know, we just kind of have that community. So that really helped me as well knowing that I have just fellowship with people who are going through it. So that also helped me keep my sanity, I guess.

I think I'm a very non-traditional scientist in that, so I came to the United States as an international student to pursue my Bachelor's, right, in civil engineering. But the way I came here was actually for tennis. So, I was actually a tennis athlete.

When explaining international students' social relationships with peers, Chavajay (2013) differentiated between “instrumental support” and “socio-emotional support.” Instrumental support examples include when peers offer transportation rides to international students, form study groups to include the international students, or invite them to attend a social function. Even though instrumental support includes a goal and collaboration, the level of closeness and

commitment is still superficial and will never make up for the unconditional love and support that only family and close friends can give (Chavajay, 2013; Martirosyan et al., 2018). In the words of some participants:

But in graduate school I made some friends and luckily there was another girl that started the program with me and was also working in the same lab I was. So, as we started becoming friends, she would give me rides. Not every day, but mainly when we had class in the main campus, and we were going to the lab afterwards. She took me home sometimes at night or sometimes in the morning she would pick me up to go to the lab. So, it became a little easier. (Luisa)

Also, with my friends, you know, I was not very hesitant to ask for help, basically, Because I found people around me approachable. And it became clear to me that if I don't seek the help that I need, nobody's going to help me. You know? (April)

International doctoral students reportedly tend to befriend other international doctoral students from their own countries of origin or other countries as opposed to domestic students. They also socialize and engage more with them because they all have overcoming cultural shock, cultural barriers, and acculturation in common, and are more empathetic toward them (Chavajay, 2013; Martirosyan et al., 2018). As Rose confided:

From my country of origin there were four women in the PhD math program. So, it was actually great because I was, yeah, my husband he still tells me. He really wanted me to do PhD in math, but he didn't really have any friends like that. We had this company, so if I cannot understand anything, there was another friend who was telling me, or like, if they have some problem, then I was able to tell them these type of things. That was actually a great blessing for us, and it rarely happens. It's just one more person we were together, like, four females. So that was a lot. It was very motivating to me.

As students establish close relationships with other international and domestic peers, they experience a great deal of social adjustment, according to study findings (Ebinger, 2011; Martirosyan et al., 2018; Rienties & Nolan, 2014). To promote social adjustment of international students on campus as well as domestic peers, universities can create special programs that promote friendships among all international students, regardless of country of origin and the domestic students (Ebinger, 2011; Martirosyan et al., 2018).

Kaya (2020) conducted a qualitative study from the socio-cultural perspective of five international students' lived experiences and their career goals after obtaining their degrees. Findings of the study revealed that the international students recognized several opportunities as a consequence of migrating to the United States to pursue their doctoral programs. Among such opportunities were friendship, networking, quality of education, obtaining resources, and exposure to multiculturalism. Previous studies (Adewale et al., 2018; Trice, 2003) reported similar findings.

### ***Resilience***

Those participants who became most resilient were part of a high-risk group that predisposed them to failure, and/or experienced unsurmountable obstacles. The Resilience Theory, as defined by Morales and Trotman (2004); the Resilience Wheel, which focuses on competence, empowerment, and self-efficacy (Henderson & Milstein, 2003); and Internal and External Protective Factors, were covered in great detail in the second chapter. In this chapter, I will review the working definition of resilience for this study, discuss resilience and women in STEM, and link them to the participants in this study. All participants in this study were extremely resilient when facing numerous barriers, such as acculturation problems, learning the American English Language, serious personal conflicts, academic challenges, death in their families, and lack of funding.

Resilience is a term commonly used in the biological, behavioral, and social sciences in many ways and within various contexts. It can be a personal attribute, a process, or an outcome (National Scientific Council on the Developing Child, 2015). Regardless of these differentiations, there are specific shared descriptors that demonstrate how this term has been utilized in intervention science and research.

1. The capacity of successful adaptation to instabilities that endanger its viability, function, or development (Wright et al., 2013; National Scientific Council on the Developing Child, 2015).
2. The ability to respond to chronic stressors while evading physiological and behavioral changes (Russo et al., 2012; National Scientific Council on the Developing Child, 2015).
3. The process of gathering resources to support well-being (National Scientific Council on the Developing Child, 2015; Panter-Brick & Leckman, 2013).
4. The ability to start again behaving and working positively after facing hardships and/or adversity (Foster, 2012; National Scientific Council on the Developing Child, 2015).
5. The amount or degree of susceptibility to shock or disruptions (Holling & Gunderson, 2002; National Scientific Council on the Developing Child, 2015).
6. An individual's capacity to adjust positively to severe trauma, constant stressors, or long-lasting adversity. (Feder et al., 2009; National Scientific Council on the Developing Child, 2015).
7. The process of well-adjustment after confronting adversity, suffering trauma, experiencing tragedy, threats, and/or multiple stressors (American Psychological Association, 2014; National Scientific Council on the Developing Child, 2015).

These are some of the ways some participants defined their resilience:

Rose: If someone tells me, "Oh, you cannot really do this," I become even more passionate towards to that, you know?"

This is my personality thing. So, if there is a challenge, I'm very...how do you say? I just concentrate on the end. Like, I was all the time dreaming about the day that I am graduating, the day that I'm getting my PhD. So, I was thinking a lot about the pathway. This is my target, so hopefully I'm going to go there. So, whatever the situation is, I will hopefully go there. This is kind of my personality.

Pilar explained that:

And my mother [who became a very young widow and had to work to support herself and my five siblings] was very strong and determined. So, we have that character that we are determined. We're focused. Challenges are not deterrents for us. Challenges are just motivators.

You always learn something. And now I try to instill that in my students. It's good. Yes, it was difficult for you. It maybe make you, cause you tears or something, but now you are stronger and now you know how to confront that type of conflict or that—you know how to overcome that barrier. So, there is always a positive thing in anything in any experience in life. And they say, "If life gives you lemons, you make lemonade."

When women in particular are exposed to experiences that make them defy social stereotypes, this can improve cognitive flexibility as is the case of females in STEM fields. Two studies by Di Bella and Crisp (2016) tested the differential effects of counter-stereotypical experiences on women from STEM and non-STEM fields. Results showed that:

It is possible, therefore, that continuous exposure to fields that are gender stereotypical or that do not challenge stereotypes might lead to rigidity in thinking, and that women in STEM fields are protected from this by their resilience to the impact of stereotypes. (p. 19)

The authors' main ideas are supported by their results, which proved that thinking about counter-stereotypes stimulates, among others, cognitive skills such as creativity (Gocłowska & Crisp, 2013), flexibility, and lateral thinking (Di Bella & Crisp, 2016); results suggest that individuals who are counter-stereotypical might be cognitively stimulated in a comparable way. As a matter of fact, their findings are also consistent with Cheng et al. (2008), who proved that under specific circumstances, female engineering students exhibited enhanced creativity on tasks relevant to their dual identities: women and engineers (Di Bella & Crisp, 2016).

### ***Persistence***

The participants were able to persevere due to personal, social, and institutional factors. The Persistence Theory, developed by White and Massiha (2016) was discussed in the second



chapter. In this section, I link to current literature with factors that compelled the international female PhD STEM and doctoral students in Health Sciences in the United States in this study to persist to graduation and succeed. Current researchers obtained their findings from the women's personal experiences. Persistence of women in STEM and health science fields appears as a new lens on STEM doctoral student retention (Blackburn, 2017). Predictions on females leaving STEM programs (Blackburn, 2017; Riegle-Crumb et al., 2016; Simpson & Maltese, 2017) or utilizing academic predictors based on past performance (Beekman & Ober, 2015; Blackburn, 2017). Persistence of women in STEM disciplines depends basically on internal (micro) and external (macro) systems of support (Blackburn, 2017; Rice & Alfred, 2014; Shapiro & Sax, 2011) and has been connected to multiple factors (Blackburn, 2017).

Mira, a participant in this study, agreed with the literature:

I think that there are always barriers. You know, there are some—and it's your outlook, and then secondly the support system. You know? So, you know, and that happens in life in general.

Mira relied on internal (micro) systems to help her persist and succeed: "And frankly, you know, I did not have any doubt that I cannot do this, you know? So, I did not have any doubt on my capability." She also relied on external (macro) systems of support: "And so, I was very fortunate. Like I said, you know, my husband's family and my husband, they are so encouraging."

Women's persistence in STEM was connected to their sense of commitment and internal motivation factors (McPherson, 2012; O'Connor, 2014). Participants in this study reported a strong sense of commitment and important internal motivation factors. Mira supported the literature regarding commitment: "I don't know. And then I think a lot of it has to be, you know, your own tenacity, you know? Your commitment that I have to do this. Your support system."

April agreed: “You know? So, it requires that discipline and dedication and persistence, and not giving up. And so, it was a lot of dedication, but I knew that was the way to be successful, you know?”

Early persistence attitudes (Ma, 2011) were shown by participants in this study who reported persistence attitudes since childhood, including Rose, a PhD mathematics student who was persistent since elementary school:

But what I can say, I think back in [Country of Origin] in elementary school, I mean, you start with the same teacher—like, the first grade, second, third, fourth and fifth. And I got a lot of positive encouragement from my teacher. He never told us that, you know, well, if you are a girl, you cannot do this. But I think this kind of vision I got from my elementary school teacher I think is so important. And I was all the times I think I can do it in terms of solving the mathematics problems, especially solving word problems. And we were given a lot of word problems.

Flexibility in career adaptability (Murray, 2016) in this study was voiced by April:

And that’s what I tell you. You know, like, if you have people around you, they become extremely generous and, you know, without that kind of support it would have been really difficult. And so, I was able to graduate. (April)

And so, I remember, you know, composing an email to contact this faculty member. And, I mean, I spend hours just writing, like, five lines, you know, asking him to be a part of my dissertation committee. Well, a long story short, he agreed. He said, you know, he’d be glad to participate in my committee. And so, for my actual defense he had to come for my final evaluation. So, I had the opportunity to meet him. And that day of my evaluation I was, you know, asking him for, you know, kind of like suggestions, input about post-doctoral positions. And then he said, “Come visit my lab.” And I was like, “Oh, my goodness.” So, I interviewed in a different lab, and then I went, and I visited his lab. And he offered me a job to do my postdoctoral training with him. And from that, you know, here we are. (April)

So again, everything that happened during graduate school became really important for defining the trajectory ahead of me. And again, one door opens, another one opens. And I think, you know, the whole environment that was around me—really good people that care about me—myself being able to trust those around me. My dedication, you know, discipline, too. Because there were things that I knew I couldn’t do. I had to focus on my studies to be able to graduate. (April)

PhD STEM and doctoral students in the health sciences in the United States are sure to persist if they have perceptions of continued support from academic advisors and mentors (Blackburn, 2017; Clark et al., 2016; Prime et al., 2015). All participants in this study had perceptions of support from academic advisors and mentors [Linked to current literature in the second chapter under Support from Academic Advisors, Research Supervisors, Faculty and Mentors]. Hence, it was a contributing factor for their persistence.

A good high school preparation in STEM and math courses (Ceglie & Settlage, 2016; Riegle-Crumb et al., 2012) existed for Luisa, Akilah, April, and Rose. All four of them had strong preparation in STEM courses in high school.

Luisa took “many courses in science and math at the advice of my older sister. So, I did well in high school. I had no problems, no issue.” Akilah took a lot of science and math courses in high school as well following advice from her teachers: “So, I kind of decided to do more in science in High School and I think that was the beginning.”

April loved biology since high school:

And so, I did very well in high school. And when I was looking into careers, I loved biology since I was in high school. Oh, I remember when we were learning about the cell and I used to draw the cell, you know, with white chalk and talk to my friends about all the organelles. It was just something that, it was just kind of natural for me to learn and to read about. And so that was the major that I chose for college.

And Rose excelled in math:

In [country of origin in Euro-Asia], actually, it’s a little bit different once you go into the high school. There is actually there a single exam you have to take and it kind of determines your future, you know? Like, the grade that you got. And after the score that you get, you start thinking about where to go. I got 100% in Math, so I decided to study Math.

Good academic performance in college science and math courses (Blackburn, 2017; Lang, 2008; Milesi et al., 2017), in this study was displayed by Pilar, Tanvi, Mira, April, Akilah and Ana, among others.

Pilar took many Science and Math courses as a pre-med student:

Then I did first my social work degree. I always wanted to do my master's and public health was always a dream for me. I wanted to be a physician initially, but then something...I said, "No. Maybe I get too emotionally connected to patients. I don't think I can do that. Maybe yes, maybe no." So, I was doubting about that, so I pursued first the social work, and then I said, "Well, public health is something that I really would like to do."

Tanvi took many science and math courses in college. She also first considered being a physician or a surgeon but became a nutritionist and obtained an MBA:

Because being physician was not my interest...even though I passed the entrance exam for med school, I just don't deal very well in a clinical environment emotionally speaking. So, I don't like, I get affected by people's bad health and that really...I bring that home.

So, I decided that being a physician or being a surgeon is not something I'll be able to deal day in and day out. So that's why I got a little bit out of norm from there. So other than being a physician or being an engineer, which my sister is, I decided to deviate a little bit and I never had any issues or concerns from my parents. My Bachelor was in Nutritional Sciences followed by an MBA.

Mira also took a lot of science and math courses in college and obtained good grades, initially trying to pursue medicine:

So again, like I said, you know, it was my parents' dreams that we would become doctors. But since we, you know, it's very competitive in [Country of Origin in Asia] to get admission into medical school. And so, none of us could really accomplish that. But then that doesn't mean that, you know, that there is nothing else, right? So, I entered, you know, pharmacy.

April had excellent grades in many science courses in college where she majored in

Biology:

I excelled in all my science courses in college. Biology, chemistry, physics. But my passion was biology. And I became very interested in research in my second year in college. With those experiences, there was very limited resources in [native country] to

do research. But I was actually able to connect with a group [Name of International Research Group]. Outside the University is a private research institution. And they actually supported these national programs in [native country] trying to look for talented students that will have kind of a profile to do research. And so, I ended up being selected to be part of that group. And that was basically the door that opened basically so many different opportunities for me to actually be here now.

Akilah had a great foundation in physics, chemistry and math:

First, I got my Bachelor's in physics, chemistry, and mathematics, and from there I got a Master's in applied electronics around physics. And another, we call it MPHIL, Master of Philosophy. In one of the branches of physics, it is called photonics. P-H-O-T-O-N-I-C-S. That's all about laser of light and things like that.

Ana had a very good GPA in math, chemistry, and engineering:

And when I was in college, I still had a really good GPA. I started out in chemical engineering. But I just really felt like civil engineering had a bigger appeal because I really wanted to go outside and being able to see structure, the construction. You know, and things like that. I really liked that about the field. So, I switched from chemical to civil engineering, and then I was reading about smart structures, which is the ability to be the doctor of a bridge was really fascinating to me. So being able to detect the health of a bridge before it collapses, or I could provide maintenance. I thought that was really cool, and that really attracted me to go to grad school.

There was also evidence of resilience when facing gender stereotypes in STEM (Di Bella & Crisp, 2016). [See *Testimonios*, Themes and Connections to Literature under Gender Microaggressions for participants' examples in this study]. Additionally, there was evidence of love, care, and support from family (Blackburn, 2017; Hughes, 2010; Robinson, 2012; Talley & Ortiz, 2017). This was reported by all of the participants in this study [See connections to Literature under Family].

Romantic partners also contributed to persistence (Barth et al., 2016). Luisa, April, Rose, and Mira confirmed this perspective.

Luisa shared how the support she received from her husband helped her to persevere to get her PhD in neurobiology:

I came without thinking about it, my husband never said, ‘No, you’re not going.’ He knew that’s what I wanted to do, and he was even considering the possibility of coming with me. And ever since my husband has been here, he’s been very supportive of me.”

April shared how much her husband helped her persist in STEM microbiology: “Having company, having that additional support just motivated me much more to continue doing well.”

My husband was very supportive, all the time, yeah. And he has always been. So basically, he gave up his career at home to come here. And then, so once he came in my third year, so I finished up pretty much on time. So, after that we moved to [Name of State in the U.S.] for my postdoctoral training. So, then he moved again with, you know.

Rose’s husband, despite being a traditional Muslim, postponed his own PhD plans to work as a math teacher to support Rose obtaining her math PhD first:

Well, I think another important issue was the reason that he [her husband] didn’t start for the PhD, we know that if you are two students in one house, it’s pretty much a lot, like a lot of stress. And at the same time, he didn’t really want us to have financial problems because of the salaries and things like that. During that time there was, like, a charter school. He applied for it to be, like, a math teacher because he had his master’s degree in math, so he was able to work there.

Mira confirmed her husband helped her persist to obtain her PhD: “And he [her husband] was always like, ‘You can do this.’ “

The campus community (Morganson et al., 2015; Pedone, 2016) also contributed to persistence for participants in this study. Tanvi, Mira, and Pilar gave examples of a supporting campus community:

Yeah, and everything was situated well. I was focusing on study and then I was TA and a graduate teaching assistant, teaching classes and just going on living, just seeing the regular students at my campus—I should say my campus had great resources, I got besides assistantships I got some fellowships too. (Tanvi)

Mira had support and encouragement on her campus and in her department:

And at that time, support system, not only are you sort of supported at home, but also for support at work. You know, that’s very crucial. If you have a good relationship with your mentor, you know...if you have good relationship with your peers, you know, your other graduate students, then that helps. You know, you can sort of talk things out. You can troubleshoot. So those are things that are very crucial.

Pilar expressed support at her campus also: “And we have at the school of public health we have a center for health promotion. And that was one of the centers that also provides the support to students that didn’t have any.”

A strong women peer group can also contribute to women’s persistence in STEM (Blackburn, 2017; Morganson et al., 2010; Robnett, 2016; Shapiro, 2011; Stine, 2010). In this study, Rose, Tanvi, and Mira gave concrete evidence of perseverance for having a strong women peer group.

We had this company, so if I cannot understand anything, there was another friend who was telling me, or like, if they have some problem, then I was able to tell them these type of things. That was actually a great blessing for us, and it rarely happens. It’s just one more person we were together, like, four females in the Math Department from my country of origin doing the PhD program. So that was a lot. It was very motivating to me. (Rose)

Discrimination as a female? You know what? Our profession, nutrition science, it’s a female field. I think males have a harder time than females. I don’t think there are any gender discrimination. I don’t think there are any gender barriers because 90% of my classes or 95% is same gender and we support each other. (Tanvi)

So, it’s really your own peers. You know, like, peers that you are sort of familiar with. And I had so many Asian graduate students in our program. So, you know, again, you have that sort of strong female group—of course, among the Asian female graduate students it’s kind of easier, you know? (Mira)

Even my colleagues, there was never [negative competition]—my female peers who were also graduate students—like, I had one who was just a year ahead of me. She was also from [country of origin]. But I think, you know, we got along well, and we were helpful to each other. (Mira)

According to Le and Robbins (2016), females were more likely to persist in engineering programs if they had previously persevered in difficult situations in the past. In this study, Ana provided a very good example. She had persevered in the past as an undergraduate and master’s student in Engineering, which helped her to obtain her PhD in civil engineering:

So, I think I faced the challenges that many people face when the transition from undergrad to grad school in terms of being able to, like, it's a lot more challenging curriculum. There was a lot more learning on your own kind of situation, developing those skills.

Students' middle and upper socioeconomic backgrounds (Kerr et al., 2012) [as evidenced by the Demographic Survey under Family Income] and having college-educated parents also improved the chances to persist (George-Jackson 2014). In this study, Ana and Tanvi had college-educated parents. Mira's father was college educated as well.

My mother was very, very supportive. And so, she's an economist and majored in economy and she went to grad school. She got grad school in management. That's what you would call it here, Master of Business Administration. So, she's also very educated and she was always about, you know, grad school and things like that. (Ana)

Professionals in My family? My mother, you know, I have several different aunts. I have an aunt who pursued law school, right? And that takes a lot of schooling, too. And my grandfather, he was a doctor. So, he had, you know, also highly educated person. So yeah. And my mom an economist works, my dad an engineer works so that—I mean, you never know how those little things influence you. But just having the non-traditional, I guess, role in the family really made me see that I guess, that was my normal, right? Like, women have to work. There are no questions about it. (Ana)

My mother's professor in English. So, we tag all the environments at home. And our large [Asian country of origin] community, or family I should say where we had the expectation in that sense that education is something—our human capital is the biggest aspect we have. So, there was always a push towards human capital. Even my grandmother was educated. My mom had a doctoral. She has a PhD. So, it wasn't nothing out of norm (Tanvi).

Mira: "And my father was a professor in mathematics."

Although these factors helped these women persevere to obtain their PhDs in STEM, they worked very hard to obtain their degrees.

But I never had, I shouldn't say better opportunity because my dad was in a diplomatic position and my mom was in education. What I have done is what I have done on my own. And I never had more potentially better opportunities because of this. (Tanvi)

Underrepresented minority students persisting in STEM were members of student organizations, participated in undergraduate research programs, and attended institutions with a



robust community of STEM students, and built good systems of support with peers (Espinosa, 2011). In this study, Ana, April, Pilar, Akilah, and Rose had these descriptors in common:

Ana participated in a lot of activities and organizations as an undergraduate:

But then going to [Name of Public State University], well, that felt like a big thing because of, you know, they were so competitive. They were in conferences. They go to the big games. You know, so that part of the culture was just something that I was just aware of being so important for the college life was just pretty much being there, you know, trying to navigate those things.

April was part of an undergraduate international research team:

With those experiences, there was very limited resources in [Country of Origin] to do research. But I was actually able to connect with a group. Outside the University, is a private international research institution.

Pilar made connections with International Health organizations during her first job, right after college:

So, we had a program that we visited the rural areas and operated and provided classes and all that stuff. And they had an international course in London. So, I was offered...Dr. [name of Supervisor] always supported me also, and he was the director of the [name of Public Health agency where Pilar got her first job]. He said, "Okay, [Pilar], this is your chance. Before you leave, why don't you stay a little longer and I send you to London with this sponsorship." "

Akilah went to work in an important lab in her native country after her second master's:

"And after my degree, after my MPHIL degree I got an opportunity to work as a research and development assistant at the really popular laboratory in [country of origin]."

Rose attended a college with a strong program in mathematics in her native country and she was involved in many organizations:

But I don't know. It was just a great experience for me. I had a lot of close friends. I was living in a dorm and for a while I actually stayed in some house. We actually got to the house with my friends, and we stayed there. So, while I was actually there, I was voluntarily involved in some [Mentoring Program]—I was a mentor for some of the younger students who are coming to the college. So, it actually helps me a lot because some people [Faculty mentors], they mentored me, so they gave me some vision. And I

was actually kind of involved with some social student clubs. I was in theater society, so I was able to play—I was a player [an actor].

In the course of the literature review, the concept of what makes a female successful in STEM in higher education in the United States surfaced a lot. What women sought to obtain was investigated by Meyer et al., (2015). Charlevoix-Romine (2008) attempted to create a good working definition of a successful female in STEM; women who complete their degree programs (George-Jackson, 2014). There were also studies on successful STEM female faculty (Olund, 2012). The success of females belonging to underrepresented groups (Alexander Nealy, 2017; Charleston et al., 2014) is also an emergent area of research.

Persistence of women in PhD STEM and doctoral programs in the health sciences and “quiet” graduations with subsequent leaving their fields to marry and/or raise their children in the United States does not suffice (Blackburn, 2017). The stakeholders need and want them to be successful and to practice (Whalen & Shelley, 2010). There is a direct positive correlation with this need due to the incredible amount of time and financial resources invested in the women in STEM, as well as in recruitment, retainment, academic preparation, and completion of their degree requirements. (Blackburn, 2017). Institutions need women to be successful in STEM to be able to justify such investments. No literature for men in STEM PhDs was found to define or pursue their success. There is a great need for further research as to why there is such an interest in successful women in STEM (Blackburn, 2017).

In this study, all participants completed their degree programs, graduated, and successfully practice their fields of study working as STEM and/or health sciences faculty, researchers, and scientists. In addition, seven out of the eight participants are married or in a committed relationship, five are mothers, and one is a stepmother. They all balance family and STEM career demands well.

### ***Identity Building***

Stets et al. (2017) posited that having a scientific identity will have a positive outcome in following a STEM career. There is a growing body of research in the current literature that deals with the notion of scientific identity and how many females make many efforts to become respected partners in STEM fields; in particular those who identify as underrepresented minorities (Blackburn, 2017; Szelényi et al., 2016). In the present study, Ana worked very hard to build her identity as a civil engineer:

Well, I think one of the things that really motivated me the most. Yeah, like, highly motivated me, especially when things were really bad, was that I was gonna be the first woman graduating with a PhD in structures since 40 years ago.

Some authors believe that females can overcome many barriers such as bias and stereotypes by concentrating on their self-concepts, self-efficacy, and their personal scientific identity if they have a strong appreciation and support from their communities (Blackburn, 2017; Lee, 2013). In this study, Ana focused on building her identity as an engineer. She received support from her university and the Association of International Female Students:

So, travel support for conferences. The university had that, too. So being able to get to go to these conferences for free helped also. I think most of my conversations, my best...my key research ideas were thought conversations with our fellow engineers in the community. So being able to have that conversation for research purposes really helped a lot, developing my skills as a professional.

Yes. We were all graduate students, all international working on different fields. And we had lunch together every day. And if you were struggling with research, then you open up that question. You know, like, "I've been working on this problem, and I haven't solved it. What do you guys think?" You know, and some of us are engineers, so we just put [our brains together]. You'll stand there, you'll try to solve an equation or something like that for work or in class. And just having conversations. And I remember being, having this problem and having them, just like brainstorm ideas.

And some of the things that they were using in their field, kind of like, how that ties in. Civil engineering, and that really was very critical for my field of study and developing my research project. But it was just, like, a conversation kind of thing, so it's nothing really formal about it.

Females reportedly have expressed quite often that they do not have a sense of “belonging” in STEM fields after repeated encounters of intimidations such as stereotypes, sexism, discrimination, and not being allowed to fit in well, which threatens their personal, social and professional identity (Blackburn, 2017; O’Brien, Blodorn et al. 2015).

And that also comes with an imposture syndrome. Doing, like, when things are hard, maybe there’s a reason for it. Maybe I don’t belong here. Maybe it’s just not for me. So, I guess imposture syndrome was also something when things get rough, you question yourself—is this for me? (Ana)

And he [Academic Advisor] always had, you know, kind of shown the partiality as well. Cause he never asked the students from here to work on Saturdays and Sundays. But he asked me to come on Saturdays and Sundays, telling me that if I don’t do it, I won’t graduate. (Akilah)

They may have experienced disconnected personal, academic, and scientific identities upon enrolling in STEM programs, and this is common for underrepresented minority females (Beals, 2016; Blackburn, 2017; Mahfood, 2014; Tran, 2011).

So, a lot of times in STEM fields—in particular for under-represented minorities in women—because we don’t see a lot of role models out there, you feel like you don’t belong in a classroom, right? Because you sit around, and you feel like you’re by yourself, so you feel like you don’t belong there. And sometimes when you go to the field or the research lab—when things get difficult, then it’s almost like a justification to that fear. (Ana)

But when I chose my advisor in the PhD program, while I was doing my co-research, I didn’t get as much support as I expected. And there were a lot of discriminations from my senior lab mates, my female doctoral students (Akilah)

A strong sense of belonging in the classroom, the research lab, and the specific academic STEM field has been linked with positive and successful effects for women (Blackburn, 2017). Sax et al. (2015) proposed that women’s lower mathematics self-concept is a poor justification for their underrepresentation in STEM. On the contrary, Ackerman et al. (2013) suggested that

women who persist have more positive mathematics/science self-concepts. In this study, Rose experiences proved the authors correct:

And I remember one of my professors—he was a great person in terms of teaching the course. But once you go to his office to ask questions, he was pretty, like, I can say rude. One time I went to his office, and it was a real analysis course and I asked him if he can help me with that. But maybe because of my language, but he said, “I don’t understand what you are saying.” I felt so bad, you know?

This is a male professor, yeah. This is one thing that he told me. Then I don’t know. I just felt myself so bad and I never went to his office again. Instead, as I said, I asked my friends, because my friends, actually, they were pretty smart girls because they college that they were going back in [Country of origin], it was kind of the college like you guys are here, like, MIT or Harvard type of things, so they were very brilliant girls. So instead of going to that professors’ room, I went to my friends’ office, so we discussed the problems.

Solid STEM identities can be developed with love and support from family (Blackburn, 2017; Howard, 2016; Parker, 2013), professional organizations (Blackburn, 2017; Revelo Alonso, 2015), and peers who are good STEM role models (Ahlqvist 2014; Blackburn, 2017; Robnett, 2013).

### ***Self-Efficacy***

According to Wise (2007), this term refers to a personal assessment regarding a person’s ability to function and accomplish at the expected level within a discipline. It can be task-specific, goal oriented, or general (Blackburn, 2017). In STEM PhD students, self-efficacy may produce persistence (Aryee, 2017; Blackburn, 2017; Hardin & Longhurst, 2016). Positive outcome prospects may be instrumental in forecasting self-efficacy (Falk, 2015). Advisors, peers, faculty (Hogue, 2012), and/or mentors (MacPhee et al., 2013; Wise, 2007) can all have a profound influence on the degree of self-efficacy (Blackburn, 2017; Charleston & Leon 2016; Dugan et al., 2013). Most females evaluate themselves with low mathematics and science skills yet evaluate themselves as having high skills with problem-solving, critical thinking, and

teamwork, which points to the fact that young females who persist have higher than average perceptions of self-efficacy (Blackburn, 2017; Gurski, 2016). Stereotype threats may produce low self-efficacy levels (Whitson, 2008). However, more research is needed on this topic (Blackburn, 2017).

### ***Finding Balance in STEM***

When women study and/or work in male-dominated fields such as STEM, work life balance (WLB) is very important (Brue, 2019). Underrepresented groups in STEM, including females, have been persuaded to apply, study, and achieve in STEM fields with the passing of the America Completes Act (U.S. Congress, 2007) and its update (U.S. Congress, 2010). Furthermore, the *Educate to Innovate* crusade strived to increase educational and professional prospects for females and other minorities within STEM disciplines (Brue, 2019; Office of the Press Secretary, 2010). According to Blackburn (2017), while these campaigns have encouraged women to obtain STEM degrees and seek career prospects in STEM fields, women remain an underrepresented minority (URM) in STEM disciplines and leadership ranks.

Studies by (Blackburn, 2017; Brue, 2019; Mullet et al., 2017; Wynn & Correll, 2018) revealed that gender biases, chilly or alienating environments, unconfident identities, lack of mentorship and funding prospects, unaccommodating or inflexible WLB policies, and failure to be admitted into career advancing networks continue to create barriers for women in STEM careers and leadership ranks. Moreover, requests for gender equality and job flexibility in WLB have become apparent in STEM disciplines that have traditionally been male-dominated fields and women still remain underrepresented minorities (Brue, 2019; Kabat-Farr & Cortina, 2014; Robnett, 2016). Despite the fact that women experienced gender biases and inequalities in many fields, current literature points to women in STEM fields experiencing pervasive gender barriers,

social alienation exclusion, and isolation in STEM fields (Brue, 2019; Leaper & Brown, 2008; Moss-Racusin et al., 2012; Robnett, 2016).

Researchers have also posited that gender biases may be originated by faculty, research supervisors, academic advisors, and male and female peers. However, they are also alleviated by these same people (Halpern et al., 2007; Leaper & Brown, 2008). Further research is needed in order to maintain women's advancement within their STEM professions, especially as senior leadership prospects, mentors, funding, and acceptance in critical professional networks continue to elude women within STEM disciplines (O'Connor et al., 2018).

**Work-Life Balance.** The term work-life balance was first coined in 1886 in the United Kingdom and has been linked to the women's liberation movement (Brue, 2019). Today, WLB is an umbrella term which covers achieving harmony despite impediments that takes place between a paid job and family responsibilities (Chang et al., 2010). Proper management of job and family commitments remains critical in the labor force today (Brue, 2019; Carlson et al., 2000; Phipps & Prieto, 2016). Based on a comprehensive literature review on the conceptual definition of work-life balance, Casper et al. (2018) determined that work-life balance is a self-assessment of how a person effectively combines work with family and leisure roles (Owens et al., 2018). Likewise, Casper et al. (2018) defined life balance as a multi-faceted approach resulting from a perception of effectiveness and gratification or fulfillment while juggling multiple life roles (Owens et al., 2018).

Sorensen (2017) defined work-life balance as a change toward flexible and adjustable borders between a person's work and life. The later positively correlated to the work-life balance definition assigned to faculty and the ability to control external pressure from a competitive work environment with family and or leisure (Khallash & Kruse, 2012; Owens et al., 2018).

Researchers Bernstein and Russo (2007) as well as Cabay et al. (2018) and Mason et al. (2009) hypothesized that having to mix work and personal life is a crucial cause of gender imbalance in STEM. Several participants in this study support this hypothesis:

But the main barrier was actually, probably, myself because I was kind of the person that I love to be at home. I love to be, I don't know—I love to cook. You know, I love to take care of my kids. You know, these types of things. I was all the time in between. I was all the time asking myself, am I doing the right thing? Should I go back home? Stay, do whatever my, like, calling, my heart is really whispering to me. (Rose)

One of the things is that my personal life was on hold. It's not that I didn't go out. I went out... So, I only Skyped to not get into a relationship that I think this is not going to be possible for me (Pilar)

Many researchers reported that for the decrease of the number of women in physical sciences and engineering, some just did not get to graduate while others quit between the time they finished their PhD programs and when they were expected to start their academic research positions (Ceci et al. 2009; Gibbs & Griffin, 2013; Hartman & Hartman, 2008; Ivie & Tesfaye, 2012; Kmec, 2013; Mason & Ekman, 2007; Mason et al., 2013; Moors et al., 2014; Tan-Wilson & Stamp, 2015). In this study, Ana was one of the few international female STEM PhD students who graduated with a PhD in civil engineering and went on to become a researcher and faculty member in a tier one university:

There were people before me who quit the program and got a master's instead. There were people who switched departments because, again, there was no funding with my research lab. So, they have to get funding someplace else, so they ended up switching advisors or just dropping out or just changing schools, you know? Especially for international students.

My advisor will tell me, it's like, "Look. So, you work hard for this." And he really, like, I didn't think I was going to get a professor position even if I was applying. Because I wanted to apply for a prospect position, he would be like, "No. You are faculty material. You can succeed at a research one institution."



The current literature reported other barriers for achieving balance in STEM surfaced from families in the country of origin, romantic relationships, and friends (Cabay et al., 2018). In this study, some participants voiced this sentiment:

Yeah, I think I had a personal issue with someone I was involved with [in a romantic relationship for many years] here [in the United States] and something which didn't work out. But a lot of it was because a lot of it was internalized [after we broke-up] and resolution delayed (Tanvi)

Sometimes when you have family, we have to take care of them. I have to think about my parents too. So, I don't go to counseling [after her younger sister's death]. (Tanvi)

My peers were like, "Well, you know, it's probably challenging, but maybe you should be pursuing something easier." Or like, even my relationships, you know, my boyfriend at the time or something like that, they would say, "You know, why don't you know, just maybe don't do a PhD." You know, like, maybe just start working and do something, you know, maybe easier or they just wanted something more traditional, I guess. Some peers, you know. And there were some peers that they just couldn't, they would just look at me and be like, "That can't be your work." Like, you cannot be doing that complicated thing. Oh, you do want to get a PhD in civil engineering and work in that area? Really? Hmm..." (Ana)

**Work-Life Interference.** Also known as work-family conflict, this term is composed of two different but connected constructs: work interfering with family and family interfering with work (Brue, 2019; Chang et al., 2010; Nitzche et al., 2014; Moreno-Jiménez et al., 2009). In this study, the participants worked hard not to allow family interference with their STEM PhD studies, teaching assistantships, and research assistantships. Luisa worked long hours, leaving her husband at home:

I always did all my experiment as scheduled or as requested by my advisor, I had very clear in my mind that even though I was married and had a personal life I couldn't let that life interfere with my studies.

Rose had 2 babies during her Math PhD and continued to post-Doctoral work:

And sometimes my mom, she even tells me...I mean, she was the person who supports me the most. After I got my position as a post doc, she was telling me that, "Oh, dear. You are still in school. When are you going to get some rest?" I was saying, "Oh,

mommy, if you are working at university, there is no time for resting, right?" So, you just need to continue.

April received a lot of support from her husband:

And so, [her husband's name] he's always been very supportive of my career. He's made sacrifices to accommodate the things that had occurred with my transitions, right? From graduate school to the postdoctoral training. And then from the postdoctoral training to the faculty position. Yeah, without that kind of support, I think it would have been very, very difficult to, you know, to be successful in this business you do need support from your husband.

In this study, other participants did not allow their PhD studies to interfere with their faith or their families and kept a balance. Mira did not overwork herself. This is one of her traits for success: to be dependable and consistent while avoiding unnecessary stress. Her priorities were in order: God and her Hindu faith, her family (at that time, her husband), her studies, and research:

And, you know, again, it wasn't like I was a workaholic that I was in the lab for 20 hours a day. It wasn't like that, you know? And perhaps if I were doing that, I could have maybe graduated in 5 and ½ years. But I wasn't like that, you know? There was like a work-life balance, you know?" "That was important. Yeah, it's important. I don't regret, you know, taking that much time."

Other participants had to balance work and studies or multiple responsibilities. Pilar suffered from time constraints. It was very difficult for her to balance her job as a research associate and her doctoral studies: "So, I couldn't devote my entire time to the doctoral degree. I was just mixing it with— [work]." Additionally, Ana explained that:

And I got recruited to play at the university to play tennis as a student athlete. So, I think that's very different. I don't think that's the usual ... cause I was recruited to the United States to pursue my tennis career and getting my education as a student athlete. It so happened that I chose civil engineering and that's one of the things that I think is a little bit different. My priority was always tennis and secondary was actually just getting an education.

## ***Barriers***

According to Blackburn (2017), in spite of various research studies focusing on the persistence and success of women in doctoral STEM and health science disciplines by means of building strong networks and systems of support, there are still many barriers that impede them to graduate. This is true especially for female doctoral students who are transfer students, first-generation students, students from low socioeconomic backgrounds, students at risk, and underrepresented minorities (Fouad et al., 2010). The intersectionality of gender, ethnicity, race, and socioeconomic backgrounds makes it very problematic to discuss one barrier without talking about many others because students are multidimensional in their identities, backgrounds, countries of origin, and personal experiences and education. Further research is needed, particularly as it relates to international female students in STEM and how their specific gender, ethnicity, and race intersect with their religion or faith, social class, sexual orientation, and/or skills in different disciplines in STEM (Blackburn, 2017).

Under Themes, *Testimonios*, and Key Findings I discussed the many barriers that women in this study experienced. In the first chapter, I covered the Specific Barriers faced by International Female Doctoral Science Students. In the second chapter, in the review of literature, I presented barriers under Barriers Faced by International Doctoral Female Students in Science Programs; International Student's Acculturation and Financing a doctorate in STEM in the United States. Nevertheless, in this section, I will discuss some of the barriers women in PhD STEM programs experience in general and how these barriers relate to the women in this study, following Blackburn (2017).

One of the largest barriers for women in STEM programs is the common perception that STEM and the health sciences are male dominated fields (Blackburn, 2017; Lee, 2008). These

pervasive beliefs are the main cause of diminished interest in these fields through negative psychological influences from the media, the ability beliefs of parents, faculty, and peers (Saucerman & Vasquez, 2014). Abundant research also points to barriers that include scarce availability of programs and limited financial assistance with very high tuition costs (Engberg & Wolniak, 2013; Packard et al., 2011), making initial STEM field choices without previously researching these fields for a good fit (Iskander et al., 2013), and without seeking academic advice (Chaudhuri, 2011; Thackeray, 2016).

**The Chilly Climate.** Even though numerous issues cause gender inequality in STEM (Shapiro & Sax, 2011), the contemporary research concentrates on social ostracism. Seaton (2011) defined the “chilly climate” as “when individuals within an environment are not treated equally or fairly” (p. 6). When women join male-dominated STEM disciplines, they may be subjected to a “chilly climate” in which they feel unwanted (Flam, 1991). This chilliness results from explicit and implicit messages that communicate to women that their gender could be a problem in STEM locations. Certainly, women may experience environmental signals that represent STEM disciplines as masculine (Cheryan et al., 2009), stereotypes that imply women lack skills, knowledge, or ability (Appel & Kronberger, 2012; Steele et al., 2002; Thoman et al., 2013) and men in STEM settings who behave toward women in subtle manners that are sexist (Logel et al., 2009). In this climate, even highly knowledgeable, skilled, and motivated women may doubt if they will be fully accepted, respected, and appreciated in STEM (Cheryan et al., 2009; Flam, 1991; Good et al., 2012; Murphy et al., 2007; Shapiro & Sax, 2011; Steele et al., 2002; Yoshida et al., 2012)

For example, the findings of Settles et al. (2016) reveal that “The Chilly Climate” [treated coldly by male peers in STEM] perception and identity interference were negatively correlated

with scientific performance, which points to stronger identities and welfare and positive correlations with high academic scientific performance (Ahlqvist et al., 2013; Blackburn, 2017).

Ana experienced the “chilly climate”:

So, I guess I did feel that- the “Chilly Climate”- as a TA. So, having this group of people, faculty meetings with other TAs and things like that—sometimes, you know, you may have an opinion about a certain thing and then people are like, “Okay, sure.” But then the same opinion will come from a male counterpart, and they will take it seriously. And you’re like, “But I just said that.”

### **Results That Appear to be Discrepant With Previous Studies**

There is a dearth of research that describes the lived experiences of international females in STEM PhDs and/or doctorate programs in the Health Sciences in the United States. Most of the current literature discussed in this study was found in studies on international PhD and doctoral students in the United States in general and studying in multiple fields. A few dissertations were found on unrepresented populations of women in STEM PhD fields, mainly studies of African American females. There were a few theses and dissertations that dealt mostly with undergraduate international female STEM students. Most of the studies were research reports that dealt with domestic female STEM PhDs. Hence, I had scant current literature with which to compare my study. To the best of my knowledge and based on an exhaustive review of current literature, there are extremely few studies on this topic. Based on these principles, I deemed my dissertation unique and the findings I obtained as breaking new ground. There were no discrepant findings.

### ***Findings That Went Beyond the Literature or Broke new Ground***

The findings from this study that went beyond the current literature or broke new ground within the context of international female STEM PhD and/or doctoral students in the health sciences in the United States are represented in the following topics: The Importance of Religion,

Faith, and Spirituality in obtaining a STEM PhD and/or Doctoral Health Science degree in the United States; Arts-Based Research; and STEM/Doctoral Health Science Programs Research. Although the words “religion, faith, and spirituality” are used interchangeably, they are very different (Newman, 2004).

**Religion.** According to Smith (1995), providing a definition for religion “is often held to be difficult” (p. 893). A good definition is grounded in the acknowledgement that “religions are systems or structures consisting of specific kinds of beliefs and practices: beliefs and practices that are related to superhuman beings” (p. 893). These “superhuman beings” are “known for miraculous deeds and powers that set them apart from humans” (p. 893). Smith posited that religion is a “stable cluster of values, norms, statuses, roles, and groups developed around a basic social need” (p. 905). Furthermore, the author explained its importance to sociology: “Religious life thus thickens and solidifies community life, inducing a sense of attachment to the community and its values” (p. 906).

**Faith.** According to Newman (2004), “Faith is nearly impossible to define. It means something different to each individual. Faith is understood to be intensely personal and often seen as extremely private” (p. 102). Faith continues to be an “extraordinarily important construct” (Lee, 1990, p. vii). Faith is defined as a “general religious attitude or accepted set of personal beliefs usually associated with Religion” (Newman, 2004, p. 103).

The terms *faith* had its roots in Hebrew scripture. Hellwig (1990), as cited in Newman (2004) tracked the concept of faith all the way to the New Testament, the Church Fathers, the Middle Ages, the Reformation, and into the Modern Era. Faith has been studied from the perspective of multiple religions and by many scholars (Newman, 2004). But it was Fowler (1981) who departed from these original concepts of faith and “equates faith with

individual meaning systems” (p, 321). “Fowler describes the most generic and most profound process of being human, the process of meaning-making, as faith. Faith, in Fowlers’ understanding, appears often but it is not necessarily religious” (Newman, 2004, p. 103). Fowler (1981) posited that faith:

is so *fundamental* that none of us can live well for very long without it, so *universal* that when we move beneath the symbols, rituals and ethical patterns that express it, faith is recognizably the same phenomenon in Christians, Marxists, Hindus, and Dinka, yet it is so *infinitely varied* that each person's faith is unique. (p. xiii, emphasis original)

Hence, faith is a phenomenon experienced by people of all religions. Moreover, faith depends on our social interactions (Fowler, 1981, 1986a, 1986b). Faith is also described as knowledge; “Knowing occurs when an active knower interacts with an active world of persons and objects, meeting its unshaped or unorganized stimuli with the ordering, organizing power of the knower's mind.” (Fowler, 1986b, p. 19)

**Spirituality.** According to the Oxford Dictionary, the definition of spirit [from Latin *Spiritus*] is the nonphysical part of a person that is the seat of emotions and character, the soul. (<https://www.lexico.com/en/definition/spirit>). The definition of spirituality is the quality or state of *being spiritual* (<https://www.merriam-webster.com/dictionary/spirituality>). To be spiritual or have spirituality means persons attempt to live a life guided by the spirit of their faith. Persons may meditate, pray, or make conscious decisions regarding their actions based on how they sense the spirit is leading them. In short, it is a state of being (Newman, 2004, p. 106).

In this study, seven participants described themselves as members of a traditional religion; all eight stated they were women of faith and one participant described herself as practicing more spirituality than religion. In terms of religious affiliation, one identified herself as a Protestant or Evangelical Christian, three stated they were Catholic, one was Muslim and

three were Hindu. How religion, faith, and/or spirituality helped them overcome critical events, barriers, and grieve the death of family members was presented under Religion, Faith, and Spirituality, with numerous quotes from all participants. In the following section, I discuss the participants' intersectionality between religion and science within the context of their country of origin and how it helped them to form their new identities as female scientists in the United States.

**Religion and Science.** In many countries around the globe, religion and science have an ambiguous correlation (Ecklund et al., 2016). Additionally, their association varies among scientists. Richard Dawkins, a biologist who posited that the two are in conflict (Dawkins 1996, 2006). By contrast, the ex-National Institutes of Health Director Francis Collins maintained that the two are quite harmonious (Ecklund et al., 2016). Heated discussions on the old controversy regarding the association between religion and science are currently very prominent, playing a major role in people's acceptance of science and how new discoveries and or threats are being communicated (Curry, 2009; Ecklund et al., 2016).

In the United States, these discussions have been included in the controversies of deadly global pandemics such as COVID-19 (commonly known as Corona Virus); human embryonic stem cell research; the teaching of evolution in public schools; and sex education (Binder, 2007; Ecklund et al., 2016). Discussions over how evolution is taught have analogously emerged in Asia, where faculty at the University of Hong Kong were in an uproar over a proposed guideline from Hong Kong's Education Bureau to promote the addition of artificial intelligence technologies in the public-schools (Cyranoski, 2009; Ecklund et al., 2016).

European nations have observed a reappearance in religious antagonism to scientific research, and in the United Kingdom public officials have serious concerns that a recent



incursion of Muslim immigrants may cause exclusive religious-based barriers and opposition to science (Curry, 2009; Ecklund et al., 2016). Public discussions on science and religion are the highlight of global discourse. Scientists and public health officials are frequent guests in these discussions and gaining insight on what scientists' perceptions of religion are and can be beneficial in the globalization of science (Ecklund et al., 2016).

Deep questions such as whether global science is substituting and/or destroying religions, contributing to the creation of a "new world order," with "one religion for all." Can the secularization and rationalization of science sweep over and outdo the rights to religion and faith-based dogmas (Ecklund et al., 2016)? Is it utopian to believe that people from different countries and religions around the world and international renowned scientists can work together for the common good, such as finding a cure for cancer or a vaccine against COVID-19 or alternative effective therapies in times of a global pandemic? (imCORE Network 2020; Oxford COVID Vaccine Trial Group 2020; Ecklund et al., 2016)

The predominant disagreement is that religion and science are in opposition because they represent different ways of how people perceive and understand the world. Religion is grounded by faith and what we cannot see. In contrast, science relies on empirical observations of natural world occurrences. Current religion theories and how it intersects with science might lead us to believe that scientists are not religious. Hence, they promote antagonism between religion and science (Ecklund, 2010; Ecklund & Scheitle, 2007; Ecklund et al., 2008; Ecklund et al., 2016; Leuba, 1916). Although preceding studies on the religious faiths and customs of scientists in the United States present a single lens on the religious faith of scientists and their perceptions of the intersectionality between dogma and science (Ecklund & Scheitle, 2007), current research forces us to look at multiple lenses for global conflict. European countries such as the United Kingdom

and France now exhibit low levels of religious practices compared to the United States. Other countries in Asia, such as India and most countries in South America, are displaying increasing levels of religious practices (Ecklund et al., 2016).

In this study, Rose, a devout Muslim from a country in Euro-Asia, openly discussed the intersectionality of her traditional religion and how it affected her decision to follow a STEM career and her studies as an international Muslim female in a PhD program in mathematics in a public university in the United States:

But some people [in country of origin] they think that if you are a religious person, especially if you're a female—well, eventually, you're going to raise the kids, right? So, they say, [to Rose's mother] "Well, why are you selling your daughter to the school?"

But yeah, like, these people as I mentioned from the University Preparation facilities, there were also some, like, religious people. But they didn't really believe like that. I mean, they said that, I mean, even if you are religious or non-religious, I mean, you really need to get an education. It's not just, like, the science is not about [anti-God]—so you don't really need to say negative things about God if you do science. It's something parallel to the religion, so there shouldn't be any conflict. Does that make sense?

Rose got married very young and came with her husband to the United States to pursue her PhD in mathematics. During her PhD studies, she had two children while following her Muslim traditions.

I was feeling myself so blessed because during that time back in my own country, they are not allowed to wear their scarf if they want to work in public spaces. Isn't that weird?

Yeah, if you want to work in governmental places. If you do your own business, that's fine. You can do whatever you want, but if you want to be a professor at the college, if you are going to be the teacher in the elementary school and things like that. So yeah, these things happened. So right now, we don't really have these issues. They actually fixed it, but it took a long time. For instance, in my country, I couldn't join the graduation ceremony because I was using scarf. But here, that's why I attended my PhD ceremony, which I was almost going to cry because of thinking about my situation in my own country. But you know, this country maybe I'm saying maybe it's not my country, but they are respecting me. So that was I think a very big thing. So that was very, yeah, encouraging and a very pleasant experience for me.

Yeah. I can say that it's the most important factor is my faith. Because I was able to, yeah, I actually believe that if I do science, if I help people, if I educate girls, boys or whatever, it's a very blessing act. I mean, it's kind of as equal as you pray, you know, it makes me—it elevates me. It makes me close to God, I mean, the way that I believe.

I mean, sometimes I even got surprised because in traditional Muslim men [from country of origin], for instance, my brother-in-law, he didn't want his wife to do her PhD. I mean, she was a very talented person. I don't know. He just didn't want it. But my husband, I don't know. For some reason he was different. He was encouraging me a lot and yeah, I really didn't have any [Problem or opposition] from him.

Rose motivated her husband to get his PhD after her graduation:

Okay, you have to do the PhD because I know that if we go back to our home, some of my relatives, my brother's wife, she still thinks that [name], my husband's name, he already got his PhD before me. Because this is something, like, the people have in their mind. I mean, all the time the husband needs to get the degree before the wife. But my husband, he's very comfortable with that, so there is no problem.

It really touches me whenever I see, like, especially here in the United States, I see especially females that, "Oh, I'm not good at math. Oh, I cannot do that. I don't have this brain, you know?" And people think that literally the God man created, the people, you know, they put a different brain for the girls. I don't really think so. I mean, we all are created equally. Those are, like, the bounds that we are kind of putting these things into our mind. This is ourselves, you know, what we are doing. So, I also have this type of passion. I really like to help these girls. I think that also was kind of my motivation I would say.

Well, actually, they shouldn't let anyone to tell anything about their capacity. I mean, they really should go after their dreams. So, nobody has right to tell them that, "Okay, you are a girl. These are your job opportunities and not the others," you know? So yeah, they should believe, and they should really go for it. Because there are, like, some things that as a female we have, but we are very compassionate. And maybe this is not something that, you know, I don't want to discriminate because yeah, I think this is the way. So, it's some males, they may not have these types of strong feelings. So, I think in community, in public places, in government, so more females are really needed to have a better world, a lot more detailed policies in education, to have a better compassionate world, I think we need more females.

Yeah, in math, too. Yeah, specifically. Because, yeah, I think this is why it happens because as I said, I mean, whenever there is a common thing that, okay, the girls cannot do math, cannot do engineering... So that's why. We are trying to emphasize that girls can do it. I mean, girls can do math. Girls can do anything, right? So, I don't really want to say that. I think the calling is important. I mean, if you are good at art, just go ahead and do art. I mean, if you are good at engineering, if you like to model the world, just go ahead and do that, you know?

So, we shouldn't really put some gender barriers when we raise our kids. I know that there are some of the things. There are, I don't know, as I said, the woman is more compassionate, but the men are having differences around certain parts. But it shouldn't really stop us to go and pursue STEM or other fields. So currently, actually, I'm working on some of the grants that they are encouraging more females into STEM fields. Hopefully, I'm going to organize some math day event next fall where we will invite some high school girls along with their teachers, so we are going to have a one-day event here. This is really kind of my passion, hopefully.

The findings from this study that went beyond the current literature or broke new ground within the context of international females STEM PhD and/or doctoral students in the health sciences in the United States were presented within the following topics in the chapter on *TESTIMONIOS*: Human Capital; Cultural Dissonance; Discrimination; Sexual Harassment; Gender, Cultural and Class Microaggressions in STEM; Microaggressions against Asians; Microaggressions against Latinas from South America and Hispanics; Socioeconomic status (SES) Social class; Classism and their effects on STEM FIELDS; *Testimonios* and International Females in STEM PhD Programs; *Testimonios* as a Methodological Research Tool in Doctoral STEM and Health Science Fields. With regard to the use of *Testimonios* as a methodological tool, please refer to the third chapter on *Methodology*, under Data Collection and Procedures.

#### ***Arts-Based Research and STEM PhD/ Doctoral Health Science Programs Research***

The integration of the domain of science with the domain of art has caused a new arbitration of the scientific standards that conventionally be directed to social research procedures while emphasizing where the two domains merge between these two incorrectly separated realms. This new methodological hybrid opened up for scientific discovery through arts-based research (Leavy, 2015). Hesse-Biber & Leavy (2006, 2008) posited that new research methods could pave the way to “come at things differently.” Hence, methodological innovation does not mean to add more research tools but rather to create new ways of thinking and knowledge building “new ways to see.” Creativity and innovation were blended to produce new

ways of thinking by means of “new research structures.” Arts-based research procedures are on the methodological cutting edge—producing “new ways to see” (Leavy, 2015). “These practices are about composing, weaving, orchestrating, creating tapestries of meanings, and producing knowledge in new shapes” (Leavy, 2015, p. 291).

On the advice of my dissertation chair, I incorporated ABR within my descriptive phenomenological study on the lived experiences of international female doctoral STEM and Health Science students in the United States. I was not aware of this methodological tool, nor did I consider myself an art connoisseur as I was collecting different types of data already. Hence, I was reluctant at first. But my dissertation chair persuaded me by explaining that ABR would teach me “new ways to see, to obtain new knowledge” and would produce rich data. After data collection and analysis, I was ecstatic. I was able to see so many new things and obtain much more knowledge from different lenses.

**Crossing the Great Divide of Arts-Science.** Art is enigmatic. Science is up-front. Art endorses thought through its dependence on imagination, metaphor, and symbolism, while science provides truths, evidence, and facts through its reliance on numbers, texts, and impartiality. These kinds of opposing, separating, and single-lensed view of scientific investigation and artistic practices have steered the building of the great wall, which has symbolically divided artistic inquiry and scientific inquiry (Leavy, 2015).

I was not the only one fearful and hesitant of using ABR. Some of my scientist participants expressed similar fears: “The only data I am not sure I can help you with is the Art artifact” (Luisa). “I will have to do a lot of thinking and use all my resources before coming up with the Art Sample” (April). “I am not artistic, at all, I will make you laugh” (Pilar). “I will send you something but in my Native Language, which you will have to have translated. I can

only do Art in my native Language, and it is hard for me to put that in English” (Rose).

Additionally, it took months and several attempts before I received the ABR contribution from Tanvi.

To cross these great divides, researchers have provided exposés of the wrong division (Leavy, 2015) and other researchers explained how both fields, art and science, are propelled by creativity (Janesick, 2001; Leavy, 2015). To this end, Ivan Brady (1991) coined the term “artful science” and Valerie Janesick (2001) coined the term “artist-scientists.” Saldaña (1999) noted that both artistic and scientific inquiries need thinking conceptually, symbolically, and metaphorically.

According to Leavy (2015), both endeavors require flexibility, intuition, and innovation, and all play important functions in both the scientific and artistic groups. Hence, the main principles are the same and both groups’ goals are to explore, discover, and illuminate. In essence, Leavy summarized the fundamental norms found in both artistic and scientific practice: thinking conceptually and building conceptual structures, thinking symbolically, using metaphors and metaphorical analysis, intuition, flexibility, and innovation, exploring, discovering, and illuminating (p. 305).

All the participants in this study used intuition, flexibility, and innovation to explore, discover, and illuminate their knowledge. In particular, Ana practiced thinking conceptually and building conceptual structures, while the other 7 participants used to think symbolically using metaphors and metaphorical analysis. Pilar, who reportedly “makes lemonade out of lemons,” kept true to her promise and made me laugh with hilarious cartoons! [Refer to Arts-based Research ABR Data Analysis and interpretation].

**The What, the Why, and the How of Arts-Based Research.** For those who have worked in the arts and have used ABR as a research tool, they know at a “gut level as well as at a conceptual one just how effective arts processes can be as exploratory, deconstructive and teaching tools” (Greenwood, 2012, p. 2). When explaining “The What of ABR” we need to understand the many forms and practices of the arts as teaching and research tools – as well as tools for diversion, amusement, customary, and other visual or hearing appealing purposes – reach back to the roots of prehistoric and recorded times (Greenwood, 2012). In this phenomenological study the participants provided a wide variety of ABR artifacts. For example, April presented me with a handcraft she learned to make in the United States trying to recreate or mimic the South American “Mochilas” or “Arhuaca knapsack.”

Additionally, Mira presented me with 2 ABR artifacts. The first was a prayer or hymn *Bhagavad Gita, Chapter 2, Verse: 47*. The second was a poem that Mira, who is a very accomplished poet writer yet never boasts about it, composed herself: *If You Think*. She now uses it to motivate her students and her son. Ana provided 3 ABR samples: the first, Christian Pastels Drawing/Poster of Proverbs 16:3, was made during her PhD in Engineering while being member of The Council for Christian Graduate Students. The second and third were *Collages* for “*The Wall of Fame*.” The fourth ABR sample provided by Ana was an actual painting created by a group of Hispanic female PhD student engineers during one of the conferences they attended to motivate and empower each other. The conferences were sponsored by the Society of Hispanic Professional Engineers.

Pilar presented comics that humored me. One comic strip she was raised with and brought with her to the United States is from South America, *Mafalda*, who became a feminist role model for all the little girls in South America. Pilar read *Mafalda* to overcome cultural

shock and homesickness. Two other comics she read to practice English in the United States were comic strips for *Calvin and Hobbes*. Luisa listened to the song “*Que Bonita es Esta Vida!*” by singer Jorge Celedon from her home country quite often during her STEM PhD to overcome loneliness, depression, sexual harassment, and alienation. Rose taught me how to overcome death in the family with her beautiful hymn, *Ezeli nur* translated to English as *the Eternal Light*. Furthermore, Tanvi presented me with a poster that reminded her, as a PhD student of nutritional sciences, how blessed she was as it depicted African children having to travel long distances to find water and having to drink contaminated water.

When trying to understand “The Why of ABR,” why we need ABR, we need to know we are body and mind. Additionally, numerous people might argue we are also spirit. Hence, human beings are multifaceted. We experience the world through our senses and through the coded information we verbally receive. We communicate through words and our bodies [non-verbal or body language]. When we know or receive knowledge, we frequently do that through other means than just the intellectual (Greenwood, 2012). An example of the “why” of the specific ABR artifact presented to me in this study was provided by April:

The item basically represents a photograph of my dad and I when we went to a vacation in [north coast of her country of origin, beautiful, historic, and expensive touristic city, a resort]. That was pretty much the last time that we went out together as a family before he died. Back then we didn’t have digital cameras. My mom carried the actual photographs of some of these vacations. In one of the times that I went home and visited I realized that I didn’t have very many pictures with my dad. And as you know I kept thinking and looking. When I saw that one it was very special because we had a really good time and I decided to scan it and the actual original was not in really good shape because my mom experienced a flooding in the house. And all the photo albums got damaged. So, I was able to scan it and to have a more long-lasting memory of that particular event. Then I decided to put it into a fabric. So, I put it into that, it’s like a little pouch where I keep very important documents. And so, it was in a safe place in my house.

Yeah, I used it, but I kept it basically in a safe place. And the few documents that I keep there are, they are like my documents of (country of origin), my passport, my I.D. from



(country of origin), which I don't get to use very often here. So those are a few of the items that I keep in there. And that's pretty much it.

Another example of the "why" of a specific ABR artifact presented to me in this study was provided by Pilar:

It is important. As I was telling you, right now that is the only item that has a picture of my dad. As you know, here in my house, here in (City in the United States). So, to me it's very important and I took good care of it often hoping that it would last me a long time. And that way I can, you know, give it to my kids at some point later in the future.

It's a part of I would say the legacy that my dad left us. He was a very joyful person. He was happy and he tried with the few resources that he had to make from every moment something special. And the fact that he was able to take us from that location, I understand now how financially challenging that was at the time. But he was always displaying such an immense amount of love that I'm pretty sure that even with the struggles he was just happy to see us enjoy the time together.

Three words... Family. Love. And hope. (Pilar)

When trying to figure out "The How of ABR," Eisner (2017) and many artists repeatedly tell us that the arts elicit multi-dimensional responses both from their creators and their spectators. The arts utilize the whole human being. The use of arts-based methodologies in research, therefore, originated from the wish of researchers to provoke, sort out, and share experiences, as well as knowledge that is not promptly or completely retrieved through other conventional fieldwork methodologies (Greenwood, 2012). Within the extensive archetype of art-based research, two major general methodologies stand out. In the first, one or more modalities of the arts are used as tools to study a social or educational problem. In these circumstances, the art procedures could be utilized for data collection and/or data analyses, presenting or illustrating findings, or for various other objectives (Greenwood, 2012). This was the ABR methodology I used in this study. In the second methodology, the research is an exploration into the arts themselves; an inquiry for a way to describe and comprehend the multifaceted strata of meaning within an art form or specific type of art form. Obviously, in

some circumstances, the research may involve combinations of both methodologies (Greenwood, 2012).

When considering how science meets art, within contemporary literature, there has been an increased interest about the connection. Braund and Reiss (2019) investigated this emerging relationship and proposed that sciences and science learning are not whole without the arts. The authors identified 3 stages in which the arts are instrumental in expanding the teaching and learning of science.

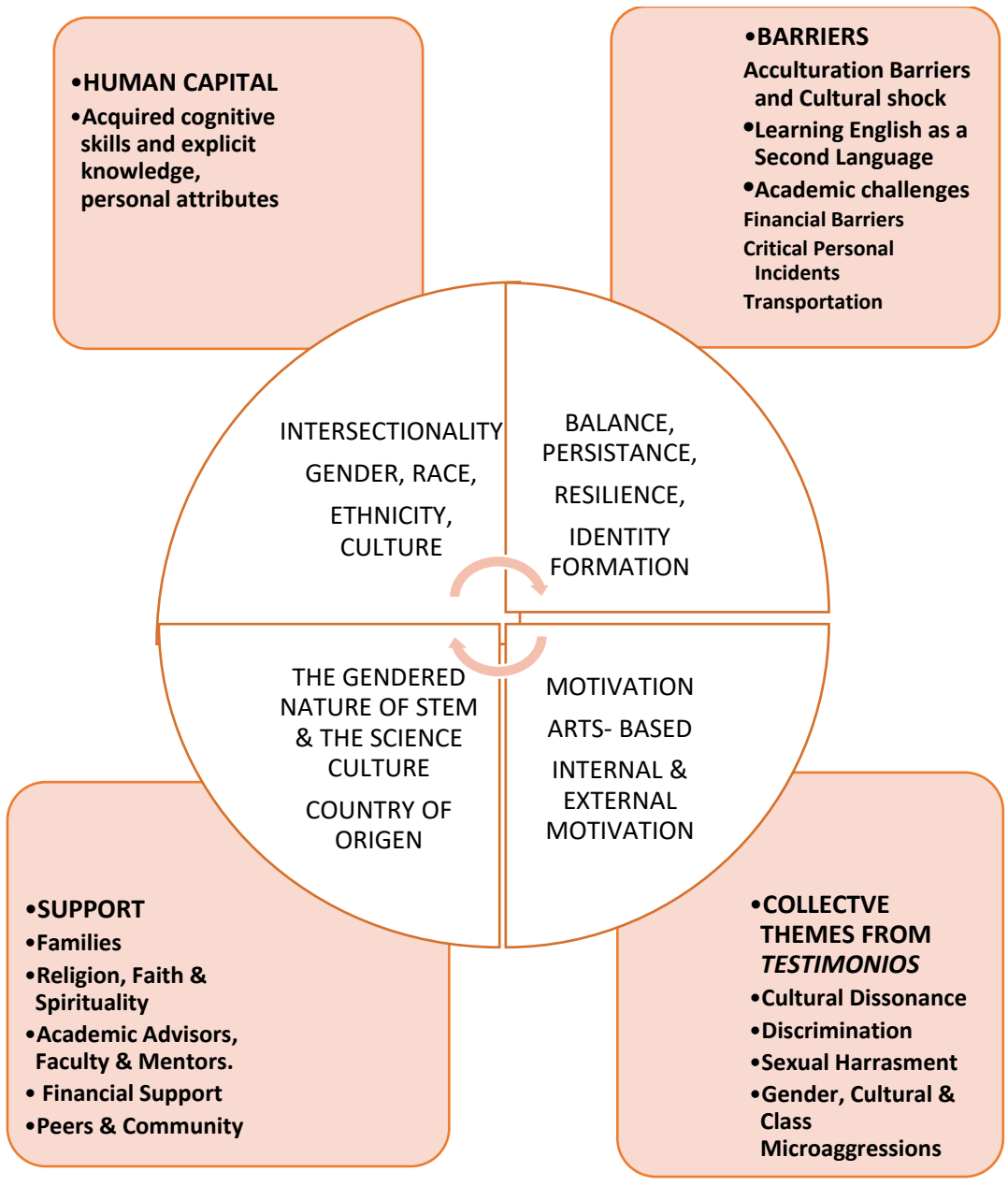
The first is at a macro-level and dealt with ways in which subject matter (sciences and the arts) are structured, shown, and taught with specific options given to students on how to study these subjects. The second is at the meso-level, leading methods and planning science curricula that engage learners by utilizing STS (Science, Technology and Society) contexts. The third is at the micro-level of educational processes in science teaching and learning that can be extracted from the arts. The advocates of STEMM (Science, Technology, Arts, Engineering and Mathematics) add new levels to the nature of science in the 21<sup>st</sup> century and make science less likely to get dropped from school as new pedagogies, including those from the arts, are introduced. The effect could be a more lifelike and connective school science, more relevant to address the scientific challenges of the 21<sup>st</sup> century (Braund & Reiss, 2019).

### **Summary**

This chapter provided the data analysis, synthesis, and interpretation of my research, as well as key findings that were organized by how they answered the main research question and sub-questions. It included “Inferences for Higher Education” for each topic and literature connections. In the following chapter, I provide Conclusions and Recommendations.

**Figure 36**

*Conceptual Framework of Successful International Female Science Students in the United States After Data Collection, Synthesis, and Interpretation of Findings*



## Conclusions and Recommendations

The purpose of this qualitative transcendental descriptive phenomenological study was to explore the lived experiences of international female doctoral students who succeeded in their PhD programs in STEM fields or completed a doctoral program in the health sciences in the United States. I conducted this qualitative descriptive transcendental phenomenological study to seek more knowledge and obtain “the essence” of the lived experiences of international female students in STEM PhD programs and/or doctoral health science programs in the United States following Moustakas (1994). The following research question guided my study:

What are the lived experiences of successful female scientists who earned a PhD as international doctoral students in Science, Technology, Engineering or Mathematics (STEM) or completed a dual PhD and/or Professional program in Health Sciences in the United States?

The following sub-questions also guided my study:

- 1) What factors do participants perceive enabled and constrained them to complete their program of studies and graduate in a timely manner?
- 2) What barriers do successful international doctoral female students experience in science fields in the United States?
- 3) How did the successful international doctoral female students in science fields in the United States navigate these barriers?
- 4) What attributes do international doctoral female students in science fields in the United States credit to their academic success?

Out of 10 potential participants who were recruited, eight participants were selected who met the criteria for this research. I then obtained IRB approval, followed by the signed informed consent forms before scheduling the participants' first interviews and collecting data.

### **Data Collected and Methods of Analyses Used**

All interviews were voice-recorded, and the audio recordings were sent to a professional transcriber who signed a confidentiality agreement prior to transcription (see Appendix H). All interviews were transcribed verbatim (Bloomberg & Volpe 2016). Subsequently, I analyzed the data, which I previously described. Eleven themes emerged from my study, with sub-themes listed under the "umbrella" of a theme. All themes and sub-themes were discussed within the sub-questions they addressed.

1. Family Encouragement
2. Finding Hope and Strength in Religion/Faith/Spirituality
3. Overcoming Academic Barriers
4. Learning English as a Second Language Effectively
5. Overcoming Acculturation Barriers
  - a. Building Systems of Support
  - b. Overcoming Critical Personal Incidents
  - c. Learning to Grieve a Family Member's Death.
  - d. Finding Safe Environments.
  - e. Being Close Yet So Far from Loved Ones.
6. Support from Academic Advisors, Research Supervisors, Faculty, and Mentors
7. Balance
8. Self-Determination

9. Resilience
10. Persistence
11. Identity Building

In the chapter on *Testimonios*, I presented complete *testimonios* of 3 pre-selected participants: Luisa, Akilah, and April. In “Collective Testimonial Narrative Themes,” I presented the themes and key findings that emerged from the *Testimonios* along with relevant quotes from participants:

1. Human Capital
2. Cultural Dissonance
3. Discrimination
4. Sexual Harassment
5. Gender, Cultural and Class Microaggressions

In a previous chapter, I presented Data Analysis, Synthesis, and Interpretation with Key Findings of Factors Which Support Success and Barriers, including inferences for higher education. Also, in the previous chapter, I provided the following literature connections: Participants’ Backgrounds’ Connections to Literature; Literature Connections to Key Findings of Data Analyzed by Moustakas (1994); and Literature Connections to Testimonios, Themes, and Key Findings.

In this final chapter, I present *testimonios* and research-based recommendations for action; recommendations for universities, STEM PhD/doctoral programs in the health sciences, departments, administrators, and faculty in the United States; recommendations for STEM PhD/doctoral programs in the health sciences, student affairs, international student centers, and faculty in the United States; recommendations for current and prospective international female

students in STEM PhD/Health Science programs and faculty in the United States; and, recommendations for further research. Also presented are the researcher's final reflections and conclusions.

### **Recommendations for Policy and Practice**

Within the federal government, the executive and legislative branches have the power to serve as enforcers of transparency and accountability in the STEM and health science fields. Transparency and accountability are essential forcers for obtaining positive change in equity, diversity, and inclusion attempts. The legislative and executive branches of the U.S. government should join efforts to increase transparency and accountability among federal agencies and universities which receive federal funding. These tasks can be achieved by requiring data collection, analysis, and reporting on the type, influence, and number of efforts to improve the recruitment, retention, graduation, and career advancement of international female doctoral students in STEM and the health sciences in the United States, highlighting the current efforts that take an intersectional methodology (National Academies of Sciences, Engineering, and Medicine, 2020).

Federal agencies should hold universities receiving federal funding accountable for implementing effective practices that deal with gender inequalities in the recruitment, retention, graduation, and career advancement for international female doctoral students in STEM and the health sciences in the United States. Additionally, universities should be required to conduct regular data collection and analyses to oversee improvement. These agencies should also include universities and individual researchers' efforts that support larger equity, diversity, and inclusion as part of the proposals' observance, review, and award processes. Currently, most proposals to the National Science Foundation only document the societal benefits of the research (e.g.,

improving climate change, curing cancer, developing a COVID-19 vaccine, etc.) in the “Significance” section. The impact on equity, diversity, inclusion, and career advancement for international female doctoral students in STEM and the health sciences in the United States should not be substituted for benefits to the general population. Rather, both impacts should be included (National Academies of Sciences, Engineering, and Medicine, 2020).

### **Testimonios and Research Based Recommendations for Action**

Universities can provide “safe spaces” on their campuses that provide a sense of belonging and support for international female doctoral students in STEM and/or the health sciences who suffer from discrimination, alienation, and/or microaggressions that will serve as refuge centers. Such safe spaces can function within the context of peer-to-peer relationships, mentoring relationships, counseling services, national STEM/ Health Science discipline diversity conferences, campus student groups, and STEM/Health Science departments. These safe spaces can be physical spaces, online chat rooms, or intangible ideological spaces (NASEM, National Academies of Sciences, Engineering, and Medicine, 2020 p.15).

Universities should also provide direct and visible support for victims of sexual harassment, concretely for international female doctoral students in STEM and the health sciences who are vulnerable to this type of exploitation due to their temporary international visa status and, their spouses (as dependents) risk losing their status as well. Presidents, provosts, deans, and department chairs should express that reporting sexual harassment is protected by law and is a moral and brave act. Whether or not the victim files a formal report, academic institutions must provide access to support services (counseling or psychological support, health services, social services, legal advice, and academic, career and/or professional counseling). They should provide other means or less formal ways of documenting information about the



negative experience and reporting the experience anonymously if the victim is not ready to file a formal complaint. Universities should develop tactics to prevent the victims of sexual harassment from being subjected to and/or fearing retaliation in academic settings (NASEM, National Academies of Sciences, Engineering, and Medicine, 2020).

### **Recommendations for STEM PhD/Doctoral Programs in the Health Sciences for Universities, Departments, Administrators, and Faculty in the United States**

The recommendations in this section outline a change process. The process starts with a university and specific STEM/health science departments collecting, analyzing, and evaluating quantitative and qualitative data to identify the specific problems they are experiencing with recruitment, retention, inclusion, and graduation of international female doctoral students in STEM and the health sciences in the United States. Then, universities and specific departments should take the necessary corrective action to address their inadequacies by extracting from the existing research and practice to implement directed, evidence-based corrections. The next step in the process is to replicate the data collection and evaluation after implementing changes to establish whether the treatment has been effective or whether it is time to try a new intervention. The last step in the process is to officially commit to effective practices through policy changes so they can withstand transitions or changes in leadership. Ultimately, universities and the federal government should resource, recognize, and reward those that promote diversity, inclusion, and equity efforts. Most universities assume that faculty who care about these issues (mostly international female doctoral students in STEM and health science programs) will endorse positive change without authority or proper funding. Moreover, of great concern, is the well-known fact that these faculty members who endorse diversity, equity, and inclusion practices are reprimanded and punished for taking time from other university priorities, including

publishing research peer-reviewed articles and/or grant searching and applications to secure funding (National Academies of Sciences, Engineering, and Medicine, 2020 , p.10).

According to the National Academies of Sciences, Engineering, and Medicine (2020, pp. 14-15), other specific recommendations based on participants' *testimonios* and current research include:

1. Ensure that equal access to funds, jobs, grants, health insurance and counseling for all employees and doctoral students regardless of gender, country of origin, visa status, age, race, and/or disability.
2. Effectively communicate and advertise clearly and largely about the institutional resources that are available to doctoral students and faculty and be transparent about how resources are distributed and how to apply for them.
3. Revise policies and resources to reflect the diverse personal life needs of faculty and doctoral students at various stages of their STEM/Health Science careers and/or doctoral education and advertise these policies and resources so that all are aware of how to access them when needed.
4. Create policies and educational programs that encourage an inclusive and respectful educational and research environment free of discrimination, including gender microaggressions and sexual harassment.
5. Create detailed and specific policies for faculty, academic advisors, lab directors, dissertation Chairs and senior doctoral students on how to behave to avoid impropriety, sexual harassment and treating others without dignity or respect. Advertise these policies in different places ensuring constant open dialogue and

- access to counseling and where to report infractions. Include descriptions of punishment and discipline for perpetrators. Explain the investigative process.
6. Create policies that support faculty and doctoral students during times when family and personal life demands are overwhelming—specifically for raising young children, taking care of an ill or disabled family member, and caring for elderly parents or when personal disability or illness occurs. Do not retaliate or penalize those who take a family leave or sick leave for valid reasons.
  7. If budget and infrastructure allow it, consider creating a day care center within the university campus.
  8. Provide a dedicated room for privacy with appropriate equipment for parents to feed infants and, if needed, to express and store maternal milk.
  9. Create policies and practices that address faculty and doctoral students need to balance work and family life (including not only child and family care but also time to attend to children’s school functions and extracurricular activities).
  10. Limit department meetings and other formal functions to working hours that are family friendly.

**Recommendations for STEM PhD/Doctoral Programs in Health Sciences, Student Affairs, International Student Centers, and Faculty in the United States**

To address issues with the recruitment of international female doctoral students and faculty into academic programs in STEM and the health sciences in the United States, international student centers, admissions officials, student affairs, human resources, administrators, and hiring committees should:

1. Work unceasingly to identify talented applicants from underrepresented minorities and countries and expand the databases and groups from which applicants are obtained.
2. Write specific program and job descriptions that promote diversity and inclusion and advertise them in different media outlets and forms in a manner that appeals to a broad applicant pool.
3. Question the requirements and review standards against which applicants will be drawn for selection and either abolish or lessen the importance given to those that are particularly subject to stereotypes and discrimination and may also include poor predictors of success (e.g., GRE, ESL, and certain STEM standardized test scores).
4. Decide on the comparative priority and power of various admissions or employment criteria *before* interviewing applicants.
5. Ensure a cost-effective and fair translation, evaluation and accreditation of foreign students' and foreign faculty transcripts, diplomas, certifications, professional licenses, and credentials. Keep in mind that most of these applicants do not have the financial or non-immigrant visas to return to their country of origins to obtain further documentation. Ensure their original credentials are returned to them.
6. Make those in charge of admissions and hiring outcomes accountable for their decisions at every stage of the application and selection process.
7. Ensure evaluators are aware of the maternity, childcare and family leave responsibilities often faced by females, especially when considering "gaps" in curriculum vitae.
8. Utilize structured interviews in admission and hiring decisions as much as possible.

9. Train hiring and admissions personnel about biases and stereotypes and develop systems to eradicate them.
10. Increase compensation, wages, and/or stipends for graduate students, particularly international PhD and doctorate students in STEM and the health sciences in the United States, postdocs, nontenure track faculty, adjunct, and others to ensure all doctoral students and faculty are paid a living wage and receive health care insurance.
11. Ensure all international and doctorate students in STEM and the health sciences in the United States, postdocs, nontenure track faculty, adjunct and tenured faculty and their dependents have the necessary visas to remain legally in the United States. (NASEM, National Academies of Sciences, Engineering, and Medicine, 2020)

**Recommendations for Current and Prospective International Female Students in STEM PhD/Doctoral Programs in the Health Sciences and Faculty in the United States**

In order to be effectual mentors and to create or improve additional effective mentorship relationships, faculty and staff should recognize that the international female doctoral students' identities and personal attributes influence their STEM/health science academic and professional development (NASEM, National Academies of Sciences, Engineering, and Medicine 2020).

Therefore:

1. Institutional leadership should purposely support mentorship projects that accept, respond to, appreciate, and build on the power of diversity. Leaders should purposely create cultures of inclusiveness to improve the quality of STEM/Health Science doctoral programs.
2. Mentors must receive professional development or training on how to use inclusive approaches to mentorship such as, cultural responsiveness, moving beyond

“colorblindness,” intentionally considering how culture-based dynamics and gender can negatively influence mentoring relationships, active listening, and reflecting on how their personal and professional biases and stereotypes affect their mentees or current and future doctoral students and their relationships with them, concretely in mentorship of underrepresented populations such as the international female doctoral students in STEM and the health sciences.

3. University leaders, faculty, and staff should encourage procedures, policies, and other organizations that allow mentees to engage in positive mentoring relationships with various individuals within and outside of their university, STEM/health science department, or programs such as conferences, learning communities, online networks, and/or professional societies by specific discipline, with the definitive objective of providing wide-ranging mentorship support systems.
4. Mentees or international female doctoral students in STEM and the health sciences or those students planning to apply for these programs should consider and acknowledge the influence of their gender, race, culture, socio-economic class, identities, religion/faith, systems of beliefs, and personal attributes on their academic and career trajectory and should seek mentorship that is purposeful and consider their specific personal lived experiences.

### **Recommendations for Further Research**

This present study suggests further research that might explore, shed light, and provide more knowledge to help understand the lived experiences of international female doctoral students in PhD STEM and doctoral students in the health sciences in the United States.

Hypotheses specific to the experiences of this underrepresented population must be tested

through explanatory quantitative studies to ensure generalizability and replication and a larger population sample and demographics, from participants in multiple universities in many states within the United States. Moreover, a follow-up mixed method research would be highly recommended.

The current study's participants all had average GRE scores in Math and Science and the majority of participants had modest scores in English as a Second Language. Yet, they are all highly successful scientists, faculty, and researchers. They all successfully completed their program of studies and graduated. The findings of this study suggest that other factors contributed to their success. Hence, further research on themes that emerged from the study would be beneficial.

I also propose additional studies aimed at replicating my study within different settings and contexts (Bloomberg and Volpe, 2016). Therefore, other qualitative studies such as case studies, ethnographies, and/or action research might yield new findings and different viewpoints. The intersectionality of gender as compared to race and other barriers was more significant for most of the participants in this study. Further studies on how gender affects these women during their doctoral studies and after graduation is warranted. Gender is a crucial factor in STEM and the health sciences at all educational levels. Studies for international doctoral students comparing male and female students is merited.

Lastly, this study investigated participants who were Latinas from South America, one participant from Euro-Asia, and the rest from south Asia. In terms of fundamental religions, it involved Catholics, Protestants, Muslims, and Hindus. Buddhism and other faiths were not included. Cross-cultural studies of international female doctoral STEM and health science

students in the United States from other countries and continents and other religions or faiths, doubt in God's existence, or lack of religion or faith altogether is worthy of inquiry.

### **Researcher's Final Reflections**

In the initial chapter, under the "Role of the Researcher," I provided my personal and educational background. In this section I provide my final reflections. I share and understand the experiences of my participants. Just like them, I received family support and encouragement during my studies. I became resilient and persistent during my studies as an international female STEM graduate student in the United States, relying on my Christian faith and developing networks of support.

I have had the honor to study with peers from all over the world and have been taught by faculty from different continents and have co-workers from many nationalities. For my PhD studies, I specifically chose to study at the University of the Incarnate Word due to the great number of international students who come to study there from all over the world. I feel blessed to count as my dear and closest friends many people from different races, age, gender and gender-orientation; religions and faiths, or lack of it; members of different political parties; philosophies; level of education; socio-economic class from all walks of life; all of whom I respect despite our different point of views or systems of belief.

I started this research in an honest effort to gain more knowledge about successful international female STEM and health science scientists who completed their doctoral programs in the United States. Realizing that all of these international female STEM and health science students faced the same barriers, I sought to find out how the successful ones overcame those barriers, which strategies they used, and what personal attributes contributed to their success.



Because I was more interested in their lived experiences and because I was not sure which factors (other than grades, standardized exams, GRE, GPA, and English as a Second Language scores) would be quantifiable, I chose a qualitative descriptive phenomenology study. I have always believed that the GRE scores by themselves and English as a Second Language (ESL) scores cannot predict academic success for international students, especially in a STEM PhD and in doctoral health science programs. The findings of this study confirmed that belief. The majority of the participants in this study had received average GRE scores and modest ESL scores, yet they all received excellent grades in all their courses, including their most difficult ones, and they excelled in their STEM and health science doctoral programs. Instead, the participants succeeded by forming networks or systems of support with their faculty, academic advisors, mentors, peers, and communities where they lived. They were resilient in the face of multiple and difficult barriers and persevered due to their inner motivation and determination and specific personal attributes. Resilience and perseverance had been taught to them by the experiences of their own family members and/or siblings at different stages of their lives. Moreover, they diligently sought the help they needed whether it was academic, financial, emotional, during conflict-resolution, or death of a family member. They overcame their fears and insecurities and took control of their own knowledge and learning by self-directed means.

I have been honored and humbled by my participants, extremely successful international female STEM and Health Science faculty and researchers working presently in the United States. My participants generously and without any reservations shared their intimate lived experiences with me. I can only hope I give them enough credit as I narrate their stories and share my findings.

Little did my participants, nor I, know that somehow, by divine intervention and God's infinite grace, my participants shared lived stories prepared me to face the most difficult times of my own life and taught me how to become resilient and persevere to finish my dissertation, despite life-threatening illness, facing permanent disability, and grieving the untimely and irreparable death of my only child and son. Then, the COVID-19 pandemic broke out. National violence broke out in a divided and conflicted United States. My husband and I both survived COVID-19 and Omicron. While getting this dissertation ready for publication, I experienced the death of my older brother Oscar Leon Villamizar Bernal in Colombia, South America, during the pandemic, and making long distance decisions to place my 90-year-old mother, who suffers from Alzheimer's, in a nursing home. My younger sister Monica, a dentist in California, went to Colombia during this family crisis, only to catch Covid and had to quarantine in a hotel, unable to return to the United States as planned. We have experienced severe weather conditions in our area and suffered power outages during two extremely cold winter, while sick.

Thousands of international female STEM and health science students in the United States have been displaced, lost funding, and/or lost their international student visas. Many were forced to return to their countries of origin without fulfilling their academic goals. Some experienced the Covid-19 or Omicron. Others lost family members who were abroad and could not attend their funerals. Some fell victims of crime.

In these violent and unprecedented uncertain times, I relied on my Christian faith, systems of support from Church, my university, family, friends, and my dissertation chair committee members, and editor Dr. Patricia Noske, along with my professors of my last course "culminating experience," Dr. Macias and Mr. Duncan Hayse, to finish and publish my dissertation.

During every step of this 5-year research endeavor, I tried to arrive to the *essence* of the participants' lived experiences. I collected data about this phenomenon from multiple perspectives and in different contexts; then spent long hours immersed and actively involved with the data. I conducted rigorous scientific analysis of multiple forms of data. I utilized triangulation of methods across different periods of time and in different places. In this section, I provided my personal voice and now provide the lessons learned. This qualitative research gave me profound knowledge of the experiences of international female students seeking a STEM PhD and doctorates in the health sciences as well as a comprehensive insight of the problem explored. Writing my dissertation was a transcendental personal experience for me. I obtained many qualitative research tools and learned strategic skills for conducting qualitative research. Working within my chosen genre of descriptive phenomenology, I learned to value this qualitative approach inquiring social phenomena and its great value to society at large. Furthermore, whereas before, as a scientist, I was mostly a quantitative researcher. In the field of Higher Education, I was exposed to and trained in qualitative research. I am highly motivated to continue to use qualitative studies, including phenomenology, for future inquiries, scientific phenomena, and social science problems that have yet to be solved and investigated.

## **Conclusions**

This study was conducted to explore the “essence” of the lived experiences of eight international female students in STEM and/or the health sciences in the United States. In this study, I utilized multiple methods of data collection that included a survey for demographics; lengthy semi-structured interviews with open ended questions; second interviews for follow-up, clarification, or to answer specific questions and a third interview for pre-selected participants for *testimonios*; interviews' observations; document analysis; art-based research; and

*Testimonios* (Bloomberg & Volpe 2016). I used triangulation of methods across different periods of time and in different places to collect data about this phenomenon from multiple perspectives and in different contexts.

The participants faced what seemed like unsurmountable barriers such as learning English as a Second Language (ESL); preparing for TOEFL, GRE, STEM, and entrance exams; admission interviews in English; leaving their country of origin, family, and loved ones; acculturation barriers and cultural shock; difficulty finding safe affordable housing; transportation barriers; serious financial barriers and hardship; academic challenges; critical personal incidents during their studies; health problems and mental health issues, and finding affordable health insurance); not having enough time to rest during pregnancy and/or after childbirth; difficulties with finding good affordable childcare; and problems with their research supervisors and/or peers. Furthermore, *Testimonios* revealed that despite their efforts to improve their human capital in the United States, some participants experienced cultural dissonance, discrimination, and sexual harassment as well as gender, cultural, and class microaggressions.

The *Key Findings* for my study revealed that the factors that support success for these international female STEM and Health Sciences doctoral students are:

1. families really provided what was needed (resources broadly defined, including emotional support) specifically for each student to persevere;
2. regardless of specific traditional religion or spirituality, faith gave strength and provided endurance to all participants during crisis;
3. support from academic advisors, research supervisors, faculty and mentors is the number one factor for retention and student success for international female STEM and doctoral health sciences students in the United States;

4. supportive role of peers;
5. balance plays an extremely important role in retention of female International STEM and doctoral health sciences students;
6. those participants who became most resilient were part of a high-risk group that predisposed them to failure, and/or experienced multiple obstacles;
7. the participants were able to persevere due to personal, social, and institutional factors;
8. the participants underwent a process of transformation to create their new doctoral, scientific, and personal identities.

During my lifetime, I have had the honor of considering this problem from different lenses: as a graduate international female STEM student in the United States; as a health science graduate student in the United States; as a science teacher; as a scientist and health science professional; as an adjunct faculty; and as a higher education PhD student and candidate researching and writing this dissertation. All of these experiences gave me the knowledge and strong conviction that the challenge of obtaining more equitable, diverse, inclusive STEM and health sciences doctoral programs in the United States can be achieved if all stakeholders persevere to become agents of change and share their passion for social justice and diversity goals globally.

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## Appendices

## Appendix A: Institutional Review Board (IRB) Approval

July 17 2017

PI: Ms. Maria Cantu Protocol title: Factors for Success of Female International Doctoral Students in  
STEM in the United States

Maria:

Your request to conduct the study titled "Factors for Success of Female International Doctoral Students in STEM in the United States" was approved by Expedited review on 07/17/2017. Your IRB approval number is 17-07-006. Any written communication with potential subjects or subjects must be approved and include the IRB approval number.

Please keep in mind these additional IRB requirements:

- This approval will expire **one year** from 07/17/2017.
- Request for continuing review must be completed for projects extending past one year. Use the **IRB Continuing Review Request form**.
- Changes in protocol procedures must be approved by the IRB prior to implementation except when necessary to eliminate apparent immediate hazards to the subjects. Use the **IRB Amendment Request form**.

Any unanticipated problems involving risks to subjects or others must be reported immediately.

Approved protocols are filed by their number. Please refer to this number when communicating about this protocol.

Approval may be suspended or terminated if there is evidence of a) noncompliance with federal regulations or university policy or b) any aberration from the current, approved protocol.

Congratulations and best wishes for successful completion of your research. If you need any assistance, please contact the UIW IRB representative for your college/school or the Office of Research Development.

Sincerely,

*Ana Wandless-Hagendorf, PhD, CPRA*

Ana Wandless-Hagendorf, PhD, CPRA

University of the Incarnate Word  
(210) 805  
3036  
[wandless@  
uiwtx.edu](mailto:wandless@uiwtx.edu)

## Appendix B: Institutional Review Board (IRB) Approval

January 11, 2021

PI: Ms. Maria Cantu

Protocol title: Φαχτορσ φορ Συχχεσσ οφ Φεμαλε Ιντερνατιοναλ Δοχτοραλ Στυδεντσ ιν ΣΤΕΜ ιν τηε Υνιτεδ Στατες

Maria:

Your request for continued review of Expedited protocol 17-07-006 titled

"Φαχτορσ φορ Συχχεσσ οφ Φεμαλε Ιντερνατιοναλ Δοχτοραλ Στυδεντσ ιν ΣΤΕΜ ιν τηε Υνιτεδ Στατες" was approved. This

approval will expire **one year** from 01/11/2021.

Please keep in mind these additional IRB requirements:

- Request for continuing review must be completed for projects extending past one year.
- Use the **IRB Continuing Review Request** form. Changes in protocol procedures must
- be approved by the IRB prior to implementation except when necessary to eliminate apparent immediate hazards to the subjects. Use the **IRB Amendment Request** form. Any unanticipated problems involving risks to subjects or others must be reported immediately.

Approved protocols are filed by their number. Please refer to this number when communicating about this protocol.

Approval may be suspended or terminated if there is evidence of a) noncompliance with federal regulations or university policy or b) any aberration from the current, approved protocol.

Congratulations and best wishes for successful completion of your research. If you need any assistance, please contact the UIW IRB representative for your college/school or the Office of Research Development.

Sincerely,

Mary Jo Bilicek  
Research Compliance Coordinator  
University of the Incarnate Word  
(210) 805-  
3565  
[bilicek@uiwtx.edu](mailto:bilicek@uiwtx.edu)



### Appendix C: Participants' Personal Invitation Letter

Dear International Female PhD's in STEM fields in the United States or PhD Stem Students pending only Graduation:

My name is Maria P. Cantu I a doctoral student at the University of the Incarnate Word (UIW), completing my dissertation requirement for a PhD. in Education (Higher Education Concentration). I am searching for PhD's in STEM fields or PhD Stem Students pending only graduation like you who meet the following criteria:

- 1) You came to the United States as a "true" International student. "True" international students are defined as those who come from foreign countries but are neither legal residents nor American Citizens by naturalization.
- 2) You are a female.
- 3) You have learned English as a second language.
- 4) You have graduated in a Science PhD or a dual PhD and Professional program in the United States twenty years ago or less in STEM fields.
- 5) You have experienced the phenomenon of migrating to the United States from a foreign country to obtain a PhD research degree in the STEM fields.
- 6) You are willing to share your experiences and perspectives related to the research inquiry.

The purpose of this qualitative phenomenological study is to explore how international doctoral students succeed in their doctoral programs in the United States in the Science, Technology, Engineering and Mathematics (STEM) fields and graduate in a timely manner. I will explore the perceptions of women scientists on their experiences as international doctoral students and what

experiences and attributes contributed to their academic success. I am interested in finding out how these experiences have shaped your academic, professional, and social identity. I also want to explore what experiences or collaboration with others do you believe attributed to your academic success.

Sharing your experiences may help improve American Universities' administration, student affairs, advising and teaching practices as it relates to female doctoral international students in non-conventional fields like the sciences. This study is important because it may improve policy and decision making in the areas of recruitment and retention. The findings have the potential to increase graduation rates of international doctoral female students in the sciences and in education programs in universities in the U.S.

Your participation in the study is voluntarily, and you may withdraw from it at any time. It will be strictly confidential, and no personal identification will be released or published. You can use a pseudonym of your choice. If you volunteer to take part of this study the researcher will ask you to:

- 1) Complete a survey sent you via e-mail to collect demographic data from you and the researcher will ask you return it back by e-mail. The researcher will request that you send her an electronic copy of your Curriculum Vitae (C.V.); list of research articles published; and any academic awards you received. We will input your academic data together in the Demographics Data Survey during our first interview.
- 2) Attend two face-to face interviews which will last 60 to 90 minutes approximately. The interviews will take place at the library in a reserved study room of your university main campus, a private conference room where you conduct research, your office or a private place convenient to you. No one other than you and the researcher will be present.

Location, date and time will be scheduled at your convenience. The researcher will ask your permission to tape record your interview and she will take notes during the interview. During the interviews, the researcher will ask you to tell her specific narratives, vignettes, stories, or testimonies “*Testimonios*” of your lived experiences, perceptions, memories, thoughts, feelings and recollections.

- 3) After completion of the interviews, they will be transcribed. The researcher will use the services of a professional transcriber who has previously signed a confidentiality agreement. The researcher will send you the transcripts via e-mail or ask that you meet again with her or tell her via e-mail if the transcription reflects what you were trying to tell her. She will validate the accuracy of the interviews as written in the transcriptions. You will be given the opportunity to correct, edit, add or delete any part of the transcription that you feel does not agree with what you were trying to tell the researcher.
- 4) The researcher will ask you, on a volunteer basis, to provide her with any art sample (in the various forms) that you used to motivate you or relieve stress while in the STEM Doctoral program or that you think connects to or represents your experience. Representational forms may include music, songs, music scores, dance, photography, videos or films, poems, short stories, novels, theatrical performances, theatrical scripts, parables, comics, and any art form of your choice. Visual representations may include photographs; films or videos; drawings; collages; wall hangings; ceramics; needle point; cross-stich; basket or tapestry weaving; scrap books; or any chosen handcraft that depicts their journeys and experiences as international female doctoral students in STEM, in the United States. I will return these artifacts to you at the end of the study.

You have a story to tell and your experiences, and perceptions on how you have managed to succeed in a very difficult non-traditional academic field despite acculturation, language and any barriers you may have experienced makes you very accomplished. This study will give you the opportunity to share and reflect on your experiences as an international female student in a doctoral or professional program in the STEM fields.

If you are interested in participating, please respond to this e-mail indicating your availability to be interviewed including date and time and sign the participant's consent.

You can reach me at:

Maria P. Cantu, Doctoral Student and Principal Investigator: [mpcantu@student.uiwtx.edu](mailto:mpcantu@student.uiwtx.edu)

(210) 775-8991 (cell phone). Your collaboration is greatly appreciated!

Sincerely,

Maria P. Cantu

Doctoral Candidate

Drebeen School of Education

University of the Incarnate Word

Appendix D: Participant's Informed Consent Form

**Complete Title of Study:** Successful International Doctoral STEM Participant Informed Consent

**Principal Investigator:** Maria P. Cantu

**Dissertation Chair:** Dr. Alfredo Ortiz-Aragon

Dear International Female PhD in STEM Faculty, Researcher, or Doctoral Student Pending Graduation:

My name is Maria P. Cantu, I am a Doctoral Candidate at the University of the Incarnate Word (UIW) Dreeben School of Education (Higher Education Concentration). I will be conducting a qualitative phenomenological research study as part of my dissertation requirements towards my PhD in Education (Higher Education). My dissertation Chair is Dr. Alfredo-Ortiz Aragon, Assistant Professor at University of the Incarnate Word, Drebeen School of Education, UIW, San Antonio Texas. You are invited to contribute and participate in this qualitative phenomenological study about the experiences of international female students in doctoral and professional programs in the STEM (Science, Technology, Engineering or Mathematics) in the United States. The purpose of this qualitative phenomenological study is to explore the perceptions of female scientists on their experiences as international doctoral students and what attributes contributed to their academic success. I also want to explore what experiences or collaboration with others do you believe attributed to your academic success.

You have been invited to participate in the study because you meet the following criteria:

- 1) You came to the United States as a "true" International student. "True" international students are defined as those who come from foreign countries but are neither legal residents nor American Citizens by naturalization.
- 2) You are a female.
- 3) You have learned English as a second language.
- 4) You have graduated in a Science PhD or a dual PhD and Professional program in the United States twenty years ago or less in STEM fields.
- 5) You have experienced the phenomenon of migrating to the United States from a foreign country to obtain a PhD research degree in the STEM fields.
- 6) You are willing to share your experiences and perspectives related to the research inquiry. Your participation is extremely important; you will add to the body of knowledge about international students in the United States in general, international female doctoral students in the United States and international female doctoral student's choices and experiences in non-conventional fields of study like the STEM fields in the United States. Sharing your experiences may help improve American Universities' administration, student affairs, advising and teaching practices as it relates to female doctoral international students in non-conventional fields like the sciences. This study is important because it may improve policy

and decision making in the areas of recruitment and retention. The findings have the potential to increase graduation rates of international doctoral female students in the sciences and in education programs in universities in the U.S.

Prior to the research study being implemented, approval was obtained from the UIW Institutional Review Board (IRB). The IRB Approval Number is 17-07-006. Your participation in this study is strictly voluntary. No interventions or procedures will be conducted. The study poses minimum risks for the participants. No compensation will be provided to the participants due to limited funding. The interviews will be conducted on volunteered basis. If the results of the study are published, you will not be identified in any way. Confidentiality will be maintained including Institutional or University confidentiality. Names will not appear in any data collected, and participants cannot be identified from the demographic data collected. If you feel stressed or uncomfortable during any of the interviews, you may stop at any time. You may choose not to answer any questions that you feel are too personal, either on the demographic data sheet or during the interviews.

If you volunteer to take part of this study the researcher will ask you to:

- 1) Complete a survey sent you via e-mail to collect demographic data from you and the researcher will ask you return it back by e-mail. The researcher will request that you send her an electronic copy of your Curriculum Vitae; a list of research articles published and a list of academic awards you received. We will input your academic data together in the Demographics Data Survey during our first interview.
- 2) Attend two face-to face interviews which will each last 60 to 90 minutes approximately. The interviews will take place at the library in a reserved study room of your university main campus, a private conference room where you conduct research, your office or a private place convenient to you, no one else expect you and the researcher will be present. Location, date and time will be scheduled at your convenience. The researcher will ask your permission to tape record your interview and she will take notes during the interview. During the interviews, the researcher will ask you to tell her specific narratives, vignettes, stories, or testimonies “*Testimonios*” of your lived experiences, perceptions, memories, thoughts, feelings, and recollections.
- 3) After completion of the interviews, they will be transcribed. The researcher will use the services of a professional transcriber who has previously signed a confidentiality agreement. The researcher will send you the transcripts via e-mail or ask that you meet again with her or tell her via e-mail if the transcription reflects what you were trying to tell her. I will validate the accuracy of the interviews as written in the transcriptions. You will be given the opportunity to correct, edit, add, or delete any part of the transcription that you feel does not agree with what you were trying to tell me.
- 4) The researcher will ask you, on a volunteer bases, to provide her with any art sample (in the various forms) that you used to motivate you or relieve stress while in the STEM Doctoral program or that you think connects to or represents your experience. Representational forms may include music, songs, music scores, dance, photography, videos or films, poems, short stories, novels, theatrical performances, theatrical scripts, parables, comics, and any art form of your choice. Visual representations may include photographs; films or videos; drawings; collages; wall hangings; ceramics; needle point; cross-stich; basket or tapestry weaving; scrap books; or any chosen handcraft that depicts their journeys and experiences as international

female doctoral students in STEM, in the United States. I will return these artifacts to you at the end of the study.

You have a story to tell and your experiences, and perceptions on how you have managed to succeed in a very difficult non-traditional academic field despite acculturation, language and other barriers makes you very accomplished. This study will give you the opportunity to share and reflect on your experiences as an international female student in a doctoral or professional program in the STEM fields.

Signing this form indicates your consent to participate in this research project. You will receive a signed copy of this form for your personal records. If you choose not to take part or to stop at any time, it will not affect your current and future status at your department and University in the United States or your place of employment in the United States. Furthermore, your decision not to participate will not adversely prejudice future interactions from the researcher and/or the University of the Incarnate Word (UIW) with your institution. By signing this form, you indicate you understand and agree to the following:

- ☐ The researcher will tape record and take notes during observations, interviews, and conversations between me as the researcher and you as a participant.
- ☐ The records and data will be kept by the researcher and shared confidentially with the Dissertation Chair Dr. Alfredo Ortiz- Aragón, Associate Professor, Drebeen School of Education and with two Dissertation Committee members at The University of the Incarnate Word (UIW): Dr. Julie, W. Nadeau, Associate Professor Ila Faye Miller School of Nursing and Health Professions (2018), UIW and Dr. Sandra Guzman-Foster, Assistant Professor Dre4een School of Education, UIW.
- ☐ I will keep and analyze the data for one and a half years for research and educational purposes after the last date of data collection. After the completion of the study the art pieces will be returned to you. No personal identifiers about you, while taking part of this study will be published or given to others. You can choose a pseudonym of your choice to be used in the study. If you do not provide me a pseudonym, I will assign you one or a number.
- ☐ Minimum risks are expected; however, if you experience any discomfort or stress during the observations, interviews or while keeping the diary then you may discontinue your participation in the study, and it will not affect your current or future status in your department or university. If you discontinue participation during the study all records and data will be destroyed or deleted immediately.
- ☐ ***The researcher will not use your personal information for any purposes outside of this research project. Additionally, the researcher will not include your name or any other identifiers in any reports of the study. Parts of your interviews, including direct quotes, may be printed in the dissertation, but your real name and or personal identifiers will not. Your demographic data may be used along with that of other participants to describe the research sample, but it will not include your name, name of your institution nor any other personal identifier. You have the right to request to review the researcher's manuscript prior to final submission***
- ☐ ***You have the right to refuse to answer any question that makes you feel uncomfortable or that you perceive it as an invasion of privacy.***

- ☐ The researcher has the right to refuse to answer any question that makes her feel uncomfortable or if she perceives it as an invasion of privacy.
- ☐ All raw data will be kept in a locked cabinet under lock and key in the Dreeben School of Education. Electronic files will be password protected. The data will be destroyed by shredding or deleted five years after completion of the study.
- ☐ The researcher cannot guarantee that there will be any benefits derived from taking part of the study.
- ☐ Your decision not to participate will not adversely prejudice future interactions with your institution.

The researcher will be available for questions now and during the entire research project. Please feel free to contact me at:

UIW Doctoral Candidate (Researcher): Maria P. Cantu,

Cell phone: (210) 775-8991

E-Mail: [mpcantu@student.uiwtx.edu](mailto:mpcantu@student.uiwtx.edu)

Or you may contact my dissertation Chair Dr. Alfredo Ortiz- Aragón if you have any questions

At: 210.805.2545 (work) e-mail address: [alortiz1@uiwtx.edu](mailto:alortiz1@uiwtx.edu)

You may Contact Dr. Ana Wandless-Hagendorf, PhD, CPRA, Research Officer UIW Administration Building, Suite 1A. e-mail address: [wandless@uiwtx.edu](mailto:wandless@uiwtx.edu)  
Phone number:(210) 805-3036 (work) for questions regarding the IRB or your rights as a participant.

### **Statement of Consent:**

I have read all the above information, and I have had the opportunity to ask and receive answers to my questions regarding the study. I believe I understand the study well enough to make a decision about my participation. By signing below, I agree to the terms described above.

Electronic signatures are regulated by the Uniform Electronic Transactions Act. Legally, an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically.

Printed Name of Participant \_\_\_\_\_

Date of Consent \_\_\_\_\_

Participant's Written or Electronic\* Signature \_\_\_\_\_

Researcher's Written or Electronic\* Signature \_\_\_\_\_

Electronic signatures are regulated by the Uniform Electronic Transactions Act. Legally,



an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically.

## Appendix E. Sample Survey for Demographic Data

Thank you for agreeing to participate in this study! Please complete the survey below and return To me via e-mail or in the self-stamped envelope I provided you during the pre-interview.

Please note that the information collected in this questionnaire is completely confidential and will only be used for the purposes of this research study. **You do not have to answer any questions that make you feel uncomfortable, that you consider are too personal, or that you perceive as an invasion of privacy.**

Pseudonym of your choice \_\_\_\_\_

### Demographic Data Sheet

#### Personal Demographics

1. My gender is: \_\_\_\_\_ Female \_\_\_\_\_ Male

2. My age is: \_\_\_\_\_ 23–30 \_\_\_\_\_ 31–40 \_\_\_\_\_ 41–50 \_\_\_\_\_ 50+

3. Race/Ethnicity: White \_\_\_\_\_ Black \_\_\_\_\_ Asian \_\_\_\_\_

Hispanic/Latina \_\_\_\_\_ Other \_\_\_\_\_

4. Do you have a disability? YES \_\_\_\_\_ NO \_\_\_\_\_ DO NOT KNOW

\_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

5. If previous answer was yes. Please state type of disability:

Physical \_\_\_\_\_ Emotional \_\_\_\_\_ Learning Disability \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

Name of Disability: \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

6. Country of Origin: \_\_\_\_\_

7. Continent of Origin: \_\_\_\_\_

8. Number of Nationalities [Number of Countries in which you are a citizen]: \_\_\_\_\_  
 State Nationalities [Or Countries in Which you are a citizen by birth, or  
 naturalization]: \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

9. Level of Education Completed **BEFORE** being accepted to Doctoral Program:

10. Bachelor's Degree \_\_\_\_\_ Master's Degree \_\_\_\_\_ Second Master's \_\_\_\_\_

Doctoral Professional/ or another PhD \_\_\_\_\_

11. Number of years of prior work experience you had before you completed your STEM  
 PhD in the United States:

\_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

12. Were you in a dual PhD or Professional Doctor Program (such as M.D/PhD) while in the  
 United States? YES \_\_\_\_\_ NO \_\_\_\_\_

13. Type of visa you had while a PhD student or completing your studies:

\_\_\_\_\_  
 \_\_\_\_\_

14. Marital Status:

Single \_\_\_\_\_ Married \_\_\_\_\_ Divorced \_\_\_\_\_ Widow \_\_\_\_\_

Prefer NOT to answer \_\_\_\_\_

15. If married, did your husband/spouse come to the United States to live with you while you  
 were a Doctoral student? YES \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer

\_\_\_\_\_

16. Do you have children? Yes \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer

\_\_\_\_\_

17. If previous answer was yes. How many children do you have? \_\_\_\_\_

Prefer NOT to answer \_\_\_\_\_

18. What age(s) are your children?

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Prefer NOT to answer \_\_\_\_\_

19. Did your children live with you while you completed your PhD in the United States?

YES \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

20. Current Job or Position Title:

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Prefer NOT to answer \_\_\_\_\_

21. Name /City/State of University Attended for PhD and or Professional Studies in the United States (specify program and Department)

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21. STEM Discipline of PhD or Doctoral/Professional Studies:

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22. Research Interests: \_\_\_\_\_

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23. Number of Publications completed as an International PhD Student:

\_\_\_\_\_

24. Did you already graduate? YES \_\_\_\_\_ NO \_\_\_\_\_

25. If previous answer is YES, which year did you graduate? \_\_\_\_\_

26. Native Language \_\_\_\_\_

27. Other Languages Spoken other than your native or primary Language \_\_\_\_\_

\_\_\_\_\_

28. Total number of years in the English as a Second Language (ESL) or English Language

Institute : \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

29. Did you have a scholarship from your country of origin when you came to the United States?

YES \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

30. Did you have a Doctoral or Graduate assistantship from your department or University while completing your PhD in the United States?

YES \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

31. If previous answer was yes. What type of Doctoral or Graduate assistantship did you have?

Teaching Graduate/Doctoral Assistantship: YES \_\_\_\_\_ NO \_\_\_\_\_

Research Graduate/Doctoral Assistantship: YES \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer

\_\_\_\_\_

32. I financed my STEM PhD in the United States by means of (Please check all that apply):

Personal funds \_\_\_\_\_ Family funds \_\_\_\_\_ Country of Origin Financial support \_\_\_\_\_

Country of Origin Scholarships \_\_\_\_\_ Country of Origin Study Loans \_\_\_\_\_

Teaching Graduate/Doctoral Assistantship \_\_\_\_\_

Research Graduate/Doctoral/Assistantship \_\_\_\_\_

US Scholarships \_\_\_\_\_ US Fellowships \_\_\_\_\_ Other \_\_\_\_\_ Prefer NOT to answer

\_\_\_\_\_

### Family Data

33. The number of household members in my country-of-origin family including myself was \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

34. Do you have any siblings? Yes \_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

35. If answered yes. I have (please state how many) \_\_\_\_\_ brothers Prefer NOT to answer

\_\_\_\_\_

36. Please state your brothers ages \_\_\_\_\_ Prefer NOT to answer

\_\_\_\_\_

37. I have (please state how many) \_\_\_\_\_ sisters. Prefer NOT to answer \_\_\_\_\_

38. Please state your sisters ages \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

39. The primary language spoken at home when I was growing up was: \_\_\_\_\_

40. Other languages spoken at home were: \_\_\_\_\_

41. The highest level of education completed by my father is (was):

Some high school \_\_\_\_ High school graduate \_\_\_\_ Some college \_\_\_\_

2-year College Graduate \_\_\_\_ 4-year College Graduate \_\_\_\_

Graduate School Master's Degree \_\_\_\_ PhD/Doctoral/Professional Degree \_\_\_\_\_

Other (please describe) \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

42. The highest level of education completed by my mother is (was):

Some high school \_\_\_\_ High school graduate \_\_\_\_ Some college \_\_\_\_

2-year College Graduate \_\_\_\_ 4-year College Graduate \_\_\_\_

Graduate School Master's Degree \_\_\_\_\_ PhD/Doctoral/Professional Degree \_\_\_\_\_

Other (please describe) \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

43. The highest level of education completed by my siblings (brothers and/or sisters) is/was:

Some high school \_\_\_\_ High school graduate \_\_\_\_ Some college \_\_\_\_

2-year College Graduate \_\_\_\_ 4-year College Graduate \_\_\_\_

Graduate School Master's Degree \_\_\_\_ PhD/Doctoral/Professional Degree \_\_\_\_\_

Other (please describe) \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

44. Please answer the following: I am [will be] the first member of my family from my country of origin to earn a PhD/ Doctoral and or Professional Degree: YES \_\_\_\_\_ NO \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

45. Please answer the following: I am [will be] the first member of my family from my country of origin to earn a PhD/ Doctoral and or Professional Degree in STEM (Science, Technology, Engineering/Mathematics Fields: YES \_\_\_\_\_ No \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

46. While I was an International PhD/Doctoral and or Professional Student in the United States my country-of-origin family's average yearly income in US Dollars was:

Less than \$25,000 per year \_\_\_\_\_ \$25,000-\$55,000 \_\_\_\_\_

\$55,0001-\$75,000 \_\_\_\_\_ \$75,001-\$100,000 \_\_\_\_\_ Greater than \$100,000 per year \_\_\_\_\_

Do NOT know \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

47. While I was a STEM PhD/Doctoral Professional Student Fulltime in the United States as an International Student, the number of household members in my immediate family was \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

48. My country of origin's; personal and or family contribution to finance my PhD while in the United States was approximately:

Less than 25% \_\_\_\_\_ From 25%-50% \_\_\_\_\_ From 51%-75% \_\_\_\_\_

From 76%-100% \_\_\_\_\_ Prefer NOT to answer \_\_\_\_\_

**Academic Records Data (to be completed by the researcher and the participant together from their review of the participant's records)**

Total Doctoral or PhD GPA \_\_\_\_\_

Total Courses Completed During STEM PhD Degree (State Courses):

Date of Successful Completion of Qualifying Exams \_\_\_\_\_

Date of Successful Dissertation Defense \_\_\_\_\_

Graduation Date [or Registered Date of Up-Coming Graduation] \_\_\_\_\_

Awards/Grants/Fellowships/Honors \_\_\_\_\_

Number and Titles of Publications:

Conferences Attended:

Professional Associations:

Curriculum Vitae Available: YES \_\_\_\_\_ NO \_\_\_\_\_

Thank you for completing this questionnaire! Your time and participation are very much appreciated and will contribute to a growing knowledge base on experiences and perceptions surrounding female international PhD students in the STEM (Science Technology Engineering and Mathematics) in the United States.



## Appendix F. Interview Protocol

Date:

Place:

**Instructions or Memos to myself:** Arrive early and check if equipment is in working order use Laptop with Audacity software, digital tape-recorder, and I-phone for back-ups. After the interviewee arrives greet her with warmth and politeness. The signed participant's consent should have arrived in advance. If it has not been provided, make sure the interviewee has signed participant's consent **before** proceeding with the interview. Review the purpose of the study, IRB, confidentiality, researcher's contact information, and inform the participant once again that she may withdraw from the study at any time if she so chooses.

**Greeting:**

Good morning! (Or Good afternoon!) I am very happy that you are here. Thank you so much for agreeing to be interviewed. You are invited to contribute and participate in this qualitative phenomenological study about the experiences of international female students in doctoral and professional programs in the STEM (Science, Technology, Engineering or Mathematics) in the United States. The purpose of this qualitative phenomenology study is to explore how international doctoral female students succeed in their doctoral programs in the United States in the Sciences and graduate in a timely manner. I am interested in finding what are the lived experiences of successful female scientists who earned a PhD as international doctoral students in the Sciences in the United States. Furthermore, I want to know:

- ☐ What factors did participants perceive enabled and constrained them to complete their program of studies and graduate in a timely manner
- ☐ What barriers did successful international doctoral female students experienced in science fields in the United States
- ☐ How the successful international doctoral female students in science fields in the United States navigated these barriers.
- ☐ What attributes do international doctoral female students in science fields in the United States credit to their academic success?

Please allow me to ask the following questions:

### **Interview Questions**

#### **Introductory Questions**

- 1) Why did you choose the United States to pursue your PhD studies? Were you in the United States before? Did you pursue any studies before in the United States?
- 2) Tell me about your admission experience in the university where you pursued [or are completing] your PhD in STEM and departmental experience in your STEM program of study.

#### **Broad Open-Ended Questions**

I am interested in your experiences and perceptions as a successful female international STEM Doctoral student in the United States. Please share with me your specific experiences and any barriers you encountered. Think of where you were, what you were feeling, and other persons who were involved.

#### **Possible Structured Questions**

The following structured questions may be asked following Moustakas (1994 p.116):

- 1) What dimensions, incidents and people intimately connected with the experience stand out for you?
- 2) How did the experience affect you? What changes do you associate with the experience?
- 3) How did the experience affect significant others in your life?
- 4) What feelings were generated by the experience?
- 5) What thoughts stood out for you?
- 6) What bodily changes or states were you aware of at the time?
- 7) Have you shared all that is significant with reference to the experience? (p. 116)

### **Probing Questions (Which might be used)**

I will listen carefully to the participants' responses and ask proving questions based on the participants' previous stated questions. I will follow Raymon Gorden (as cited by Given & Saumure p. 682) proving strategies. The following probing questions were adapted from follow Raymon Gorden (as cited by Given & Saumure p. 682)

1. *The silent probe—in which I will refrain from talking—allowing the participants to select the topic to talk about the topic in the least intrusive manner which is meaningful to them.*
2. *Encouragement to participants to continue will be conveyed by non-verbal communication such as head nods, facial expression, gestures, or short sounds such as “mm” and “uh huh.”*
3. *Probes to participants to obtain more information. For example: “Tell me more about that.” “What happened then?”*

4. Probes to obtain further clarification. *For example, “You mentioned x, tell me who was involved at that time?” or “What happened after you had complaint to y?”*
5. *Probes that require retrospective elaboration of statements provided earlier [May be used in second interviews]: “Earlier [or during the first interview] you mentioned that you were involved in z; thinking back to that time you experienced this incident, tell me more about that.”*
6. *Probes focused on retrospective clarification to obtain specific information about what was mentioned earlier. For example: “You mentioned before about the very first time you heard about*  
*x. Describe that event in detail— What was that like for you?” Was anyone with you at the time?*
7. *Mutation. Using previous statements to expand the topic to a new subject. For example, “You’ve mentioned how you became involved in z, and what that was like for you. Tell me about your family’s responses to that.”*

*Specifying Questions. I will follow Brinkmann & Kvale (2015 p.161) to obtain feedback with additional operationalizing questions. For Example: “What did you do when you were experiencing high levels of anxiety?”, “Did you have a physical reaction after that incident?”*

## Appendix G: Participant Identifying Information

Phenomenological Research Study Pseudonym \_\_\_\_\_

Real Name \_\_\_\_\_

Participant Number \_\_\_\_\_ [\*If the participants do not choose a pseudonym, I will assign a number and a pseudonym]

Professional ID or Student ID Number \_\_\_\_\_

Employer [Name of University or Research Center] \_\_\_\_\_

Employer's Address \_\_\_\_\_

Telephone number (work) \_\_\_\_\_

Telephone number (cell phone) \_\_\_\_\_

Telephone number (home, if available) \_\_\_\_\_

Personal Address [if available] \_\_\_\_\_

E-mail address \_\_\_\_\_

## Appendix H: Transcriber Confidentiality Agreement

## Transcriptionist Confidentiality Agreement

I, \_\_\_\_\_, hereby agree to maintain confidentiality

(Complete Name of Transcriptionist)

of all tape-recorded interviews, that I have been contracted to transcribe for the following Research Project: Factors for Success of International Female Doctoral Students in STEM in the United States. I agree to not share or discuss any tape-recording or transcription with any individual other than the researcher Maria P. Cantu or the Dissertation Chair Dr. Alfredo Ortiz-Aragon from the Dreeben School of Education at the University of the Incarnate Word.

Upon completion of the transcriptions, I will return all the audio-recordings to the researcher and I will transfer all electronic files to the researcher. Upon confirmation of receipt of all these files by the researcher; I will destroy all original electronic files.

Signature of Transcriptionist \_\_\_\_\_

Date: \_\_\_\_\_

Appendix H: A Sample of Data Analysis Following the Steps of Transcendental Phenomenology following Moustakas (1994), Modification of Van Kaam's Method of Analysis

The Data Analysis was for April (Participant 12132017).

**Theme 2. Overcoming Critical Personal Incidents:**

**C. Sub-theme Facing Separation from a Husband or Boyfriend**

**Textural Description for April (Participant 12132017).** When April came to the United States to pursue her PhD in Microbiology and Immunology, she was separated from her then boyfriend [who later became her husband] for three years. This was emotionally very difficult for both of them:

*We were separated for three years. And so, it was really difficult. Even from the distance that they used to write [her family and boyfriend] me letters or send me emails. You know, keeping my encouragement up, and that was big for me because, you know, I know they were there. You know? All the time. And they knew all my activities. They knew how my schedule was when I had an exam. You know, they sent me a little note, "Wishing you the best." And if I do well, they'll celebrate, you know, with me from the distance. (April)*

**Structural Description for April (Participant 12132017).** April stayed by herself during the first three years of her PhD in Microbiology and Immunology in the United States leaving her boyfriend in her country of origin, keeping a long-distance relationship through letters and e-mails. She went back during Christmas the first and second year of her PhD:

*I used to go back every year for the holidays for Christmas home. So, I did that my second year. My first year and second year, right? But every time I had to come back, it was harder to leave everybody there, you know? To the point that, you know, I told my mom, and I told my husband now, but we were still dating, that I was not going to come home again until I graduated because it was just so painful to leave them. And so, what we did is that my husband [then boyfriend] came the following summer because I wasn't planning to go home. (April)*

**Textural-Structural Description April (Participant 12132017).** April carried a long-

distance relationship with her then boyfriend [who later became her fiancée] and stayed behind in their country of origin. Visa restrictions, financial limitations and the professional job of her boyfriend were the main reasons for this emotional taxing separation:

*So, he came in the summer to visit me and, you know, once he saw, you know, the environment that I was seeing—you know, how much I had to study, he knew about my research. And I told him, “Oh, my God. If you go...” You know because it was so nice to have him here. You know, for a few weeks. And we actually started looking—at the time, he was an assistant professor back home. And we started looking for opportunities for him, right? He’s a chemical engineer. But we were looking for things in science, too. And so basically, he went back home, but we ended up—I ended up going home again and we got married. And then we came back together. (April)*

April was able to go back to her native country, get married and bring her newlywed husband to the United States during her third year of her PhD.

*In my third year. So, we got married and my wonderful mentor actually hired him as a technician so that, you know, we could have a little bit of stability. And so, he worked basically, in the same lab that I was doing my graduate work. And I was able, you know, to graduate. (April)*