EXPLORING THE ADOLESCENT EXPERIENCES OF LATINAS IN STEM AND HOW IT RELATES TO RETENTION

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Emily Melzer Jackson

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Major Professor: Serena Morales, Ph.D.

AUTHORIZATION TO SUBMIT

DISSERTATION

This dissertation of Emily Melzer Jackson, submitted for the degree of Doctor of Philosophy with a major in Educational Leadership and titled "Exploring the Adolescent Experiences of Latinas in STEM and How It Relates to Retention," has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies.

Major Professor — DocuSigned by: Dr. Serena Morales (3D2D107AB9B447E...) Dr. Serena Morales — Date 4/4/2024 | 07:45:35 PDT

Committee Members — DocuSigned by: Dr. Diana Garza (CB533C46DF7C4D8...) Dr. Diana Garza — Date 5/6/2024 | 16:07:56 PDT

DocuSigned by: Barbara Laux (8FD7CF749BEC452...) Dr. Barbara Laux — Date 5/7/2024 | 05:09:50 PDT

Doctoral Program Director — DocuSigned by: Heidi Curtis (18C507285A124B4...) Dr. Heidi Curtis — Date 5/7/2024 | 07:44:44 MDT

Discipline's College Dean — DocuSigned by: Dr. LoriAnn Sanchez (1F6287564ACC4DC...) Dr. LoriAnn Sanchez — Date 5/7/2024 | 10:43:14 MDT

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ABSTRACT

Women are underrepresented in the STEM workforce. This is due to microaggressions, gender biases, preconceived assumptions about their abilities, a lack of mentorship, and limited opportunities for advancement. While women are underrepresented as a whole, the deficit is even larger when it comes to Latinas, who only make up a fraction of the already low numbers of females in the STEM workforce. Girls and boys perform the same in math and science during adolescence and show equal interest in those two subjects, yet girls tend to choose alternative career paths and lose interest in these subjects as they get older. This study explored the experiences of Latinas, who are currently enrolled in an undergraduate STEM college. This study measured feelings of belonging and experiences in school that impacted participants' continuing education in STEM. The goal of the study was to analyze the participants' experiences inside and outside of school, to determine how those experiences impacted their retention in STEM. The results showed that Latinas tremendously benefit from mentorship and out-of-school programs that give them real world, hands-on experiences.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter One: Introduction

The number of available STEM jobs in the United States is increasing, which means the demand for qualified individuals is, too (Howard et al., 2020; McGee & Bentley, 2017; Nation et al., 2019; Wendt et al., 2018). STEM careers can pay 26% more than other jobs, making them highly appealing and profitable trades (Dunlap et al., 2019; Fernandez, 2018; Ramsey, 2021; Wendt et al., 2018). Despite the financial and exploratory potential of a STEM career, these roles are still disproportionately dominated by males, specifically White and Asian males (Misra et al., 2022; Robnett & John, 2020; Stevenson et al., 2019). When women make STEM their career, they are subjected to microaggressions, discrimination, and psychological pressures which inhibit and put undue pressure on them (Armstrong & Jovanovic, 2017; Myers et al., 2019; Sanchez et al., 2019; Yang & Carroll, 2018). This unequal and unwarranted treatment causes women to pursue other careers and leave a field that they have a passion for just so that they can avoid the constant negativity (De Souza & Schmader, 2022; Powless et al., 2022; Robnett & John, 2020; Yang & Carroll, 2018). Our nation's future hinges on our ability to prepare the next generation to be internationally competitive and innovative in science, technology, engineering, and math (Howard et al., 2020), and without the unique viewpoints of women, we will not be able to keep up with the advancements being made by other countries (Howard et al., 2020; McGee & Bentley, 2017).

STEM interest is generated among students at the elementary level, but in many schools and communities in the United States, there are low student academic aspirations, a lack of STEM role models, and no access to advanced STEM curriculum leading to what is known as a leaky pipeline (Collins et al., 2020; Howard et al., 2020; McGee & Bentley, 2017; Morton & Parsons, 2018; Sanchez et al., 2019; Sayilgan et al., 2022; Sheffield et al., 2017; Wheeler & Hall,

2021). Females who maintain their pursuit of STEM into the undergraduate level are left to navigate the process primarily alone, with little support or guidance from their classmates, professors, and advisors (Park et al., 2020; Rodriguez & Blaney, 2021). In addition, Latinas potentially face immense pressure from their family to do well and be successful not only for themselves, but for the benefit of their family. This mentality of family as the priority and family over all others is known as Familismo, and is a driving force for success in the Latinx community (Rodriguez et al., 2021).

Familisimo is seen as a protector from the stressors Latinas have in their day to day lives, because no matter what comes their way, their family supports psychological well being (Montoro & Ceballo, 2021). This mentality creates strong ties and bonds between Latinx families, which is also where the pressure to do well originates, particularly when the young female is the only person in their family who has been, or who is currently going, to college (Covarrubias et al., 2021; Montoro & Ceballo, 2021; Rodriguez et al., 2021; Stevenson et al., 2019).

In the United States, the first person in a family to go to college or a university is known as *first-generation* and comes with the responsibility to bring pride to the family (Vasquez et al., 2018). Going to college brings about the resources and experiences to potentially pull families out of a fraught situation. For example, if a family is economically insecure, attending college will allow the student to provide for their family more than they would be able to do without the degree (Vasquez et al., 2018). The role of first-generation student also leaves Latinas feeling guilty as they go off to college and leave their family behind to deal with responsibilities at home without them (Covarrubias et al., 2021). The family challenges only compound the struggles with enrollment that can cause many Latinas to not pursue college in the first place, including

expensive application fees, confusing enrollment language, and a lack of entry level advisership (Jackson et al., 2013; Li Huang et al., 2021; Wilkins-Yel et al., 2022; Wright et al., 2021).

During post university years, as females enter their STEM careers, they are faced with obstacles that make it hard to stay in the field (Dunlap et al., 2029; Frederick et al., 2020; Petersen et al., 2020; Powless et al., 2022). STEM careers are primarily male dominated and often come with reports of isolation, intimidation, negative bias, and no opportunities for advancement (Misra et al., 2022; Powless et al., 2022; Robnett & John, 2020). A negative work environment also bleeds into women's personal lives and impacts their mental health and romantic and family relationships, which further increases the likelihood of them leaving the field, despite having achieved their goal of a STEM career (Dunlap et al., 2019; Wilkins-Yel et al., 2022).

It is necessary to gather more information on female adolescent experiences in STEM, so that the point of youth withdrawal from the field can be disrupted (Bystydzienski et al., 2015). Studies on adolescent retention are not commonly performed by researchers because they tend to focus primarily on experiences of women in the STEM workplace and undergraduate experiences at the university level instead (Brue, 2019; Falco & Summers, 2019; Morton, 2021; Myers et al., 2019; Powless et al., 2022; Ramsey, 2021; Rodriguez et al., 2021; Villa et al., 2020; Warren & Bordoloi, 2021). There has been an increase in research on the positive impact of afterschool programs, but that still does not address what is, or is not, happening in the classroom where most Latinas spend their time (Boekeloo et al., 2017; Bystydzienski et al., 2015; Donmez, 2021; Eisenhart & Allen, 2020; Nation et al., 2019; Pattison et al., 2018; Wade et al., 2021; Young et al., 2019). The gap that currently exists among young women in STEM will not be

closed unless necessary attention is given, and soon (Rincón & Lane, 2017; Stevenson et al., 2019).

Statement of the Problem

The deficit of Latinas in STEM majors and careers can be attributed to a lack of mentorship, unequal access to resources, and low self-efficacy throughout elementary to graduate level (Ackert et al., 2021; Armstrong & Jovanovic, 2017; George et al., 2020; Sanchez et al., 2019). While microaggressions at the university and professional level are largely to blame for women choosing career paths other than STEM, a more finite focus needs to be placed on adolescent years to address why there is disengagement and a loss of interest in STEM in the first place (Boekeloo et al., 2017; Nation et al., 2019; Young et al., 2019; Yu et al., 2021).

Perceived academic abilities are generated and nurtured heavily during K-12 years, which means interventions need to take place during these early years in order to increase STEM retention into college and career (Ackert et al., 2021; Collins et al., 2020; Howard et al., 2020; S. Jiang et al., 2020; Morton & Parsons, 2018; Sampson & Clayton, 2021; Sayilgan et al., 2022; Young et al., 2019). According to the World Health Organization, adolescence is the time in someone's life between the ages of 10 and 19 when a great deal of critical development occurs, and children become adults. It is also a time when peer conformity takes a lead and youth start to pay more attention to what their peers are doing, rather than pursuing what they may be interested in (Leaper et al., 2012). The transition into adulthood also includes an increase in responsibilities and more freedom to make choices that are based on interests (Young et al., 2019). Intervention is critical in the adolescent years because it is the time when youth begin to develop a stronger sense of what activities are enjoyed and what potential career explorations can occur, but their desire to fit in and the negative stereotypes and messages they are receiving from

those around them often take precedence (Donmez, 2021). Academic experiences in K-12, particularly middle and high school years, are important to study further to pinpoint what experiences were had that increased STEM resilience (Swafford & Anderson, 2020).

When it comes to Latina students pursuing STEM careers, it is not known why the numbers of retention are the lowest of all the underrepresented groups (Collins et al., 2020; Falco & Summers, 2019; Frederick et al., 2020; McKellar et al., 2019; Yu et al., 2021). Many theories include a lack of mentors, both in school and in the workplace (Howard et al., 2020), while others say the issue lies in their familial expectations and the pressures that Latinas face on a daily basis (Dunlap et al., 2019; Rodriguez et al., 2021). It has also been suggested that for decades, the achievements of marginalized females have been systematically hidden and diminished, meaning that there have been great strides and discoveries in STEM, but because the findings were published by women, they have been brushed aside or not given the credit they deserved (Sanchez et al., 2019). This reality is a disservice to the work and contributions women have made and are continuing to make in the field, therefore deeming it critical to find the root of the issue so that women are recognized as influential contributors of scientific developments (McGee & Bentley, 2017).

Women are consistently underrepresented in the STEM workforce as well as in the world of academia (Misra et al., 2022; Petersen et al., 2020; Rodriguez & Blaney, 2021; Sampson & Clayton, 2021; Yang & Carroll, 2018). This issue needs immediate attention because the growth of science, technology, engineering, and mathematics educational fields and occupational sectors holds promise for U.S. global competitiveness and for individual and family socioeconomic mobility (Ackert et al., 2021; McClintock et al., 2021; McGee & Bentley, 2017; Richardson et al., 2019). Without a look into the reasons why there is such little retention of females in STEM

fields, specifically from underrepresented groups, the United States will not reach its full potential and will fall further behind other countries (Okahana et al., 2018).

When women in STEM are the focus of a research study, the data and results tend to include women from all ethnicities and backgrounds. White and Asian women account for close to 25% of the STEM workforce population, but Latinas specifically make up just under 3% of the present day STEM workforce (Armstrong & Jovanovic, 2017; O'Brien et al., 2015; Morton, 2021; Robnett & John, 2020). Latinas are not represented adequately to match the population size of Latinas in America, which is why concern for this population in the field is valid and requires attention (Ackert et al., 2021; Stevenson et al., 2019; Villa et al., 2020). The Latino and Latina population, while still considered a minority, are quickly becoming the majority and despite this fact, the numbers of individuals from Latin descent in exploratory careers are not growing at the same rate (Rodriguez et al., 2021; Young et al., 2019).

Purpose of the Study

The purpose of this study is to explore the connection between Latinas in STEM and their adolescent experiences that influenced their interest in science and math subjects through their K-12 years. The goal is to better understand how the experiences girls had in school connect to a successful transition into higher education and then into careers. The experiences young girls have in STEM contribute to whether or not they continue to pursue it, which is why this research is so important (Aragón et al., 2017; Bouchey & Harter, 2005; Preininger, 2017; Reding et al., 2017; Veldman et al., 2021; Zhao et al., 2018). As the world continues to move, grow, and develop, the United States must keep up and be able to contribute and without the minds of females, opportunities and advancements will be missed (Castellanos, 2018; McGee & Bentley, 2017).

Hearing the voices of Latina students who are currently in their undergraduate years will allow for a better understanding of what the variables were in their lives that positioned them for their present environment. This research will enable clarity regarding the origins of STEM identity and belonging, and trace contributions to the path that ultimately led to a STEM career. Surveying and interviewing participants will allow Latina voices to be heard. The key to STEM retention lies in the actual lived experiences of the Latinas who agree to be participants in this study. Their memories, thoughts, perceptions, and ideas cannot be assumed and must be heard directly from the person who was and is currently living it.

Background

Women are often stereotyped simply for their gender (Fernández-Garcia et al., 2019). As they grow up and show interest in careers related to math and science, their classmates, teachers, and families often assume they will want to pursue a nurturing job such as a teacher or nurse (Ramsey, 2021). Instead of solving worldwide problems and curing diseases, many women choose a career that they do not have a passion for purely out of obligation or external pressures (Boekeloo et al., 2017; Ferguson & Martin-Dunlop, 2021; Stevenson et al., 2019). A young girl's family and teachers, who share a majority of their time, are central individuals in encouraging girls to explore fields they find interesting, especially when they are not considered typical for a female (Jackson et al., 2013; Rodriguez et al., 2021; Stevenson et al., 2019; Zhao et al., 2018).

A young girl's primary guardian(s) also hold a crucial role in supporting them with their exploration and continued pursuit of STEM (Dunlap et al., 2019; Fernández-García et al., 2019; Wilkins-Yel et al., 2022). When conducting a study with a focus on Latinas, it is important to understand how Familisimo can simultaneously be a support and a burden on young women (Fernández-García et al., 2019; Lee et al., 2020). Active involvement and support from family

creates a safety net for girls to try new paths, and also allows for the caretaker to better understand the child's interest, rather than assuming they already know the career the child will want to pursue (Dunlap et al., 2019; Fernández-García et al., 2019; Wilkins-Yel et al., 2022). Latin culture relies heavily on family and the opinions of family, and this results in strong familial bonds, both when it comes to nuclear and extended family (Ackert et al., 2021; Fernández-García et al., 2019; Lee et al., 2020; Rodriguez et al., 2021). These connections are often presented as a positive support for females, but also taps into the territory of pressure and expectations that are set too high (Fernández-García et al., 2019; Rodriguez et al., 2021).

Bandura's Social Learning Theory supports the study of retention because of its emphasis on how a student's surroundings influence career decisions, and how young children are molded by their environment (Stewart et al., 2020). When a young girl is surrounded by family, especially when she comes from a family centered culture, family is something that will play a crucial role in her development and continued pursuit of STEM (Chang, 2017; Leaper et al., 2012; Rodriguez et al., 2021).

Spending extracurricular time in STEM programs can help increase interest and retain young girls further than just their primary and early adolescent years (Wheeler & Hall, 2021; Young et al., 2019; Yu et al., 2021). The current literature related to extracurricular activities is beneficial for learning how to expose and introduce young girls to STEM in a way that is more engaging, and allows for more one-on-one time than a classroom environment usually does (Young et al., 2019). Time spent learning outside of school has a cascading effect that engages students and ensures that their experiences and memories of STEM are positive, therefore encouraging them to continue in the field (Boekeloo et al., 2017; Habig et al., 2020; Nation et al.,

2019). Current literature is just the tip of the iceberg towards making necessary and beneficial advancements when it comes to women in STEM.

The lack of confidence young girls have in their ability to be successful in math and science, and how this corresponds to feelings of belonging, has not been widely studied. This is evident due to the majority of studies focusing on females in STEM during college and career years (Eisenhart & Allen, 2020; Li Huang et al., 2021; S. Jiang et al., 2020; McGee & Bentley, 2017; Paschal & Taggart, 2021; Rodriguez & Blaney, 2021; Rodriguez et al., 2021; Wright et al., 2021). Microaggressions, discrimination, and gender bias are riddled throughout a female's experience in college and career, especially when the female is from a marginalized community (Yang & Carroll, 2018).

Current research has analyzed the benefits of allyship with male coworkers (De Souza & Schmader, 2022; Warren & Bordoloi, 2021), mentors in the workplace, college professors who are of the same race and same gender (Ferguson & Martin-Dunlop, 2021; Lockett et al., 2018), and personal resilience (Frederick et al., 2020). Challenges and hurdles due to their gender are to be expected when females enter a STEM profession, resulting in numerous studies that also focus on later years when women have already persevered through adolescence and been resilient or supported enough to stay in the field (Castellanos, 2018; Stevenson et al., 2019; Stewart et al., 2020; Wheeler, 2021). While still an important part of the overall research process, addressing earlier years, prior to career, will allow for more women to enter the field and limit the inequalities experienced in the workplace (Bystydzienski et al., 2015; Chang, 2017; Crane et al., 2022; Eisenhart & Allen, 2020; Leaper et al., 2012; McKellar et al., 2019; Pattison et al., 2018; Robnett & John, 2020; Schaeffer et al., 2021; Sheffield et al., 2017; Villa et al., 2020; Zhao et al., 2018).

Background and Theoretical Framework

This research study was guided by Bandura's Social Learning Theory and the impact a feeling of belonging can have on an adolescent. Humans have a fundamental need to fit in, feel accepted, and belong; belonging has been shown to be an anchoring human motive (Veldman et al., 2021). The need for acceptance and belonging is so fundamental that it can also explain human behavior and decisions that are made, both intentionally and inherently (Leary & Cox, 2008). Feelings of belonging can also provide a sense of community, and a lack of community is one of the most prevalent reasons why there is such an underrepresentation of women in STEM (Veldman et al., 2021).

Bandura's life work focused on a person's environment and their connection to their surroundings as a way to learn behaviors, which is why Bandura's Social Learning Theory is at the core of this study (Stewart et al., 2020). This study focuses on belonging in adolescence, and how young people's sense of belonging is cultivated heavily through their social connections with their family, teachers, and peers (Parker et al., 2022; Robnett & John, 2020). Adolescent participants are the focus of this study because young girls are forming their futures based on their environment, and given that their environments are often predictive of their future, girls are not entering STEM for fear of not belonging there (Lee et al., 2020; Puente et al., 2021).

A prevalent part of an individual's environment involves the role models they are exposed to (Bandura, 1993), and role models in STEM fields are one of the proven ways to increase young women in STEM (Crane et al., 2022; Jackson et al., 2013; Morton, 2021; Morton & Parsons, 2018; Steinke et al., 2022; Villa et al., 2020; Wendt et al., 2018; Wright et al., 2021; Yu et al., 2021). Role models are particularly important in STEM when the role models are the same gender and from the same cultural background, because young girls can see themselves in the

role they are working towards and it creates a sense of community and belonging (Butz et al., 2019). Role models who are inspirational and motivational will increase the interest of young people, but when these role models are shown as "stereotypical" in the way of timid, quiet, and awkward, it has the opposite effect on girls (Crane et al., 2022). Role models must be strong in order to support and grow a young person's vision of their future career (Donmez, 2021).

When it comes to academics and schooling, confidence in self contributes to a feeling of belonging, especially in STEM subjects (Johnson, 2012). In addition, the emotional support that teachers provide in their classroom impacts the feeling of belonging a student experiences, and the greater the sense of belonging, the higher the achievement in that subject (Matthews, 2020). This need to feel belonging in order to be successful in an environment carries on into undergraduate years, too (Rodriguez & Blaney, 2021). At the university level, many Latinas find supportive groups on campus through identity-based student organizations (Rodriguez & Blaney, 2021). Fostering a sense of belonging through the years of academia will help aid in supporting retention when it comes to STEM (Frederick et al., 2020; Rodriguez & Blaney, 2021).

STEM settings raise issues of belonging when it comes to gender, resulting in female students having a lower sense of belonging (Viola, 2021). Fears related to belonging begin in adolescence, as early as nine years old, when young girls express concern about the low numbers of women in STEM, and how that will impact them in the future if they pursue that career path (Bystydzienski et al., 2015; Schaeffer et al., 2021; Veldman et al., 2021). For this reason, mentorship, support, and guidance from role models, teachers, and others is imperative because this will help young girls with their perseverance (Frederick et al., 2020).

Based on Bandura's Social Learning Theory, a relationship exists between environment and modeling in the future (Bandura & Walters, 1977). Bandura's Social Learning Theory,

specifically his work with feelings of belonging, was the best framework to guide the study because if young girls are given role models to mirror, and support from the adults in their lives who affirm their decision to go into STEM, higher retention rates will result (Bandura, 1993). Unfortunately, if young girls do not feel they belong in STEM classes, the gap will continue to widen (Frederick et al., 2020; Veldman et al., 2021).

Research Questions

The number of Latinas in STEM fields is lower than the number of White, Asian, and Black females who pursue STEM as a career (Puente et al., 2021). In fact, Latinas account for less than 3% of the already low number of females in STEM (Ackert et al., 2021; Stevenson et al., 2019; Villa et al., 2020). The STEM Latina workforce represents three percent of the workforce and is disproportionately low considering the Latinx population is dramatically increasing in the United State and is believed to reach over 25% of the population by 2050 (Paschal & Taggart, 2021; Stevenson et al., 2019). In order to better understand why the numbers of Latinas in STEM are lower than any other group, this qualitative study had three research questions. They are as follows:

RQ1: What common STEM experiences do Latinas have in their K-12 years?

RQ2: What common STEM experiences do Latinas have outside of school?

RQ3: What educational practices in school increase belonging for Latinas to ensure STEM retention?

Description of Terms

This section contains the terms most important to the study. They are offered so the reader can better understand how the terms relate to the research. It is important to understand each word in the context of the research, to ensure clarity on the past research, and to fully

understand how it will lead to success of studies in the future. Definitions are based on established research in an effort to remain consistent with evidence and progress that has already been made.

After-school program (ASP). After-school programs allow for less constructed learning time, which leads to more time addressing specific needs and more freedom to explore and experiment (Nation et al., 2019). After-school programs, which are also referred to as OST or out-of-school time, are beneficial when they are culturally responsive and provide students with a safe space (Young et al., 2019).

Culturally responsive instruction. Culturally responsive instruction draws on students' unique backgrounds and experiences through the use of meaningful texts, materials, assignments, and other strategies to increase engagement and improve the educational outcomes of their diverse learners (Muniz, 2019). The use of culturally responsive (CR) instruction leads to higher levels of persistence, attendance, and positive learning outcomes for ELs (Muniz, 2019).

Double Bind. The combination of racial and sexual stereotyping (Petersen et al., 2020; Warren & Bordoloi, 2021).

Familismo. Decisions made that are influenced by a young person's relatives, even if it means putting their own wants and needs aside to accommodate those opinions and preferences of others. Familisimo involves a strong attachment to both nuclear and extended family and is a term often used when referencing Latinx youth because it is such a frequently occurring cultural phenomenon (Rodriguez et al., 2021).

First-generation. In the United States, first-generation refers to an individual who is the first person in their family to go to a college or university (Covarrubias et al., 2021). The role of

first-generation comes with a great deal of pride as well as a heavy responsibility (Covarrubias et al., 2021).

Gendered microaggression. Nuanced and short exchanges, on a daily basis, that communicate sexist denigration towards females. They can be conveyed verbally and/or nonverbally through multiple gestures, including facial expressions and gazes. While often expressed unconsciously, they cause psychological harm and discomfort to women (Yang & Carroll, 2018).

Gendered stereotypes. Gender stereotypes can begin as early as six years old, with the misconception that boys are intellectually superior to girls in STEM subjects (Fernández-García et al., 2019; Schaeffer et al., 2021; Zhao et al., 2018). The awareness of this is enough to negatively influence girls' decisions regarding STEM interest and exploration (George et al., 2020). Gendered stereotypes become increasingly emphasized and prevalent when it comes to women who are not in a "traditional role," but rather as that of a scientist or mathematician (S. Jiang et al., 2020).

Inclusive. Feeling connected, valued, respected, and heard (Misra et al., 2022)

Latinx. A gender neutral term that is used when referencing people who live in the United States and are of Latin descent (Villanueva Alarcón et al., 2022).

Latino. The "o" replaces the "x" in Latinx to signify a masculine form (Villanueva Alarcón et al., 2022).

Latina. The "a" replaces the "x" in Latinx to signify a feminine form (Villanueva Alarcón et al., 2022).

Leaky Pipeline. When referencing the pipeline of interest in STEM during adolescence, through reaching a career in STEM, specifically when discussing women of color (Crane et al.,

2022; Nation et al., 2019; Okahana et al., 2018). “Leaky” signifies that many girls fall off the path and do not enter a career.

Resiliency. The ability for an individual to navigate barriers that are impeding their success, whether it be personal or professional (Ferguson & Martin-Dunlop, 2021). In order to better understand how individuals push through and persevere, it is critical to highlight the positive mitigating factors that contribute to resilience. Doing so will allow for a better understanding of how these tools can support liberation (Stevenson et al., 2019).

Self-identity. An individual’s customs, personal beliefs, values, family traditions, and community relationships. All components work together to develop and better explain the behaviors and ideals of the whole person (Stevenson et al., 2019).

STEM. STEM refers to all aspects of science, technology, engineering, and mathematics. STEM fields are critical in the creation of knowledge in society, as well as resources and authority for scientists (Myers et al., 2019).

Steminist. Steminist is a term used frequently for women in STEM and involves holding on to your feminism and succeeding in a world where your feminine identity will be downplayed, diminished, and disregarded (Nation et al., 2019). A feminist identity encourages women to push forward when their surroundings are not forgiving and is a way that many women self-identify in their careers (Frederick et al., 2020).

Underrepresented. A feeling of isolation because of small numbers of individuals who are from the same group (Jackson et al., 2013). In STEM fields, underrepresented individuals often lack a sense of belonging or support from those around them (Rodriguez & Blaney, 2021). Supporting the advancement of underrepresented women is both a social issue and an economic one (Ferguson & Martin-Dunlop, 2021).

Underrepresented Minority (URM). A U.S. citizen who identifies as Hispanic/Latino, American Indian, or Black. Experiences faced by URM females play a large part in the decision to pursue careers other than that of STEM (Armstrong & Jovanovic, 2017; Frederick et al., 2020; Okahana et al., 2018; Petersen et al., 2020).

Significance of the Study

It is imperative to address retention issues with Latinas and the STEM community. Building STEM self-esteem and confidence during a young Latina's primary and adolescent years will not only improve their overall performance, but it will increase the likelihood they will make the science and math fields a career (Frize et al., 2009). The underrepresentation of girls and women in STEM continues to be a global problem that has not improved for decades, despite initiatives across all countries and different facets of the STEM profession. This study is important to add to the literature so that the leaky pipeline can be addressed now, in order for more females to enter and contribute to the future of STEM (McGee & Bentley, 2017; Zhao et al., 2018). K-12 school systems and STEM colleges will benefit from this information to help create a pipeline of success for Latinas moving into a STEM career, rather than only focusing on one part of their schooling at a time, such as during high school or in after-school programs (Falco & Summers, 2019; Ng & Fergusson, 2020; Price et al., 2019; Veldman et al., 2021; Yang & Carroll, 2018; Young et al., 2019).

A current gap in the literature exists related to the STEM experiences in adolescence. This study will explore how the lived experiences in adolescence impacted the future decisions made by the participants in the study. Boys and girls share the same level of interest in STEM in elementary school (Leaper et al., 2012), but pursuits begin to diverge in high school (Puente et al., 2021). The current research primarily focuses on Latina experiences in college and the

workplace. While this information is crucial to addressing the underrepresentation in the workplace, a gap in the research still remains prior to Latinas entering their undergraduate years (Brue, 2019; Castellanos, 2018; Falco & Summers, 2019; Jackson et al., 2013; Morton, 2021; Myers et al., 2019; Powless et al., 2022; Ramsey, 2021; Robnett & John, 2020; Rodriguez et al., 2021; Villa et al., 2020; Warren & Bordoloi, 2021). Gender biases and discrimination are something that women are facing not only from their coworkers and superiors in the workplace, but also by their college professors, K-12 teachers, and often even their family (De Souza & Schmader, 2022; Frederick et al., 2020; Sanchez et al., 2019). This study aims to highlight the common experiences and draw attention to the positive supports that impact women.

Overview of Research Methods

We must understand the barriers women, specifically Latinas, face in STEM fields as they move through adolescence and into career (Falco & Summers, 2019; Fernandez, 2018; Fernández-García et al., 2019; Swafford & Anderson, 2020; Young et al., 2019). This qualitative study helps explain participants' personal experiences in STEM during their adolescent years, and how it relates to participants' current pursuit of an undergraduate degree in STEM. Qualitative data was the driving force behind this research because it explores a problem and allows for a detailed understanding of the phenomenon (Creswell & Guetterman, 2021). Qualitative data relies heavily on the voices of participants through open ended questions (Creswell & Guetterman, 2021), which best elicits responses to the research questions.

Identity-based student support groups at universities in southern California were contacted in order to seek out participants for this study. An overview of the study and the survey questions were sent via email, and site consent was obtained. Two colleges responded and granted permission to survey the students who chose to participate. Surveys were distributed

through an online platform, Qualtrics, and were distributed between September 2023 and December 2023. The researcher analyzed and presented the data in April 2024 to complete the dissertation process.

Chapter Two: Review of the Literature

Introduction

STEM careers are highly profitable and have the capability to provide successful careers and numerous opportunities for those who do the work (McGee & Bentley, 2017; Paschal & Taggart, 2021). This male dominated field has been unwelcoming to female members, resulting in underrepresentation of women in all arenas of the STEM profession (McGee & Bentley, 2017; Morton & Parsons, 2018; Petersen et al., 2020; Rodriguez et al., 2021; Sanchez et al., 2019; Veldman et al., 2021; Wheeler & Hall, 2021). As the Latinx population in the United States increases, the disproportionate gap of Latina women in STEM fields is a growing concern because their presence in the field is not increasing at the same rate (Crane et al., 2022; Jackson et al., 2013; Paschal & Taggart, 2021; Rincón & Lane, 2017; Stevenson et al., 2019; Villa et al., 2020). If Latinas are excluded from the opportunities and advancements STEM can provide, the disparities they already experience will continue and Latinas will not be able to reap the benefits of the lucrative career field (Okahana et al., 2018).

The low numbers of females in STEM careers can be traced back to negative experiences in a girl's adolescence that caused them to pursue alternate subjects (Bouchey & Harter, 2005; Leaper et al., 2012; Puente et al., 2021; Robnett & John, 2020). Low performance in math and science equates to a loss of interest in those subjects, resulting in young girls disengaging and exploring other interests that do not require a STEM emphasis (Ng & Fergusson, 2020; Swafford & Anderson, 2020; Young et al., 2019). Out-of-school time (OST) and after-school programs (ASP) have been instrumental in filling gaps and piquing interest in science, technology, engineering, and math, but cannot bear the entire weight of this monumental issue (Donmez, 2021; Eisenhart & Allen, 2020; Price et al., 2019; Young et al., 2019). In addition to OST

programs, small group time, one-on-one instruction with individuals in the field, and STEM as an extracurricular activity has also increased interest and retention in young children (Myers et al., 2019; Nation et al., 2019; Wendt et al., 2018).

Preconceived Notions

Preconceived notions regarding ability, based solely on physical appearance, impacts females in STEM fields (McKellar et al., 2019; Morton & Parsons, 2018; Park et al., 2020; Rodriguez et al., 2021; Sanchez et al., 2019). Despite academic success, female students in STEM are not acknowledged for their persistence and perseverance (Rodriguez et al., 2021). A deficit of women in STEM directly corresponds to an absence of mentors, which impacts the ability for young girls to seek advice from same race and same gender individuals (Fernandez, 2018; Howard et al., 2020; S. Jiang et al., 2020; López, 2016; Sayilgan et al., 2022). For this reason, females, particularly from marginalized ethnicities, are often left to navigate the transition from high school to college alone (Eisenhart & Allen, 2020). In addition to a lack of career mentorship and guidance, many female students do not attend college due to the demands of the application process, high fees, confusing language, little support in registering for the appropriate classes, not knowing what classes are required to move to the next year, and many other struggles that come with a transition to higher education (Eisenhart & Allen, 2020; Paschal & Taggart, 2021; Wright et al., 2021). Additionally, STEM majors require girls to enroll in courses with predominantly White and Asian men, leaving females as the minority (Myers et al., 2019; Powless et al., 2022). Female college students face gender fueled comments, microaggressions, exclusions, and assumptions throughout their college experience, resulting in largely preventable numbers who do not graduate (Frederick et al., 2020; S. Jiang et al., 2020; Park et al., 2020; Paschal & Taggart, 2021; Stevenson et al., 2019).

As if the journey through academia is not daunting enough, the challenges and negative attention will continue after a Latina earns her degree (Armstrong & Jovanovic, 2017; Ferguson & Martin-Dunlop, 2021; Sanchez et al., 2019; Yang & Carroll, 2018). Women enter the workforce and the detrimental patterns continue and are often elevated, leaving women to work alone, deal with harassment, and plateau without ever being considered for promotions or advancement (Brue, 2019; Frederick et al., 2020; Powless et al., 2022; Robnett & John, 2020). In the workplace, studies have found that women face a lack of allyship by male co-workers, automatic gender bias, no consideration for promotions, no research opportunities, no tenure, and being passed over for supervisory roles that all involve higher pay (Armstrong & Jovanovic, 2017; Misra et al., 2022; Petersen et al., 2020; Yang & Carroll, 2018).

Despite the fact that a Latina has entered a STEM career, it does not mean they will stay since familial pulls and other outside influences weigh heavily on the necessary decisions women are faced to make, adding to the burden and pressure associated with choosing to dedicate their careers to STEM (Castellanos, 2018; Rodriguez et al., 2021; Wilkins-Yel et al., 2022). Women, in general leave STEM professions at a rapid rate, leaving the future generations in the same situation as the women were in originally (Castellanos, 2018; Eisenhart & Allen, 2020; Frederick et al., 2020).

Women in STEM fields face a disadvantage strictly because of their gender, and when added to the identity of a minority race, the workplace microaggressions, lack of mentorship in schools, and little to no encouragement or support from their surroundings, it adds up to a heavy burden (Chakraverty, 2020). This study aimed to add to the literature by gathering stories of Latinas who are currently in a STEM college to better understand what their experiences were like in adolescence, and the impact those experiences had on them over time.

STEM Pipeline

The STEM pipeline is frequently used as a metaphor to refer to female students' STEM interests in early education through college, with the final intent of ending up in a STEM occupation (Bystydzienski et al., 2015; Morton & Parsons, 2018; Nation et al., 2019; Rodriguez et al., 2021; Sampson & Clayton, 2021). This pipeline is riddled with obstacles, including negative attitudes and expectations related to STEM, poor performance in math and science classes, a lack of confidence in self, and a feeling of imposter syndrome, meaning the inability to believe that one's success is deserved (Ackert et al., 2021; Hunt et al., 2021; McCullough, 2020).

The pipeline refers to all women in the field, but unfortunately when it refers to being "leaky" it primarily focuses on women of color and the underrepresentation they have in STEM (Crane et al., 2022; Nation et al., 2019; Okahana et al., 2018). STEM careers in the United States are available but remain empty due to a lack of unqualified workers (Castellanos, 2018; Pattison et al., 2018; Richardson et al., 2019). There are not enough qualified workers because females report a feeling of imposter syndrome when they are in the STEM profession, and do not feel they are deserving of positions in the field (Chakraverty, 2020). These feelings of inadequacy stem primarily from the interactions they have with their classmates, teachers, and co-workers (Chakraverty, 2020; Richardson et al., 2019). If this leaky pipeline is not fixed quickly there will not be enough workers to keep up with the competition and demand that is looming over the next 20 years of critical STEM development (Castellanos, 2018; Pattison et al., 2018; Richardson et al., 2019; Young et al., 2019).

Community and Family Support

Two primary supports that contribute to the success of Latinas in STEM are community and family (Castellanos, 2018; Chang, 2017; Leaper et al., 2012; Rodriguez et al., 2021; Villa et

al., 2020). Maintaining their native language, looking for support within their families, and having close ties to a community are imperative to ensure resiliency in the workforce, where Latinas will no doubt be facing multiple obstacles (Stevenson et al., 2019). These components, along with keeping up with customs, traditions, and beliefs, create a strong self-identity, which supports females in their career pursuits and can combat the leaky pipeline (Stevenson et al., 2019).

Making STEM lessons in school more related to the real world, changing the way STEM is taught to increase engagement, having parental involvement, bringing in the community for support, and increasing out-of-school time are all supports that can potentially combat the leaky pipeline (Young et al., 2019). Virtual reality (VR) is one proven, effective, way to increase student interest in STEM (Y. Jiang et al., 2021). Virtual reality allows students to access experiences that might otherwise not be afforded to them due to accessibility. VR has also been proven to introduce students to different aspects of STEM that they might not have known were part of the profession (Y. Jiang et al., 2021).

In addition to VR, project-based learning (PBL) creates a learning environment that exposes young people to real world experiences in a dynamic and interactive way (Ng & Fergusson, 2020). Project-based learning requires collaboration and problem solving, which is a real experience students will have if they are in a STEM career in the future. The leaky pipeline tends to be the most prominent in adolescent years, so putting supports in place during that time though family, community, and increased engagement is imperative (Ackert et al., 2021; Y. Jiang et al., 2021; Paschal & Taggart, 2021; Rodriguez et al., 2021; Sampson & Clayton, 2021; Stevenson et al., 2019; Yu et al., 2021).

K-12 Years

The number of individuals who are choosing a STEM career path is not enough to meet the demands of the ever-growing field, especially compared to the numbers seen in other countries (Okahana et al., 2018). In addition, even lower numbers of individuals from marginalized communities are choosing STEM, particularly females. Black and Latina women in STEM have been contributing for decades, but it is believed that their achievements have been systematically hidden and diminished (Nation et al., 2019; Sanchez et al., 2019). K-12 schools in the United States are severely lacking STEM resources, particularly in low-income areas (Ackert et al., 2021; Castellanos, 2018; Robnett & John, 2020; Sanchez et al., 2019). An undersupply of resources results in marginalized students not receiving any kind of access to new STEM technology (Sanchez et al., 2019).

Many levels of self-discovery and self-identity begin to form during an individual's K-12 years. Students find out what they do and do not like and begin to pursue topics that they find to be most interesting (Armstrong & Jovanovic, 2017; McKellar et al., 2019; Stewart et al., 2020; Young et al., 2019). While males and females take the same number of math and science classes throughout their time in school, there is still a large gap between the numbers of women and men in STEM fields (De Souza & Schmader, 2022; Frederick et al., 2020; Hunt et al., 2021; Lee et al., 2020; Rincón & Lane, 2017; Warren & Bordoloi, 2021). In addition to the interests that continue to develop and diverge in school years, many stereotypes related to STEM and gender also exist beginning in early childhood and continuing into adulthood (Fernández-García et al., 2019; O'Brien et al., 2015; Schaeffer et al., 2021; Steinke et al., 2022). Because of the assumption that

girls are not as capable as boys, girls' self-efficacy when it comes to math and science is low compared to their male classmates (Ackert et al., 2021; George et al., 2020).

Standardized test scores also play a crucial role in a student's perceived self-efficacy. If a student struggles or doesn't engage in class, they may miss needed content, therefore, their test scores will decrease. When scores begin to decrease, the student will not feel capable of accomplishing what is required and will feel defeated, furthering their disengagement in STEM (Young et al., 2019). In addition to the never-ending list of challenges, race is an additional component that adds to a student's circumstance. With the current economic state and school quality, STEM has also become less rigorous and an under-resourced topic, resulting in a lack of availability to low-income students (Okahana et al., 2018).

Teacher Influence

Student motivational belief relies heavily on family but is also formed based on responses from classroom teachers. Traditionally, there is a perceived falsehood that boys have higher math and science abilities and girls tend to be stronger in reading (McKellar et al., 2019). This gender bias, whether it is intentional or inherent, is detrimental to the math and science growth of girls (Lee et al., 2020). In addition to these biases, when a young girl has a female teacher who is anxious about math or does not portray confidence when teaching it, the teacher's anxiety is passed on to the student (Schaeffer et al., 2021). Young girls need role models in math, and if they are not able to find a role model in their teacher, girls will be left matching the feeling of unease and unfamiliarity of their teacher, further perpetuating the cycle (Schaeffer et al., 2021).

Middle School and High School

Middle school is a pivotal time when students are beginning their transition from childhood to adulthood, and with that comes a stronger sense of what activities they enjoy as well

as an increase in potential career exploration (Donmez, 2021). Middle schoolers begin to demonstrate preferences in certain subject areas based on what they perceive to be their strongest capabilities (Ng & Fergusson, 2020). These perceptions are based on feedback from their parents, teachers, counselors, and peers (Leaper et al., 2012; McKellar et al., 2019). Negative comments and poor grades are a contributing factor to a loss of interest in STEM and a change to a different career trajectory (Bystydzienski et al., 2015). A critical time for considering STEM as a career occurs after a student's 8th grade year, when they transition to high school, making it an important time in development (George et al., 2020). As students prepare to transition to high school, their attitudes about STEM will set the precedent for continuing in STEM or pursuing paths outside of STEM (George et al., 2020).

Middle school years are the time when young girls begin to lose interest in STEM. The lack of engagement makes retaining young girls more difficult, but it also means there is a larger void being created without any efficient intervention (Young et al., 2019). In this study, Young interviewed girls to evaluate potential factors that led to STEM engagement in middle school. The results found successes with out-of-school time (OST). OST provides one-on-one time, increased engagement when lessons were presented in real-life scenarios, and a positive connotation associated with mentors. Young females often have an interest in STEM topics, but the resources needed to teach them are not always available, which is a disservice when they are proven to work (Young et al., 2019).

When it comes to STEM education in high school, females engage less in STEM subjects due to a lack of STEM skills developed in previous years (Sayilgan et al., 2022). Assumptions are made about what they can and cannot do, what they like, and what their interests might be (Ramsey, 2021). In addition to the assumptions being made about females, negative feedback and

gender biases presented to young girls can cause them to miss out on potential opportunities in the STEM fields when they get older (Eisenhart & Allen, 2020; Lee et al., 2020; Morton & Parsons, 2018; Young et al., 2019). This is especially a problem because STEM careers are already lacking in females, and as previously noted, these positions tend to pay more than most other career paths, leaving women out of the opportunities afforded to men with the same qualifications (Ng & Fergusson, 2020).

High school principals have an influential role in STEM education, and their relationships with students can have lasting effects on the students, particularly females, that they serve. Principals can foster networking opportunities and connections outside those developed within the student's family (Howard et al., 2020; Sampson & Clayton, 2021). Principals also have a unique opportunity to create a culture of student achievement and cultivate a learning environment that encourages females to join STEM fields (Howard et al., 2020; Sampson & Clayton, 2021). In addition to the support principals provide students, they are also responsible for training and developing strong teachers who will also help introduce the students to outlets of STEM and serve as important role models for young girls (Steinke et al., 2022). The role of trainer is a huge responsibility as well as an opportunity to advocate for more classes in science, engineering, math, and technology, as well as extracurricular activities that expose as many students as possible to STEM (Ackert et al., 2021; Boekeloo et al., 2017; Howard et al., 2020; S. Jiang et al., 2020; Sampson & Clayton, 2021).

STEM Attitudes

There are many aspects of a student's life that draw them to pursue careers in STEM, including attitude, subjective norm (the social pressure to engage or disengage in a behavior), science course attendance, participation in extracurricular science activities, adult

encouragement, and personal health-related experiences (Boekeloo et al., 2017; Donmez, 2021; Wheeler, 2021; Young et al., 2019). Attitude impacts an individual's view on their career field and the likelihood of succeeding in it, which is also tied to self-efficacy and belonging (Ackert et al., 2021; George et al., 2020). Positive attitudes and beliefs towards the science fields ultimately results in higher completion and retention rates based on the confidence to succeed (George et al., 2020; Preininger, 2017).

Perceived behavioral control is the perception of the feeling of power and control of an individual's future and is highly correlated with attitude. Attitude is heavily influenced by a welcoming community and feeling of belonging (Boekeloo et al., 2017). Researchers found that general education science classes and after-school science enrichment classes can make or break a student's pursuit in STEM (Souchal et al., 2014; Preininger, 2017; Robnett & John, 2020). If the classes are lively, engaging, welcoming, and taught by teachers and mentors who guide and support students, females will continue in STEM, but when the students are not engaged or are already experiencing microaggressions and discrimination at an early age, they tended to veer away from the field (Howard et al., 2020; Y. Jiang et al., 2021; Ng & Fergusson, 2020; Price et al., 2019; Wendt et al., 2018; Wheeler & Hall, 2021).

Finally, research has found that personal health experiences can lead students to pursue science careers (Boekeloo et al., 2017). If a family member, loved one, or individual experienced a health problem, and if the student felt the situation was out of their control and wished they could have an impact, they are more likely to pursue a STEM job to help prevent others from going through the same experience (Boekeloo et al., 2017).

Out-of-School Time (OST)

Out-of- school time, or OST, refers to a wide range of supervised programs that children can attend when they are not in school. OST learning has a cascading effect that engages students and ensures their experiences and memories of STEM are positive, encouraging them to continue in the field (Habig et al., 2020). Having a community in the form of an after-school group will result in a sense of belonging, which is important for their development (Ackert et al., 2021; Donmez, 2021; Young et al., 2019). OST programs can include afternoons when the school day has concluded, during summer when school is not in session, or during school breaks. Around ten million school-aged children are enrolled in OST programs every year, which provides many hours for potential STEM experiences (Price et al., 2019).

Not only has the need for future scientists grown, but there is also a significant need for females to bring their ideas and experiences to the STEM fields (Swafford & Anderson, 2020). Gender stereotyping is one of the primary reasons that young girls either choose not to enter the field in the first place, or the reason they eventually fall through the cracks and lose interest (George et al., 2020). This loss of interest is detrimental to the field and a primary reason why OST is so important and has been proven to encourage and engage girls in STEM (Donmez, 2021; Wade et al., 2021; Young et al., 2019). The individual females, their families, and society will benefit because a woman's expertise can assist in maximizing creativity and innovation in addition to competitiveness, and time in after-school programs can make all the difference (Wheeler & Hall, 2021).

Programs that take place during out-of-school time do not focus on standards, grades, or assignments, and serve to provide hands-on experiences for students. Students are able to think critically, solve problems, experiment with tools in labs, conduct experiments, and take part in

experiences that are engaging and similar to what actual professionals in the field do on a daily basis (Morton, 2021; Yu et al., 2021). In addition, OST programs are oftentimes run by individuals from STEM fields, which gives young students role models to look up to and a place for them to feel connected (Price et al., 2019; Wade et al., 2021; Young et al., 2019).

Given that STEM-related careers are growing at such a rapid pace, access to them becomes an equity issue. African American and Latinx students are twice as likely as their white classmates to attend after-school programs, meaning these programs have the potential to disrupt the leaky pipeline, especially when it comes to girls (Nation et al., 2019). After-school programs allow for less constructed learning time, which lends to more time addressing specific needs and more freedom to explore and experiment (Price et al., 2019). When run effectively, these factors allow after-school programs to really target underrepresented students and introduce them to the expansive potential STEM careers could hold for them (Boekeloo et al., 2017; Bystydzienski et al., 2015; Donmez, 2021; Eisenhart & Allen, 2020; Ferguson & Martin-Dunlop, 2021; Nation et al., 2019; Pattison et al., 2018; Wade et al., 2021; Young et al., 2019).

Differences in feelings of belonging when it comes to STEM have consistently been reported by men and women, both while in school and in the profession (Stewart et al., 2020). These differences are also not reported solely in one outlet of STEM, but in all sectors of the field. This creates a problem because belonging influences how people engage, the effort they put into their work, their performance, and when it comes to students, their future career choices (Webb-Williams, 2018). In order to increase feelings of belonging, it is important to shift the mentality of females when they are younger in order to allow them to enjoy science so that they can see themselves having a science career in the future (Nation et al., 2019). Clubs where girls can learn, be with mentors, and experience STEM in a safe environment, whether it be in person

or online, can help build confidence and increase their feeling of belonging (Wheeler & Hall, 2021). These types of programs are especially beneficial for girls who live in rural areas who may not have the same access, exposure, or opportunities as those who live in more populated areas (Preininger, 2017; Wheeler & Hall, 2021). Proactive clubs for girls that focus on giving them a "STEMinist" mentality can increase retention, build up their confidence, and teach them what a career in science could lead to (Nation et al., 2019; Reding et al., 2017). This will also increase their sense of belonging which will be one necessary step towards closing the leaky pipeline (Nation et al., 2019).

Culturally Responsive School Leadership

Individuals from what are historically considered minority groups are increasing in numbers and currently represent a large majority of school-aged children of all backgrounds (Castellanos, 2018; Rodriguez et al., 202; Simpkins et al., 2018). By 2050, it has been estimated that half of the population of the United States will identify with what is currently considered a "minority group" (Howard et al., 2020). Increasing the awareness of how important culturally relevant, competent, and responsive K-12 leadership is necessary to ensure continuous support of different races, ethnicities, and linguistic populations (Howard et al., 2020; López, 2016; Young et al., 2019; Yu et al., 2021).

When it comes to the support of minority students, researchers continue to look into the impact principals have on students' social and emotional wellbeing and academic development (Bouchey & Harter, 2005; Chang, 2017; Howard et al., 2020; Ng & Fergusson, 2020; Rodriguez et al., 2021; Sampson & Clayton, 2021; Sayilgan et al., 2022; Stevenson et al., 2019; Wade et al., 2021; Wilkins-Yel et al., 2022). The leadership role held by a principal is a crucial aspect of supporting students in their STEM exploration and journey to retention (Sampson & Clayton,

2021). Ensuring that educators and administrators are culturally responsive means that they understand that what they may consider a norm behavior–something they are used to seeing and being around–may not look the same in other cultures (Aragón et al., 2017; Butz et al., 2019; Howard et al., 2020; López, 2016; Young et al., 2019; Yu et al., 2021). The same response applies to instructional strategies and the need to make changes to address the diverse needs of students (Howard et al., 2020).

Professional development for teachers in middle and high schools is necessary to encourage culturally responsive teaching and interactions (Fernandez, 2018; Frederick et al., 2020; McClintock et al., 2021; Wheeler, 2021). Multi Language learners should be celebrated and languages other than English should not be seen as a deficit that needs to be fixed (López, 2016). All too often, students come to the United States from other countries, primarily Mexico, and are immediately placed in a special education class, given a translator, and assigned to low-level classes (Stevenson et al., 2019). Poor treatment happens based on heritage and origin rather than getting to know the student and their needs and abilities (Stevenson et al., 2019). Teaching teachers how to ensure all children succeed academically and how to smoothly transition a newly arriving student to their class will produce more academically able students (Stevenson et al., 2019).

Stereotypes

A challenge many girls of color face is that they are pushed in the direction of professions other than STEM (Ramsey, 2021). Girls are frequently encouraged and advised by their families, teachers, and peers to pursue a profession that has a nature of helping and nurturing others, such as social work or education, and this encouragement is based purely on gender stereotypes and assumptions rather than actual skills and interests (Ramsey, 2021). STEM professions are rarely

encouraged for Latinas because of the academic and career challenges they will face, which are presumed to be too difficult for Latinas to overcome (Sanchez et al., 2019). To combat this, family members need to actively encourage STEM paths, and teachers and principals need to address the school's mission, the STEM culture on campus, their student outreach program effectiveness, and teacher recruitment and retention to ensure all components are supporting their marginalized students (Bouchey & Harter, 2005; Chang, 2017; Howard et al., 2020; Ng & Fergusson, 2020; Rodriguez et al., 2021; Sampson & Clayton, 2021; Sayilgan et al., 2022; Stevenson et al., 2019; Wade et al., 2021; Wilkins-Yel et al., 2022).

When young Hispanic girls are in elementary school, they are often referred to as, or considered to be, more disruptive and less attentive than their classmates (Sanchez et al., 2019). This message follows the young girls through middle and high school, and when decisions need to be made, Latinas themselves are doubtful of their abilities because those around them assume they will not be able to keep up or take on STEM courses (Ng & Fergusson, 2020; Rodriguez & Blaney, 2021). When these acts of stereotyping occur, the Latina students begin to doubt their abilities and their self-efficacy in their classes. Oftentimes, girls are not able to articulate the challenges they experience in STEM classes (George et al., 2020). While females in elementary school tend to do just as well as their male classmates in math and science, they still do not feel adequate in these subjects (McKellar et al., 2019; Swafford & Anderson, 2020).

College

Females from marginalized groups such as Latinas are entering higher education more than ever before, but their completion rates are lower than their peers (Rodriguez et al., 2021; Villa et al., 2020). When a candidate identifies with a marginalized group, or more than one marginalized group such as a Hispanic female, postsecondary education requirements can be

daunting (Ferguson & Martin-Dunlop, 2021). While colleges tend to offer programs and varying forms of assistance to incoming students, they often make assumptions that their terminology, deadlines, and requirements are easily understood (Armstrong & Jovanovic, 2017). In addition to this, locating housing, finding childcare (if applicable), and knowing how to obtain student loans (if applicable), can potentially be a major hindrance to enrollment (Wright et al., 2021). University administration plays a key role in ensuring a smooth transition into college, leading to more retention of women in STEM, therefore, administrators must address barriers to enrollment (Ferguson & Martin-Dunlop, 2021; Rincón & Lane, 2017; Wright et al., 2021).

Undergraduate

Higher education can disrupt the chain of poverty, but it is a huge task to take on for anyone, especially those from marginalized communities (Wright et al., 2021). Securing the fees to apply, ensuring all required documents are submitted, and meeting deadlines can be a difficult task when there is little to no navigational support from the university (Jackson et al., 2013). In order to support students, some universities have supported groups that help students with the transition of entering college for the first time by providing tuition assistance, tutoring, and professional development (Frederick et al., 2020; Wright et al., 2021)

Most students who decide they are going to major in a STEM career, successfully transition to a college as a STEM-focused undergraduate (Eisenhart & Allen, 2020; Park et al., 2020; Paschal & Taggart, 2021; Rodriguez et al., 2021). When it comes to females, the same struggles that plagued them in elementary continue in undergraduate settings. These issues increase attrition rates and are a result of grades, the major chosen, and the challenging level of classes (Hunt et al., 2021; Villa et al., 2020). For example, a Latina could be enrolled a science class with a teacher who does not provide the support to help their students. If a Latina does not

have the necessary experience with studying effectively, or does not have the required test taking skills, she may fail the class. The class failure could cause her to feel inadequate, and she might transition to classes that she finds to be easier for her. The issues faced in college classes become a problem when an increasing number of students end up leaving their STEM major, and the United States will face a challenge when it comes to filling STEM positions as current employees retire (Castellanos, 2018; Wendt et al., 2018).

When poor performance in school becomes an issue, females are more likely to opt for a non-STEM major, while males continue through the program, despite potential poor grades or performance (Bystydzienski et al., 2015; Leaper et al., 2012). This is one of the primary reasons the STEM field is so male dominated (Hunt et al., 2021). Recently, however, post-feminism, which relays a message of empowerment and independence, is breaking down barriers in male dominated arenas (Frederick et al., 2020; Xinari, 2010). The ideology of post-feminism focuses on women's discontent with the tradition of solely being a homemaker and mother with no additional opportunities (Xinari, 2010). The mentality of post-feminism, or "New Woman," also allows for a level of perseverance and determination that leads to success in a woman's chosen path (Xinari, 2010). Unfortunately, a false narrative maintains that women today "have it all" when, in fact, gender equality is still a major underlying issue (Frederick et al., 2020; Xinari, 2010). With the rise of post-feminism ideology in higher education, a priority has been placed on pushing the movement forward and ensuring females persist in historically male-dominated fields such as STEM (Xinari, 2010). College is a prime time to support this movement to retain and recruit as many females into the field as possible (Frederick et al., 2020).

The experiences underrepresented women face in higher education play a huge role in their decision to pursue STEM careers. Obstacles beyond their control such as gender bias when

hiring, unequal opportunities to advance in the workplace, and competitive male egos are all working against them (Armstrong & Jovanovic, 2017; Brue, 2019; Frederick et al., 2020; Powless et al., 2022; Richardson et al., 2019; Yang & Carroll, 2018). Many women enrolled in college report feeling negative associations with their race due to the racism they experience, which leaves them feeling isolated and stereotyped (Rodriguez & Blaney, 2021). This often leads to feelings of anger, low self-esteem, depression, and an increase in anxiety (Behnke et al., 2011; Montoro & Ceballo, 2021; Schaeffer et al., 2021). Negative racial experiences also hinder students from connecting with their predominantly White faculty, which increases feelings of isolation; further supporting the importance of same-gender and same-race role models and mentors (Morton & Parsons, 2018).

During their academic pursuit of a STEM degree, both at the undergraduate and graduate levels, women of color also report multiple personal struggles that hinder their success (Boekeloo et al., 2017; Dunlap et al., 2019; Wilkins-Yel et al., 2022). Family challenges such as illnesses, loss of family members, unsupportive parents, and balancing the demands of their own family and schooling are constant pressures that cause women to drop out of STEM majors due to the required demands of hours and work (Dunlap et al., 2019). Romantic relationships also suffer because of the time commitment of college, and personal health issues frequently spike including an increase in stress, depression, and increasingly low energy (Wilkins-Yel et al., 2022). Institutions must focus on recruiting more women to represent all races and ethnicities in STEM, but they also need to be committed to long-term success (Paschal & Taggart, 2021; Petersen et al., 2020; Rodriguez et al., 2021; Sanchez et al., 2019). A campus environment where students feel valued, accepted, and encouraged will help with resilience (Rodriguez & Blaney, 2021). Historically Black Colleges and Universities (HBCUs) have proven to be very beneficial for

encouraging STEM career pursuits and are successful in the prevention of Black women falling through the cracks and not making it to the professional field (Morton, 2021). HBCUs support students by providing tutoring, mentoring, remediation, and celebrations of student accomplishments. Senior-level administrators play a pivotal role in facilitating the varying support, and their influence often reaches much farther than just academics (Lockett et al., 2018). While attending HBCUs, Black females report feeling much more confident in their abilities, more supported by faculty and classmates, and enjoying a more home-like feeling on campus, which is why they are more successful and likely to end up in the field (Frederick et al., 2020; Rodriguez & Blaney, 2021; Yu et al., 2021). One issue that was also reported was that even though the women felt much more supported through their college years, they still noted a lack of women teaching their classes. Mentorship is necessary so that females have someone to look up to, but even at an HBCU, female role models are still scarce (Morton, 2021).

College Faculty

There is an undeniable shortage of underrepresented minority females working as faculty members in STEM departments on college campuses (McClintock et al., 2021; Misra et al., 2022; Wheeler, 2021). Fewer than 2% of tenured faculty members at American universities are underrepresented females, which means there is a lack of role models for young girls to look up to and learn from in these fields (Petersen et al., 2020). In order to engage other URM females in STEM, universities have created mentoring and outreach programs to amplify the voices of URM females in faculty positions. (Petersen et al., 2020).

Universities are working towards making the necessary efforts to become more diverse when hiring and promoting women of color, but STEM departments remain dominated by Asian and White males (Misra et al., 2022; Stevenson et al., 2019; Warren & Bordoloi, 2021). When a

department is not inclusive, inclusive being defined as “faculty members feel connected, valued, respected, and heard” (Misra et al., 2022, p.1), then the school and major will be less appealing to women of color and will lead to less diversity in the program. In addition, women report feeling more at home in a workplace when there is more diversity (Misra et al., 2022; Morton, 2021). Feeling comfortable leads to higher productivity and more success because with a higher comfort level, women can contribute more without fear of backlash (Stevenson et al., 2019).

Underrepresented minorities face many obstacles in higher education, and universities need to find more ways to ensure their success and retention as faculty members (Armstrong & Jovanovic, 2017; Petersen et al., 2020; Villa et al., 2020; Warren & Bordoloi, 2021; Yang & Carroll, 2018). There is an ever-growing body of work that studies the hurdles and challenges that gender and minority statuses play for women in STEM fields (Armstrong & Jovanovic, 2017). In addition, URM faculty members are less likely to be tenured, and frequently have what is known as solo status in their department, meaning they are the only one of their gender and race (Aragón et al., 2017; Armstrong & Jovanovic, 2017; Misra et al., 2022; Petersen et al., 2020; Ramsey, 2021; Yang & Carroll, 2018). This problem may contribute to URM female attrition because many young URM females start out interested in STEM fields but as they get older, the pipe becomes leaky due to lack of support, no resources, or experienced microaggressions. As a result, women of color pursue other careers (Armstrong & Jovanovic, 2017; Yang & Carroll, 2018).

Mentorship

One of the greatest influences in terms of success and determinants for women in STEM is correlated to same-gender and same-race role models because it yields a stronger level of psychosocial support (Crane et al., 2022; Jackson et al., 2013; McGee & Bentley, 2017; Reding

et al., 2017; Steinke et al., 2022; Yu et al., 2021). Having someone to look up to who identifies with the same experienced struggles can give the student a stronger desire to push through and overcome challenges, which increases retention in STEM careers (Howard et al., 2020). Same-gender and same-race role models also allow young students to see themselves doing STEM jobs in the future because when girls think of STEM as primarily white and masculine, their choice to engage in science will be influenced are creating their identity and may feel that since they do not fit what they perceive as the mold of a scientist, they will not view the job as appropriate for their identity (Wendt et al., 2018).

Female faculty members of color report they are more satisfied when they have access to mentors and other internal support (Brue, 2019; Misra et al., 2022). Many universities provide this support, but it is not always formal mentoring that helps a female succeed. Informal mentoring with colleagues and friendships through shared experiences allows for a more inclusive environment (Misra et al., 2022). In addition, many Hispanic and Black females say that the stereotypes they face in the field are based on the idea that White and Asian women are smarter, so they are infrequently introduced to potential STEM futures (Misra et al., 2022; Morton, 2021; Stevenson et al., 2019). When Latinas do express interest, they are encouraged to choose other paths, which results in self-doubt (Collins et al., 2020). Women experience the challenges of not having mentors, yet they persevere to become mentors for future generations (Morton, 2021).

Higher education can disrupt the chain of poverty, but it is a huge task to take on for those in marginalized communities. This is why strong mentors and role models are so vital during a woman's college years (Wright et al., 2021). The relationship a college student has with their mentor(s) influences how they feel in terms of support, their perception of their academic self,

and their level of motivation in terms of succeeding (Frederick et al., 2020). Mentorship also allows for future networking opportunities, which are important in STEM given the low numbers of women, particularly women of color (Lockett et al., 2018). Mentors and counselors are also critical supporters for ensuring the pipeline continues since mentors can encourage students to join STEM programs and all the responsibility is not strictly on administrators and teachers (Howard et al., 2020).

Career

STEM fields have often been described as "chilly" and hostile toward women, thus discouraging women from pursuing careers in STEM (Ramsey, 2021). STEM careers, however, are the fastest growing fields and account for seven out of the ten highest starting salary careers (Wendt et al., 2018). Nationally, the United States education system is not producing enough individuals in STEM careers to meet the growing needs and demand to keep up internationally (McGee & Bentley, 2017).

In the workplace, women benefit from groups or meetings where they can be with other women who are in the same positions (Petersen et al., 2020). This form of community allows for shared experiences, unjudged venting sessions, advice, and a place to feel understood and accepted when they are not receiving support in their workplace (Petersen et al., 2020). Groups have proven to be critical in ensuring female retention and happiness in STEM (Petersen et al., 2020).

Women report constant struggles when it comes to career advancement and leadership opportunities (Frederick et al., 2020; Powless et al., 2022). Women face continuous hurdles, such as gender biases, a chilly culture, insecurities, lack of mentorship, lack of sponsorships, and failures to be included in important conversations that will allow them to advance their careers

(Brue, 2019; Frederick et al., 2020; Powless et al., 2022). When they advance to a leadership role, there is no mentorship, and they are often left out of decision making opportunities, limiting their abilities to make true change (O'Connell et al., 2021). If women do make it to a supervisory role, work-life balance becomes an issue, as does a lack of support, no mentorship, and tension between their job and home life (Brue, 2019).

Imposter syndrome plagues women in STEM and is defined as the fear of being considered a fraud and experiencing an overall sense of inadequacy (McCullough, 2020). Those who are afflicted by imposter syndrome–also called imposter phenomenon and imposterism–feel their accomplishments can be attributed solely to luck, favor, and error instead of their perseverance, dedication and hard work (Chakraverty, 2020). This is especially prevalent when a woman is in a leadership role and results in a self-perception of not being good enough for the position they are in (McCullough, 2020). This feeling also results in hesitancy when listing one's own accomplishments, and opting for sharing what others think of them or speaking from the viewpoint of someone else for fear of sounding boastful (O'Connell et al., 2021). Research suggests that combating these feelings of undeserved recognition will not only help with confidence but will also encourage women to engage in research and present findings which will give them more opportunities in the workplace (O'Connell et al., 2021). Women and imposter syndrome go hand in hand, and it is imperative that women are supported in their STEM journey, so this detrimental behavior does not impact their successes and they accept the credit they have earned (O'Connell et al., 2021).

Expectations for women in the workplace tend to be higher than those set for males (Dunlap et al., 2019). Women are often torn between their personal life and work life because the two tend to have an impact on each other, specifically when a woman is in a traditionally

masculine career such as STEM, which can be considered incongruent to gender norms (Dunlap et al., 2019). Women take on more than just the title of scientist or mathematician; they also take on the title of mother and caretaker and tend to be responsible for taking care of the home (Covarrubias et al., 2021). These responsibilities are in addition to the pressure received from their immediate family, who may not understand the drive and decisions to pursue a STEM career (Myers et al., 2019; Rodriguez et al., 2021; Wilkins-Yel et al., 2022). This balance becomes a juggling act for Latinas, whose culture includes a strong focus on the family, which heavily weighs on their decisions (Castellanos, 2018; Chang, 2017; Leaper et al., 2012; Rodriguez et al., 2021).

Self-Identity

Women in STEM frequently feel torn between their scientist and female identities because they do not feel their gender and career choice align or are supposed to intertwine (Jackson et al., 2013; Pattison et al., 2018; Rodriguez et al., 2021; Steinke et al., 2022). Despite a higher reported comfort level working in the field of STEM education, women of color are still far less likely to be awarded tenure than their White co-workers, even if they are in the same role (Armstrong & Jovanovic, 2017). Women from underrepresented communities report that there is a “cultural taxation” and they are frequently asked to do extra duties such as advising minority students (Li Huang et al., 2021; Villa et al., 2020). Although this might encourage mentorship, it represents inequities in faculty workload (Villa et al., 2020). Cultural taxation occurs when individuals are expected to perform duties strictly because they have a similar skin color to mentee (Armstrong & Jovanovic, 2017).

Microaggressions

Only 27 percent of STEM titles are held by women, and only 10 percent of those roles are women of color (Martinez & Christnacht, 2021). This lack of representation impacts workplace innovation and could potentially cause problems that will ripple through the world of STEM development (Okahana et al., 2018). Not only do women in STEM often have solo status, but they are also facing unjustifiable challenges and their authority and capabilities are often challenged strictly because of how they look (Armstrong & Jovanovic, 2017; Brue, 2019). Considering the emotional toll all of this takes, facing constant workplace discrimination results in higher levels of work-related stress and trauma, which in turn leads to the decision to pursue alternate career paths (Armstrong & Jovanovic, 2017).

Underrepresented groups in STEM disciplines are likely to experience bias on multiple levels and subtle discriminations based solely on their identities as a minority or a woman (Rodriguez & Blaney, 2021). This bias is also referred to as microaggressions, which are defined as specific actions directed at an individual in an underrepresented or marginalized group, including gender, race, religion, sexual orientation, or disability (Armstrong & Jovanovic, 2017; Ferguson & Martin-Dunlop, 2021; Myers et al., 2019; Sanchez et al., 2019; Yang & Carroll, 2018). Women experience microaggressions in the form of facial expressions, gestures, verbal or nonverbal cues, or slight gazes, which can cause the women to feel uncomfortable and psychologically harmed (Rodriguez & Blaney, 2021). Gender microaggressions negatively impact a woman's motivation to pursue higher education, impede their pursuit of STEM career majors and careers, and could unintentionally impact performance evaluations and career advancement (Yang & Carroll, 2018).

Allyship

Male allyship is one promising way to address workplace gender inequalities because it involves actively standing up for and supporting marginalized groups. Because the dominant group speaks up, it brings attention to the microaggressions taking place and the unfair practices their women of color co-workers are facing (De Souza & Schmader, 2022; Warren & Bordoloi, 2021). The three most important themes of allyship are shown in Table 1.

Table 1

Male Advocacy Themes

Theme	**Definition**
Advocacy	Includes supporting an idea, giving credit to, and providing opportunities to speak.
Instrumental Support	Involves providing information related to their job, opportunities, mentorship policies, and emotional support.
Emotional Support	Involves social support and helping when needed.

By simply speaking up, male allies can be instrumental in making changes towards gender equality in the workplace (Warren & Bordoloi, 2021). While it may seem simple that speaking up can lead to actual changes, men oftentimes believe they are allies when they aren't (De Souza & Schmader, 2022; Warren & Bordoloi, 2021). When women are not supported by their co-workers, they feel judged and socially excluded, which leads to a quick burnout and much lower levels of workplace engagement (De Souza & Schmader, 2022). Women report feeling most supported when men advocate visibly (Warren & Bordoloi, 2021). Such visible actions include supporting women in front of others when the woman's abilities are questioned, ensuring time is devoted to recognizing a woman's achievements through awards and honors,

making statements about creating a safe environment for females, and admissions related to the reality of work disparities (Warren & Bordoloi, 2021).

Men feel they are supporting women when they are actively listening to their female co-workers, offering reassurance, and reflecting when it comes to decision-making (Warren & Bordoloi, 2021). Women feel supported by these actions, but they tend to not be visible, therefore, not making as much of an impact as the men believe that they are (Warren & Bordoloi, 2021). These actions, while positive, are known as pluralistic ignorance, which is the misinterpretation of group attitudes. Men in the workplace believe they are supporting women, know and will state that there are gender biases in their workplace, and want to help. However, the help they provide is in their own perceived way rather than in a way that makes meaningful changes (De Souza & Schmader, 2022).

Retention and Resiliency

For years, programs have been designed, created, and funded with the intention of guiding girls and women through the STEM pipeline and ensuring retention (Brue, 2019; Y. Jiang et al., 2021; Lee et al., 2020; Morton & Parsons, 2018; Petersen et al., 2020; Robnett & John, 2020; Steinke et al., 2022; Young et al., 2019). Entire organizations are dedicated to this mission, including the Association of Women in Science, the Society of Women Engineers, and Women in Technology International and the National Science Foundation. The NSF has donated over $270 million to support women doing research in STEM, with little change in the foundation of STEM employees (Myers et al., 2019). A common suggestion for why all this money is not proving to be impactful is because the information being shared is related to the disparities actually occurring, rather than suggesting ways to help or make STEM more welcoming for women (Myers et al., 2019).

Mentoring groups are an effective way to retain women when they are already working in a STEM-related career (Brue, 2019; Li Huang et al., 2021; Misra et al., 2022; Petersen et al., 2020; Young et al., 2019). Mentorship can come in the form of a superior but is also commonly found in same-gender co-workers (Brue, 2019). In a college environment, retention is most effectively achieved by asking for feedback and inquiring about what the females need when they are in college (Frederick et al., 2020). Some need support with the entry process, some need support with housing or childcare, and others may need tutoring (Dunlap et al., 2019; Paschal & Taggart, 2021). Due to the lack of minority female professors, especially with tenure, these women also need role models they can go to for support and to see that they can achieve scholarly positions as well (Petersen et al., 2020). When working with adolescents, however, retention requires training teachers to be culturally competent leaders while also understanding the importance of teaching children to push through and not give up on themselves (Morton & Parsons, 2018).

One of the most important characteristics a student can learn is resilience. Traditionally, resilience is defined as the ability to overcome adversity and rise above situations that are unfavorable (Ferguson & Martin-Dunlop, 2021; Stevenson et al., 2019). While this is still a valid definition, when referring to women from marginalized communities, it is important to understand how the definition changes. When referencing a Latina population, resilience is better defined as the developed modality that is consciously practiced in reaction to the societal power dynamics faced in different social situations (Stevenson et al., 2019).

Many times, resilience is developed by women through watching their family members, but it can also be taught by mentors who have been through the same experiences (Stevenson et al., 2019). Resilience is a strong support, especially when the individual is a young and

impressionable minority female (Robnett & John, 2020). Minority females of all ages report they are being teased by classmates, experiencing solo status, and are receiving negative comments and feedback from their teachers (Armstrong & Jovanovic, 2017; McKellar et al., 2019). If a Latina is spending the majority of their day in this environment, no matter how strong they believe they are, this taxing reality will eventually wear them down and out, further expanding the leaky pipeline (Morton & Parsons, 2018).

Conclusion

Women, particularly women of color, are currently underrepresented in STEM to a level that is not improving, despite a growing population of minority individuals in the United States (Rodriguez et al., 2021; Simpkins et al., 2018; Stevenson et al., 2019; Villa et al., 2020). This is an issue that needs to be addressed immediately because, according to the Department of Labor, nine out of the ten fastest-growing careers will require an undergraduate degree related to STEM, specifically math and science (Wendt et al., 2018). Through the stated research questions, this study's aim is to gather the experiences of Latinas during their K-12 years to fill the current gap in literature and to provide recommendations to make the future more practical for women to succeed in STEM.

Chapter III: Design and Methodology

Introduction

This qualitative study seeks to better understand the barriers faced by Latinas in STEM fields by gathering stories, encounters, and experiences during their adolescent years in science and math. Data for this study was collected through surveys and interviews of undergraduate students who are currently enrolled in a STEM college at a university in southern California. The research was guided by Bandura's Social Learning Theory and the significant impact that the observations made in an individual's environment has on their development and their sense of belonging.

After review of the literature associated with Latinas in STEM, it was evident there were ample reports on workplace microaggressions towards Latinas based on their gender and ethnicity (Frederick et al., 2020; S. Jiang et al., 2020; Park et al., 2020; Paschal & Taggart, 2021; Stevenson et al., 2019). There is a clear gap in the literature related to the experiences of Latinas in STEM settings during their adolescent years. To be specific, the most significant gap is related to proven methods that increase retention, which is the focus of this study. This study will contribute to the current gap related to adolescent retention and the experiences of Latinas pursuing STEM with the following guiding questions that led the study:

RQ1: What common STEM experiences do Latinas have in their K-12 years?

RQ2: What common STEM experiences do Latinas have outside of school?

RQ3: What educational practices in school increase belonging for Latinas to ensure STEM retention?

Research Design

A qualitative method was used to explore the adolescent experiences of Latinas in STEM. Qualitative data provides deeper insight into the perceptions of participants' feeling of belonging, and for this study, their sense of belonging in their STEM classes (Robnett & John, 2020). In addition, qualitative studies are more flexible and reflexive, which best enables participants to give meaningful contributions to a study and allows the researcher to gather detailed experiences (Maxwell, 2012). A qualitative study is the most appropriate method for this body of work because the researcher strived for participant voice to be the anchor of the study through first-hand accounts of lived experiences. First-hand accounts, memories, and sharing the positive and negative influences in younger years, and how they transferred into a successful STEM pursuit allowed for the best interpretation of data collection (Gillham, 2005). In addition, allowing the participants to share their personal stories and experiences resulted in deep and meaningful responses to make the work more profound, while also providing flexibility to the individuals taking the survey (Gillham, 2005).

The intention behind the survey instrument was to look for patterns and commonalities between the respondents to gather the necessary quantitative data. Open ended questions allowed the researcher to collect responses that were varied, honest, and unique for each participant. These qualitative measures are useful when exploring a central phenomenon (Creswell & Guetterman, 2021), which in this case is the lack of Latinas in STEM and their adolescent experiences that might have contributed to the current deficit of Latinas in the profession. The qualitative measures in this study were designed to allow the varied experience of individuals to surface to explore their similarities. By doing so, the researcher can provide solutions and

recommendations for future research related to this issue. Table 2 details how the survey questions are aligns to the research questions.

Table 2

Methodology and Research Question Alignment

Research Question	**Data Collection Methods**	**Survey Questions**
What common STEM experiences do Latinas have in their K-12 years?	Survey Semi-Structured Interview	SQ1: Thinking back to your experiences in grades K-12, what sticks out when it comes to STEM (science, technology, engineering, and math) classes?
		SQ2: In what ways did your experiences at school impact your experiences in STEM classes?
What common STEM experiences do Latinas have outside of school?	Survey Semi-Structured Interview	SQ3: In what ways did your experiences at home impact your experiences in STEM classes?
		SQ4: In what ways did your experiences in after-school programs impact your experiences in STEM classes?
What educational practices in school increase belonging for Latinas to ensure STEM retention?	Survey Semi-Structured Interview	SQ5: Did you feel like you belonged in your K-12 science classes? Why or why not?
		SQ6: What do you remember about the way STEM content was delivered in school? Do you feel you benefited from it? Why or why not?
		SQ7: What advice or information would you give to yourself when you were younger (8-14), in relation to a pursuit of STEM?

To collect data, the researcher chose to use stratified random sampling so that only applicable data from undergraduate Latinas in STEM based programs was used for the study's

reported results. Stratified random sampling is the foremost method to ensure that specific characteristics, i.e. undergraduate; Latina, are identified for a sample (Creswell & Guetterman, 2021). Stratified sampling divides subjects into subgroups, based on characteristics they share, known as strata. For this study, stratified sampling allowed the researcher to obtain a sample from a larger population. The sample is meant to represent and allow for inferences to be made about that greater population. The sample for this study was the undergraduate participants at two universities and was meant to represent the Latina population in the United States, working towards a STEM career. For this study, Latinas were represented in the sample in direct proportion to the population (Creswell & Guetterman, 2021).

The data collection method of Stratified Sampling accounted for all of the surveys. Snowball Sampling was added to the protocol due to low participation from participants who opted for a follow-up interview. Snowball sampling allowed the interviewees to refer the researcher to other potential participants who met the targeted demographic (Creswell & Guetterman, 2021). A researcher might not always have access to the resources needed during a study. This researcher felt a void in the interview phase, and believed Snowball Sampling would increase the amount of rich and vast data to present, which it did. For this study, the participants who completed the survey and agreed to an interview were able to refer the researcher to their classmates and friends who were undergraduate Latinas in a similar pursuit of STEM. Table 3 explains the breakdown of participants who were recruited through Stratified Random Sampling, and the participants who were recruited through Snowball Sampling.

Table 3

Participants and Sampling Methods

Participant	Survey	Interview	Sampling Method
1	X	X	Stratified
2	X		Stratified
3	X		Stratified
4	X		Stratified
5	X	X	Stratified
6	X		Stratified
7		X	Snowball
8		X	Snowball
9		X	Snowball

The data for this study was collected from two colleges, both located in southern California. This data is the sample, which serves to represent the population of Latinas in STEM throughout the country. This stratified sampling method was feasible to collect data from the specific population.

Participants and Setting

The setting for this qualitative study was two state universities in southern California. One university enrollment at the time of this study was 35,723 combined undergraduate and graduate students and is in the southern region of San Diego. The other university is in Los Angeles and has a total enrollment of 44,947. The decision to survey students from different universities in southern California was intentional to collect and report on data that represents a

broader range of STEM undergraduates. Participants were chosen based on multiple aspects, including:

- Undergraduate enrollment status
- Identification as Latina
- Attendance at a southern California university
- Identifies as female
- Age 18 to 25
- Belonging to an identity based Latinx group on campus

The universities in this study were specifically selected because of their location. Due to its proximity to the US - Mexico border, San Diego has a high Latina population, which is the targeted group of this study. Los Angeles also has a high Latina population, and the university in this study has a 12% Latina, undergraduate, enrollment. In addition to a higher Latina population than many cities, these universities also have greater percentages of Latina students enrolled on campus, which allowed the researcher to assemble meaningful data that would strengthen the study.

Data Collection

The data collection process (Table 4) began by contacting five different major universities in San Diego, California. An introductory email was sent to the Deans of the STEM colleges within the universities, who then directed the researcher to specific identity-based groups on campus that include Latinx students (Appendix C). The researcher emailed the main point of contact for the group to establish a rapport. In that email, the researcher included the purpose of the study, the survey questions (Appendix H), and a copy of the IRB approval (Appendix B). From there, the survey and research information were distributed to members of

the group, including an informed consent document for participant reference (Appendix D). Members of the Latinx group who received the survey could then provide consent to participate by signing a consent form, sent to their email via Docusign (Appendix F).

Table 4

Data Collection Timeline

April - May 2023	August - December 2023	January 2023
Contact made with universities ↓ Full IRB approval	Surveys sent to potential participants ↓ Follow up emails sent to participants interested in interview	1:1 interviews conducted with participants

With approval from one of the universities (Appendix G), data was collected in the Fall of 2023 through a Qualtrics questionnaire (Appendix A). The researcher sent the survey to the main contact point at the university, who then forwarded it to their identity-based group members. The email that the contact point sent out included an informational email from the researcher with the purpose of the study, as well as the researcher's contact information should they need to reach her. The survey was sent out at the end of August, with four follow-up emails sent in case some of the potential participants still wanted to complete the survey. The follow up emails were sent in the middle of September, at the beginning of October, at the beginning of November, and a final email was sent in December (Appendix E). The final email also included the option for participants to interview or complete the survey to increase engagement.

Instrument. The researcher validated her own survey which was adapted from the Pew Research Center's 2017 Stem Survey Questionnaire (Pew Research Center, 2017) and the Test of Science Related Attitudes (TOSRA) handbook (Fraser, 1978). The questions pulled from these surveys were Likert style originally and were adjusted by the researcher to read as open-ended (Table 5). This decision was made to allow for participants to respond in an open and honest

way, rather than ranking their responses or having a restriction on how they could answer the question. Open-ended questions also gave the researcher more data because qualitative data aims to understand the human experience, which was the goal of this study.

Converting a Likert survey to an open-ended survey required validation. The researcher added validated survey questions to Qualtrics and sent the pilot survey to three individuals who matched the demographics of the intended recipients. All three individuals were Latina and would consider themselves to be interested in STEM. Upon completion of the survey, the researcher requested feedback from the participants. Feedback was necessary to ensure the questions were clear, the survey was not too time consuming, and the consent portion of the process was clear. Feedback was provided by filling in a blank space below the question. Upon receiving the feedback, the researcher made appropriate adjustments before sending it out to the university contacts. The adjustments that were made were related to the wording of some of the questions. For example, one question was originally written, “What do you remember about your STEM classes?” The feedback was that the question was too vague, so the researcher changed the question to read, “Thinking back to your experiences in grades K-12, what sticks out when it comes to STEM (science, technology, engineering, and math) classes?”

Table 5

Survey Questionnaire Changes

Likert	**Open-ended**
Thinking back to your own experiences in grades K to 12, did you generally like or dislike Science classes?	Thinking back to your experiences in grades K-12, what sticks out when it comes to STEM (science, technology, engineering, and math) classes?
I would enjoy school if there were no science lessons.	In what ways did your experiences at school impact your experiences in STEM classes?

Open-Ended Questions. Using the TOSRA and Pew Research Questionnaire questions provides researchers with quantitative data. Quantitative data can be limiting however, because the questions are closed-ended and there is no room for participant personalization when they respond (Rahman, 2017). Questions were initially formatted as closed-ended questions, which would not be appropriate for this study. Since participant voice is the focal point of the study, the researcher modified the questions to open-ended, therefore making it a qualitative study. Open-ended questions are unstructured and solicit authentic participant voice (Saldaña, 2015). Honoring and prioritizing participant voice yields unique data and gives an overall sense of genuineness that will better allow for validation of the results and findings (Saldaña, 2015). The survey sent to participants in this study included seven open ended questions, each specifically chosen to address one of the three research questions. The three research questions and their correlating survey questions are displayed below in Table 6.

Table 6

Interview and Research Question Alignment

Research Question	**Survey Question**
RQ1: What common STEM experiences do Latinas have in their K-12 years?	SQ1: Thinking back to your experiences in grades K-12, what sticks out when it comes to STEM (science, technology, engineering, and math) classes?
	SQ2: In what ways did your experiences at school impact your experiences in STEM classes?
RQ2: What common STEM experiences do Latinas have outside of school?	SQ3: In what ways did your experiences at home impact your experiences in STEM classes?

	SQ4: In what ways did your experiences in after-school programs impact your experiences in STEM classes?
RQ3: What educational practices in school increase belonging for Latinas to ensure STEM retention?	SQ5: Did you feel like you belonged in your K-12 science classes? Why or why not?
	SQ 6: What do you remember about the way STEM content was delivered in school? Do you feel you benefited from it? Why or why not?
	SQ 7: What advice or information would you give to yourself when you were younger (8-14), in relation to a pursuit of STEM?

Interviews. At the conclusion of the survey, participants were given the opportunity to participate in a follow-up interview at a later date by providing their name and email address. Two of the participants who completed the survey agreed to an interview. In all, five individuals participated in a follow-up interview. Four of the interviews were conducted via telephone and one of them was held on Zoom. All participants signed an informed consent form (Appendix F), sent through DocuSign, giving the researcher consent to record the interview for transcription through Otter.ai. Interviews ranged from 5-15 minutes long. Midway through the interview process, the researcher added snowball sampling to increase participation that would yield valid results (Kirchherr & Charles, 2018). The interview questions asked by the researcher are listed below.

- When did you first become inspired to get into a STEM field?
- What made you choose STEM after high school?
- Describe your experience with your STEM class now. What does it look like? How does it feel? What has surprised you?
- Describe the reason(s) you decided to go into a STEM major at _university name_

Analytical Methods

It is important for the researcher to understand the data that is collected. Understanding comes from multiple readings of the transcriptions and analyzing and inferring what is being said by the participants (Saldaña, 2015). The analysis process was led by two main components: (1) The study's three research questions, and (2) The theoretical framework of Bandura's Social Learning Theory. This qualitative study sought an in-depth understanding of the direct stories and experiences expressed by Latinas who are currently enrolled in an undergraduate STEM college. The data presented is a result of six completed surveys, and five one-on-one interviews. Using her own lens for interpretation, the researcher launched the analysis phase by conducting multiple read throughs of the interview and survey data. With the research questions and theoretical framework in mind, the researcher began to extract meaningful quotes and phrases from the transcriptions and methodically categorized them into sections. The researcher looked for initial codes and themes, selecting phrases from each individual's responses, which would later produce important patterns (Saldaña, 2015). An example of the organization of the initial coding is below in Table 7, for reference:

Table 7

Example Of Coding Process

RQ1: K-12 experiences	RQ2: Experiences outside of school	RQ3: Educational practices	Theoretical Framework
Shy away from seeking help when I needed it	I started interning at an optometrist office.	The way they laid out a strong foundation for me.	I was able to talk to different professionals.
Only person of color in the room.	I ended up getting a job at the physical therapy place.	I applied to a lot of GATE schools.	I want them to see me succeed.
I noticed that it was mostly guys.	Having her as a mentor helped me.	They [teachers] tend to brush them off.	You grew up with that misconception.

Following a preliminary exploratory analysis of the data, the researcher used thematic analysis to look for themes that emerged from the transcribed conversations. Given the qualitative nature of the study, the research found emergent themes by looking for repeating ideas, metaphors, analogies, topic shifts, and similarities and differences in participant expression (Saldaña, 2015). The researcher recorded key concepts, phrases, ideas, and themes in the margins of the transcripts resulting in a list of seven preliminary themes. The researcher narrowed the themes down to a final number of four. The final four themes were selected because they were the most expressed by participants. The participants expressed how they were made to feel, stories of self-motivation and determination, the constant battle of high expectations from family, and explanations of where they felt successful. The themes, from most frequently displayed (1) to least frequently displayed (4), are as follows:

1. Feelings
2. Determination
3. Expectations
4. Safe Spaces

Member Checking

When the data analysis was completed and the themes finalized, the researcher conducted member checking. Member checking was an important component of this study to validate the results and ensure that participant voice was the anchor of the study. To conduct the member checking process, an email was sent out to all participants (Appendix I). One participant replied and shared that the results were very interesting to her, and she thanked the researcher for doing the study. The lack of replies indicated that the participant's voices were depicted accurately and that there is no misalignment in the data and the results.

Limitations

The researcher took all necessary measures to ensure the validity and reliability of the study by carefully planning out her research questions, creating survey and interview questions that would effectively answer the research questions, identifying the most appropriate participant demographic, and studying and analyzing the data thoughtfully. Even when taking considerable precautions, there can be aspects of the research that need to be addressed for full transparency within the study. Citing limitations is the best way to acknowledge that the study had parameters out of the researcher's control that may have an impact on the results of the study (Ross & Bibler Zaidi, 2019).

The first limitation of this qualitative study was the location of the data collection. The two locations where data was gathered were universities in southern California. Southern California has a high Latinx population, accounting for 32% of the population in San Diego County alone, which is where one of the surveyed universities is located. Due to a higher Latinx population in southern California than what is seen in many other cities and states, the access and opportunities for Latinas is greater. This could cause a skew in the results because there is a greater potential of same-race classmates, educators, mentors, co-workers, and supervisors acting as pivotal supports. Mentors and other crucial support could all lead to a greater sense of community and support during adolescence, which would have made their transition into an undergraduate STEM decision smoother than those who do not grow up in the same environment.

A second limitation is that the universities in the study have a very large Latinx population and are known for a high enrollment of Latinx students. These statistics are a limitation because the results likely will not represent Latinas who are significantly the minority

at their school. Participants may have different experiences in their undergraduate years, or circumstances that give them more support in their STEM journey. These supports might not be available to all who are in the same demographic group may experience support that is provided strictly based on where they live, or they could have advantages not experienced by others.

A third limitation of this study is the survey delivery method. The open-ended survey was sent to a single contact point at the university, who then forwarded the survey and an email with an overview of the study to the potential participants. There is no way to have complete confidence that the survey was completed by the intended population group, Latinas. The lack of direct monitoring of who took the initial survey is a limitation that could produce data that is not valid or reliable.

A final limitation is that the study is qualitative, which leaves room for emotions to lead the responses, incorrect recall of experiences, and the potential to forget as time has passed on (Buckley, 2016). While qualitative research aims to allow participants' voices to lead the study, the way that individuals remember and interpret their experiences is limiting since there is always room for unintentional misinformation.

Role of the Researcher

For transparency, it is important for the researcher to give some background for this study, and what influenced the decision to make Latinas the focal point. First, she is an educator in San Diego who has worked with Latinas throughout her entire career. She taught math and science in rural communities and solely at Title 1 schools, where the populations were almost entirely Latinx. During her time in the classroom, the researcher witnessed her Latina students lacking confidence, feeling inadequate, and showing an overall disinterest when it came to math and science related content. The researcher enjoyed these subjects and wanted to engage her

students so they could build their confidence and find a passion for these topics, too. In order to do so, the researcher sought out multiple external programs to bring to campus, which resulted in grants for stormwater pollution prevention clubs and relationships with the city. Doing so introduced her students to new potential careers, with the hope that they would be able to see how the science and math content in the classroom connects with exciting jobs out in the real world.

While it would be ideal to enter this research bias free, it is not possible to do so entirely (Maxwell, 2012). Given that the researcher currently works with the population that is being studied, she made the decision to move the study out of her working environment. The goal behind this decision was to be able to get pertinent information that would in turn benefit the students she worked with on a daily basis, giving a broader perspective to the issues being discussed.

Chapter IV: Results

Introduction

The United States economy is driven by individuals with comprehensive knowledge of science, technology, engineering, and mathematics (STEM). According to the U.S. Bureau of Labor and Statistics, STEM careers are projected to grow by 8% between 2020 and 2030, which is at a much more rapid pace than other occupations (Falco & Summers, 2019). The financial benefits of these careers are substantial, paying up to 26% more than other careers (Dunlap et al., 2019; Fernandez, 2018; Ramsey, 2021; Wendt et al., 2018). In addition to STEM careers being more profitable, they also offer exploratory opportunities for groundbreaking discoveries that shape humanity, making them highly in demand. While a STEM career is one that many seek to obtain, these positions continue to be disproportionately dominated by White and Asian males (Misra et al., 2022; Robnett & John, 2020; Stevenson et al., 2019). In fact, according to the U.S. Department of Commerce, women only hold 27% of STEM jobs in the United States.

While STEM advancements are continuing to move the country forward, the Latina population yields the lowest numbers of individuals working in STEM related careers (Collins et al., 2020; Falco & Summers, 2019; Frederick et al., 2020; McKellar et al., 2019; Yu et al., 2021). The Pew Research Center reports that Latinas hold less than 3% of all STEM occupations. The barriers faced by Latinas are systematic and include limited access to educational resources, gender discrimination, cultural stereotypes, and socioeconomic factors (Yang & Carroll, 2018).

Guided by Bandura's Social Learning Theory (SLT), this qualitative study sought to better understand the current deficit of Latinas in STEM and how much of an impact adolescent years had on the current situation. Bandura's Social Learning Theory explains that humans learn through interactions with others and mimic the observed behaviors. This theoretical framework

was chosen because of its emphasis on the power of observation and mimicking. The researcher wanted to uncover the connection between messages that tell Latinas they will be unsuccessful in STEM, and adopting those beliefs based on messaging. In addition to the guidance of Bandura's SLT, this research study was also supported by the analysis of three research questions that were designed to invoke participant recall of their adolescence:

- **Research Question 1:** What common STEM experiences do Latinas have in their K-12 years?
- **Research Question 2:** What common STEM experiences do Latinas have outside of school?
- **Research Question 3:** What educational practices in school increase belonging for Latinas to ensure STEM retention?

Demographics

To ensure that the data collected met the specific inquiry of the study, the universities that the researcher sampled had a higher than average Hispanic population, averaging between 20% and 45% of the total undergraduate enrollment. Participants were sought out through stratified random sampling, as well as snowball sampling during the interview process. Stratified random sampling allowed the researcher to obtain a sample of data to represent a much larger population (Creswell & Guetterman, 2021). Snowball sampling was beneficial for the interviewing phase because it allowed the researcher to access individuals who exactly matched the targeted demographic.

In all, six participants completed the survey, and five participants interviewed one-on-one with the researcher. All participants were undergraduate students, ages 18 through 21, and were currently enrolled in a STEM college at a southern California university. The researcher

predetermined the age range of participants to be the average age of an undergraduate student. The researcher also wanted to make sure the participant was a traditional undergraduate in age therefore able to better recall memories of that time. Figure 1 demonstrates the gender identity of all participants. Figure 2 demonstrates the age of participants.

Figure 1

Gender of All Participants

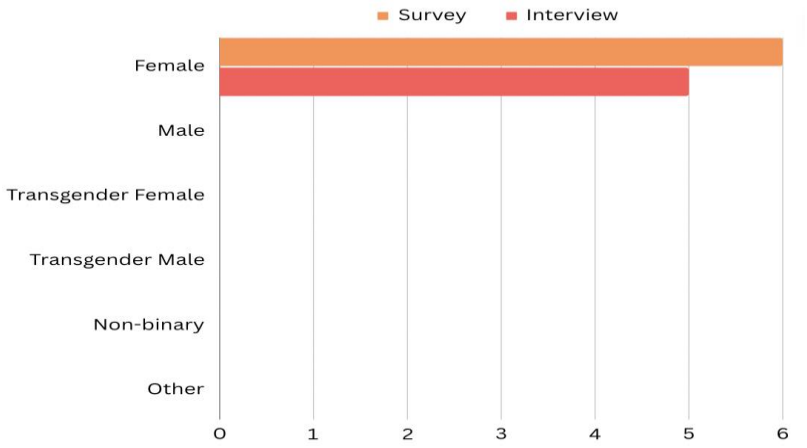
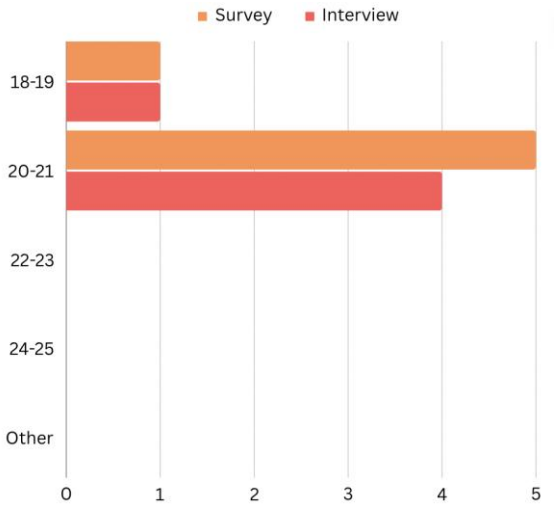


Figure 2

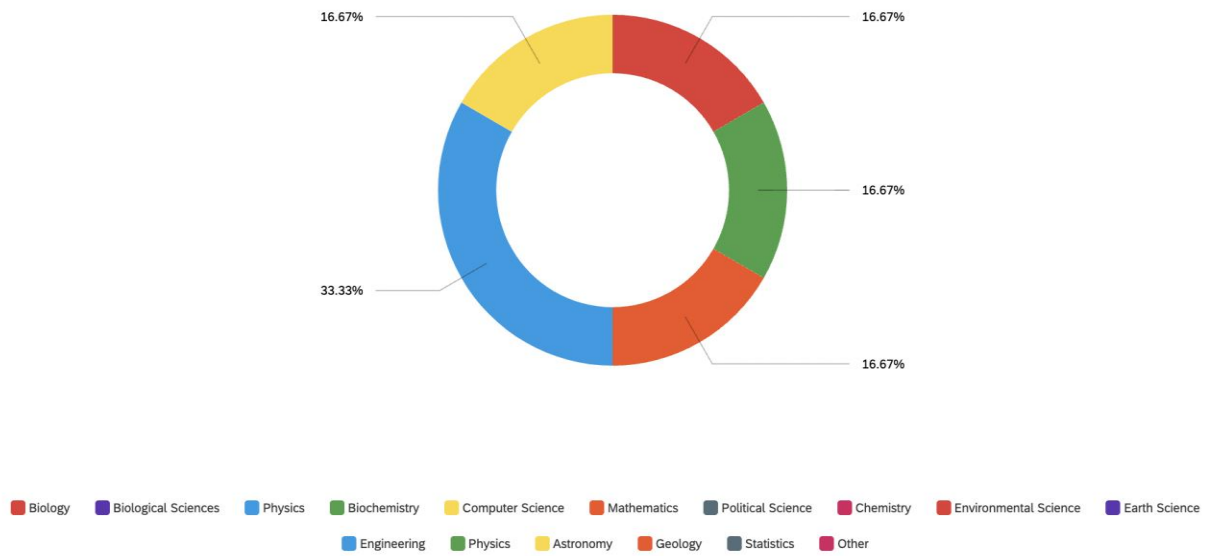
Age of All Participants



At the time of this study, all participants were undergraduate students, attending a university in southern California. They were also enrolled in a STEM based college within their university and a STEM major. The survey respondents had a range of majors, while the interview participants declared Biology related majors. All six of the interview participants also reported that they were first-generation. First-generation or "first-gen" refers to Latinas who are part of the first-generation of their family to attend college. Some participants shared that their parents didn't finish high school, or that they attended elementary school in Mexico, which was the extent of their education. The breakdown of the participant majors who completed the survey are below in Figure 3.

Figure 3

Major of All Participants



Survey and Interview Questions

Memories, lived experiences, supports, barriers, and environment contribute to an individual's development (Fryling et al., 2011). To better understand the adolescent path that led the participants into an undergraduate STEM program, the researcher created a qualitative survey

and semi-structured interview questions to answer the three research questions. These survey and interview questions also address different aspects of childhood, from elementary to high school, both inside and outside the classroom. The seven survey questions (Table 8), and four interview questions (Table 9) asked of willing participants are shown below.

Table 8

Survey Questions

Number	Question
1	Thinking back to your experiences in grades K-12, what sticks out when it comes to STEM (science, technology, engineering, and math) classes?
2	In what ways did your experiences at school impact your experiences in STEM classes?
3	In what ways did your experiences at home impact your experiences in STEM classes?
4	In what ways did your experiences in after-school programs impact your experiences in STEM classes?
5	Did you feel like you belonged in your K-12 science classes? Why or why not?
6	What do you remember about the way STEM content was delivered in school? Do you feel you benefited from it? Why or why not?
7	What advice or information would you give to yourself when you were younger (8-14), in relation to a pursuit of STEM?

Table 9

Semi-structured Interview Questions

Number	Question
1	When did you first become inspired to get into a STEM field?
2	What made you choose STEM after high school?
3	Describe your experience with your STEM classes now. What does it look like? How does it feel? What has surprised you?
4	Describe the reason(s) you decided to go into a STEM major at your university.

Coding Process

After the surveys and interviews were complete, the researcher followed strategic steps during the data analysis portion. The order of steps allowed for sorting, categorizing, coding, and emerging of new themes (Saldaña, 2015). The organization of this chapter is reflected below.

Step 1: Survey

Step 2: Initial Analysis

Step 3: In Vivo Coding for patterns

Step 4: Descriptive Coding for emergent themes

Step 5: Semi-structured Interviews

Step 6: Initial Analysis

Step 7: In Vivo Coding for patterns

Step 8: Descriptive Coding for emergent themes

Step 9: Comparison of survey and interview data

Emergence of Themes

Categorizing. As the researcher began the data analysis portion of the study, she created four predetermined categories, the three research questions, and the study's theoretical framework (Table 10). Any quotes, ideas, phrases, or words from the surveys and interviews that tied into the research questions or theoretical framework were put in the correlating category. For example, one participant shared, "I kind of grew into it because it was in middle school when I joined the Robotics Club." This statement is a STEM experience in the participant's K-12 years; therefore the researcher categorized it under RQ1.

Over time, and after multiple read throughs of all data, the researcher created three more applicable categories that emerged multiple times (Table 11). When the categories were finalized, and all the raw data was sorted into the corresponding categories, the researcher coded the data.

Table 10

Predetermined Categories

Research Question Number	**Research Question**
Research Question 1 (RQ1)	What common STEM experiences do Latinas have in their K-12 years?
Research Question 2 (RQ2)	What common STEM experiences do Latinas have outside of school?
Research Question 3 (RQ3)	What educational practices in school increase belonging for Latinas to ensure STEM retention?
Theoretical Framework	Bandura's Social Learning Theory

Table 11

Emergent Categories

Emergent Category Number	**Emergent Category**
Emergent Category 1	Internships, Career Immersion, Mentorships
Emergent Category 2	Community, First-generation, Family
Emergent Category 3	Transition from high school to college

Coding. The first method of coding that occurred during data analysis was in vivo coding. Since the data collected was all direct participant quotes, in vivo coding was determined to be the most appropriate method because just one in vivo code can capture and represent a long

excerpt that is shared by a participant (Saldaña, 2015). In vivo coding has been labeled as "literal coding" (Saldaña, 2015), and given that the primary goal of the study was for it to be led by participant voice, in vivo coding ensured what was being said in the surveys and interviews was being transferred into the study's findings. After the process of in vivo coding was complete, the researcher then added another layer of coding, descriptive coding. Descriptive coding summarizes a passage with a word or phrase (Saldaña, 2015), which is appropriate when working with long passages of storytelling, such as the ones in this study. Four examples of how the researcher pulled raw data, and performed in vivo coding, followed by descriptive coding, is below in Table 12.

Table 12

Coding Process Examples

Data	**In Vivo Code**	**Descriptive Code**
I got inspired when like, I was in elementary school.	Inspired… elementary school	Inspired
After that, after that internship, I started interning at an optometrist's office.	I started interning	Interning
The Hispanic community at [university] campus made me feel like I belong here.	Feel like I belong	Belong
I would shy away from seeking help when I needed it.	Shy away from seeking help	Shy

Themes. Results from the in vivo and descriptive coding produced the final themes. The themes support the organization of the data, and display the patterns that were produced through analysis of the participant surveys and interviews. The four final themes and sample responses are below in Table 13.

Table 13

Themes and Sample Responses

Theme	Sample Response
Feelings	Doubt that I made the right decision when choosing a STEM major.
	Shy away from seeking help when I needed it.
	It's really hard to help females in general to be interested.
Determination	I got inspired when I was in elementary school.
	After that internship, I started interning at an optometrist.
	I still find myself looking for opportunities outside the classroom.
	You kind of have to figure that out for yourself.
Expectations	Only a few girls in the classroom.
	I've seen a lot of struggle because I'm the oldest child in my family.
	My mom always wanted me…
	He [dad] always told me like when you grow up, you're going to be a neuroscientist.
Safe Spaces	Having her as a mentor helped me.
	[University] offered the option for me to live on a floor with all women in STEM.
	The Hispanic community at [university] campus made me feel like I belong here.

Patterns. Many patterns emerged during the coding phase of the research. One pattern that surfaced during the data analysis was that many of the participants took part in a Robotics class in both elementary school and high school. Another pattern that arose was an overall

feeling of lack of support. The participants stated that their parents pushed them to do better, but that push didn't necessarily mean they were pushed into STEM. Whether it was because their parents weren't too familiar with STEM, or didn't allow them to attend STEM programs, the push didn't correlate with what the participants perceived as the support they needed. A third pattern that emerged was that when the Latinas in this study attended a STEM program,, they all reported that it was an "eye opening" experience. All participants stated that they had a misconception of what a STEM career entailed, and that seeing people in the profession taught them what the workplace is actually like. A final pattern that emerged is that most of the participants were in biology related majors. The biology majors vary in specificity, but the majority of them shared the same college major choice.

Results For Research Question 1: What common STEM experiences do Latinas have in their K-12 Years?

Survey Results for Research Question 1. Participants reported that they were often the gender minority in their science and math classes. When asked Survey Question 1 (SQ1), one participant stated, "what sticks out the most is being one of the only few girls in the classroom and in other cases the only person of color in the room." Another noticed that "in engineering classes in high school…I noticed that it was mostly guys. There were only a few girls." When answering Survey Question 2 (SQ2) the responses were varied. Some reported that good grades encouraged them to continue to study, while others stated they didn't learn anything relevant in school.

Interview Results for Research Question 1. Interviews yielded rich and detailed data about the experiences of Latinas in K-12 years. In their elementary and middle school years, the Latinas in this study reported joining Robotics club as their entry into the field of STEM. They

also recalled taking assessments and struggling in math and science classes due to language barriers. Participants stated that during high school, their experience included internships and taking college level courses at local universities. While in high school, they shared they felt a lack of support from all of the adults around them and recalled their time in advanced placement (AP) classes. One participant stated, “I vaguely remember anything before high school, but in high school I never felt like I belonged. In fact, when it was registration time at my high school, counselors would not really encourage me to take AP classes because they thought it would be ‘too hard’ but I had been doing just fine.” Another participant shared an experience of her time in AP classes; “my high school also offered an AP Computer Science class where I learned a bit of Java and Python and about different computer parts.” High school years were formidable for STEM engagement, and many participants found themselves seeking opportunities on their own.

Overlaps in Data for Research Question 1. The overlap between the survey and interviews, in relation to Research Question 1, is the feeling of solitude in science and math classes. One participant echoed the sentiment of others when stating, “what sticks out the most is being one of the only few girls in the classroom and in other cases the only person of color in the room. I remember feeling imposter’s syndrome because my classmates had previous exposure to STEM because of their parent’s professions, while I am a first-gen student.” Participants felt isolated as one of the only females and member of a minority racial group.

The sentiments shared above were reported consistently by all of the interview participants. This is important because the experiences were the same, but the cities the Latinas grew up in were different. The feeling of isolation is universal in the STEM pursuit.

Results For Research Question 2: What common STEM experiences do Latinas have outside of school?

Survey Results for Research Question 2. Survey Question 3 (SQ3) sought to answer Research Question 2. Participants reported that while their parents pushed them, their parents were not able to support their children academically because they either didn't know English, or didn't know the required material. The consensus from all participants can be summarized in the following participant statement: "experiences at home did not really influence my decision to pursue STEM because my parents were not too familiar with what goes on inside school, but they did encourage me to study what I like and always try my best." Survey Question 4 (SQ4) asked: In what ways did your experiences in after-school programs impact your experiences in STEM classes? Five of the Latinas who completed this study's survey stated they did not attend after-school programs. The participant who stated that she did attend an out-of-school program mentioned, "I was a part of a robotics team in high school which fueled my interest in computer science and engineering. I started college as a Computer Science major but I changed it to Civil Engineering my second semester."

Interview Results for Research Question 2. Research Question 2 determined that off-campus activities were an instrumental part of continued interest in STEM. One participant recalled that internships allowed her to get better and stated, "It was eye opening for me as I feel more confident, and everything made sense while I was doing the research." Another shared, "I think through internships, I was able to get better." Other participants took college level courses in high school and found those contributed to their retention in STEM. One participant shared, "I went to an all-girls stem all program and I got to live college life for a bit. That's when I was like, okay, I really like these things. I really like math. I really like chemistry, like, I want to pursue

something in it." Off campus activities and the experience of being surrounded by a community who shares their same passion and interests was reported by all participants as an instrumental support.

Overlaps in Data for Research Question 2. While participants who completed the survey stated that they did not attend after-school programs, the participants who interviewed credit non-school related programs for engaging them in science and math. These programs all occurred outside of school hours and were off campus in college and workplace environments. Three of the programs' participants shared are listed and described below:

1. San Diego Squared: Through access to education, mentorship, and resources, San Diego Squared connects underrepresented students to the power of STEM. A participant who participated in this program explained, "take those students to biotech companies and see that there's much more than just being a chemist or a science scientist."
2. University NOW: The University NOW initiative offers chances for underrepresented high school students in San Diego to see themselves as college attendees and effectively finish two integrated university-level courses. One of the participants credited University NOW with her decision to choose STEM after high school, stating, "I think that [program] made me feel that Biology was the right major for me."
3. STEM for Girls Conference: This event is a hands-on STEM learning experience for girls in 6th-12th grade and is held on Fresno State's campus. This event includes keynote speakers, and active break-out sessions with local women who are currently working in STEM. A participant shared, "I got to live college like for a bit and that's when I was like, I really like math, I really like Chemistry. That was the very beginning."

In both the survey and the interview, participants mentioned Robotics. One participant shared “I kind of grew into it [STEM] because it was in middle school when I joined Robotics Club.” Another shared a memory of competing at colleges during her high school years: “It was a robotics club where we basically coded and we constructed these robots to go into competitions at Fresno State.” Out-of-school programs will vary in the way they are delivered as well as how they are perceived. The data collected from the survey and interviews proves that the exposure provided in the out-of-school programs was positive for the Latinas in this study.

Results for Research Question 3: What educational practices in school increase belonging for Latinas to ensure STEM retention?

Survey Results for Research Question 3. Research Question 3 (RQ3) was addressed by two survey questions. The first question asked participants: What do you remember about the way STEM content was delivered in school? Do you feel you benefited from it? Why or why not? In the survey portion of responses, many of the responses focused around negative comments and phrases such as “frustrated”, “indifferent”, “not able to learn anything” and “on my own.”

One participant credited her high school for her success in STEM stating, “In high school there were a few STEM related elective options which included Biomedical engineering and Robotics. I did benefit from taking these classes because I learned skills that I then used in college.” This sentiment was not the same for others. One participant said, “I remember reading from textbooks and doing short labs. I think it was helpful in the moment for class but I don’t remember any of it.” Another shared her science class experience as the following: “I feel like sometimes in high school, concepts in STEM are described as much more complex and complicated than they really are. This would make it seem like I couldn’t do it.”

Survey Question 5 (SQ5) asked about the participants' sense of belonging in their K-12 STEM classes. Participants had varying answers, some stating, “I hated going to class and not being engaged” while others shared “I felt that I did belong but sometimes it was a struggle.” While the feelings varied from each individual, one thing that stands out is that participants did not feel a strong sense of belonging, and participants did not feel that their time in STEM classes gave them an advantage as they moved through the education system.

Interview Results for Research Question 3. A very consistent sentiment was echoed through each participant that interviewed in regard to educational practices in school. They all stated that they did not feel their K-12 years, specifically high school, prepared them for college. One participant shared: “I thought that my math class was going to go very easy. I really thought it was because I had already taken calculus in high school. I really underestimated the classes here at first.” Another participant noted,

> Making that switch from high school, I didn't realize how dependent I was on my notes or my teachers in high school and then moving into college, you just have to do so much more for yourself. You have to do reading outside of class, watch YouTube videos, go to office hours and no one is telling you, ‘you have to do XYZ’ to take the exam. You kind of have to figure that out for yourself.

The difficult transition from high school to college, and the level or rigor that is required in higher education, was not something the participants were prepared to experience. Despite taking advanced classes and high-level courses, they all shared a feeling of overwhelmed when they made the transition.

Overlaps in Data for Research Question 3. Research Question 3 brought up many different experiences, with the same underlying tone of disappointment because the education

they received in their K-12 years, and the way content was taught, was not conducive to the expectations in higher education. Whether it be overestimating their abilities as they enter college level math classes, or not gaining any usable knowledge in their high school courses, the participants all reported a struggle and shared a feeling of unpreparedness for higher education.

Combined Overall Impressions and Patterns for Research Question 1

The STEM experiences Latinas have in their K-12 education reflect an interplay of inspiration, passion, self-doubt, a lack of support, and an underlying feeling that they don't belong in STEM. While prior research has found that elementary years are when STEM interest is primarily generated, this study found that the interest varied from elementary to high school, depending on the individual participant's familial situation and experiences. Participants' experiences during their STEM pursuits were often negative and compounded by an absence of role models and a sense of isolation from classes or programs predominantly attended by their male classmates. The findings of Research Question 1 can be found in detail below regarding the impact of life experiences, imposter syndrome, and a perceived lack of support.

Life Experience. The survey and interviews revealed that throughout their K-12 years, Latinas had varied life experiences that drove their interest in STEM. Some participants reported that a death in their family was the catalyst: *"*I was, I think, two years old. My grandmother, my dad's mom, passed away from ovarian cancer. I knew I wanted to go into something in the sciences and just kind of find a way to help with cancer research or diagnosis or drugs.*"* Others found interest through school based programs such as Robotics, "I kind of grew into it because it was in middle school when I joined Robotics Club.*"* Some participants generated interest in high school: "I was first inspired when it was my last year in high school. My high school offered certain specific STEM career paths,*"* while others found their passion in elementary school, "I

said, ‘I'm gonna be an optometrist.’ This was third grade. After that, I applied to a lot of GATE schools.”

Imposter Syndrome. In their K-12 years, Latinas face barriers that hinder their academic performance and clouded their career pursuits with doubt. This study found that Latinas do not feel like they are good enough, and do not feel that they belong in the STEM world, leaving them with a feeling of imposter syndrome. One participant shared about her feeling of imposter syndrome: “Because of the imposter’s syndrome I dealt with and feeling alone as the only woman in the room, I would shy away from seeking help when I needed it. This caused me to get low test grades and made me doubt that I made the right decision when choosing a STEM major.*”* Another shared about her experience as the only person of color in the room: *“*What sticks out the most is being one of the only few girls in the classroom and in other cases the only person of color in the room. I remember feeling imposter’s syndrome because my classmates had previous exposure to STEM because of their parent’s professions, while I am a first-gen student.”

Lack of Encouragement. In their K-12 years, Latinas often lack encouragement and support from their family, educators, and their peers. One participant stated, “When it was registration time at my high school, counselors would not really encourage me to take AP classes because they thought it would be too hard.” The schools are not solely responsible for supporting Latinas in their pursuit of STEM, many reported a difficult home life contributed to the barriers they faced. One participant shared, “I didn’t have any academic support at home because my parents don’t understand English and they didn’t go to college, let alone finish elementary school in their home country of Mexico.” Another stated, “I think subconsciously, the lack of pressure from my family as a whole made me put pressure on myself to do well in all classes, including

STEM." Community is a crucial factor in early year STEM pursuit, and the nurturing of the next generation Latinas in STEM (Ackert et al., 2021).

Combined Overall Impressions and Patterns for Research Question 2

Latinas face unique challenges as they pursue STEM, but there are supports that combat negative feelings and self-doubt. In this study, mentorship was identified as a crucial role in supporting and guiding Latinas through the obstacles they face. Mentors serve as role models who have experienced the struggles and isolation themselves and are able to provide guidance, advice, and networking opportunities. One participant shared her experience with her mentor: "Having her as a mentor helped me a lot in the sense of walking into college with an idea of what I might want to do." Another participant shared that observing her mentor allowed her to "realize it was really interesting and that there was definitely much more than just being in the lab."

Internships are a vital component for the support of Latinas in STEM because internships allow students to see themselves in the role of a professional. One participant shared, "Through internships, I was able to get better. Being able to practice the language, being able to expose yourself in the science field was eye opening. I feel more confident, and everything makes sense." A personal injury brought another participant to a STEM internship. She shared, "I was playing softball, and I had sprained my knee. I ended up getting a job later at the physical therapy place." Another participant recalled her internship, and being in the environment as how she first became inspired to pursue a STEM career: "I just continued to seek opportunities within the STEM field…there was definitely much more than just being in the lab…that's how I first became inspired in the STEM field." Internships provide the opportunity to connect with professionals and an opportunity to showcase their abilities in a professional setting. Internships are also an invaluable opportunity to build community and gain experience.

Taking a higher-level STEM course has numerous benefits for Latinas as they plan for college and career. Immersive experiences are a preview of the academic rigor that is expected in college, which many participants expressed was a very challenging transition for them. Two of the participants in this study attended a college Biology class at a local university while they were in high school and expressed "It was a college level biology course. I become passionate about being in a lab. Just the way the professor was introduced and ran the class. I think that made me feel that that was the right major for me." Another participant shared her experience in a college STEM program for girls: "I got to like live college life for a bit and then that's when I was like, okay, I really like these things. I really like math. I really like chemistry, like, I want to pursue something in it."

Many of the participants also discussed a hard transition from high school, as shared below in Table 14.

Table 14

Sample Responses Regarding the High School to College Transition

Participant	**Response**
1	"I have to say that college is nothing compared to high school. And it's definitely something I'm still trying to adjust to."
2	"The first two years of college were really difficult."
3	"Making that switch from high school, just I didn't realize how dependent I was on my notes or my teachers in high school and then moving into college, you just have to do so much more for yourself."
4	"I wouldn't really say high school super prepared me for my college experience."
5	"So it is hard. Like I'm still like I still like pushing through."
6	"I thought that my math class was going to go very easy. I really thought it was because I had already taken calculus in high school. I really underestimated the classes here at first."

The interviews and survey, aimed at answering Research Question 2, produced data signifying out-of-school experiences such as internships and taking college level courses in high school, as pivotal in shaping the trajectory of Latinas in STEM.

Combined Overall Impressions and Patterns for Research Question 3

Strong and intentional educational practices are essential to support Latinas who are interested in STEM fields. An inclusive and supporting learning environment has the potential to engage and retain Latina students in STEM courses that will empower them to pursue their interests without fear. Research Question 3 sought to better understand how a school, and the way educators are teaching, impacts a Latina's pursuit in STEM.

A notable discovery that emerged from Research Question 3, which was corroborated through both interview and survey methodologies, as well as attested to by each participant, is that Latinas must actively pursue opportunities on their own. When asked about their education experiences, only one participant mentioned their teacher as a source of support. She shared, "subjects like math come easy for me and I attribute some of that skill from my experiences with teachers and the way they laid out a strong foundation for me." Another participant recalled, "I do not remember specific details of STEM classes other than math, which was taught as a step-by-step process. I greatly benefitted from it and I still prefer to take notes in that manner." Aside from these two comments, teachers and their educational practices were not communicated as a source of support.

Despite their passion and capabilities, societal expectations and cultural norms impose a challenge on Latinas who are pursuing STEM. One common thread in the data related to Research Question 3 is that many participants stated that they had to seek out opportunities on

their own. One participant shared: “My high school did not have anything astronomy so I would really just research on my own.” Another shared about how familial situations impacted her pursuit; “You don't get enough support. There's a lot of things that go on at home and a lot of females’ families, their parents don't want them to do anything. If a girl wants to go on a trip for something STEM related, they're [parents] like, oh, it's a waste of your time.” Another participant shared that culturally, “It's really hard to help females in general to be interested. You have aspirations but a lot of us that come from communities like that end up with a lot of family who end up getting pregnant.” Another participant stated, “the expectations of a person who's first gen, who is Latina, is really, really low.” A lack of support from school and family drives Latinas to make their own way. In addition to their gender and cultural barriers, the familial one is often an inevitable hurdle to break through. When participants found the STEM support, they were looking for, it always came by way of opportunity they sought out for themselves. Some found a mentor: “I was able to talk to different professionals and I even was able to get my own mentor” and others “just continued to seek opportunities within the STEM field.”

Data Interaction with the Theoretical Framework

Albert Bandura’s Social Learning Theory (SLT) was a critical guide in this qualitative research study. SLT, which emerged in the 1960s, states that individuals learn by observing, modeling, and imitating what they see in their immediate social environment (Bandura & Walters, 1977). This theory further suggests that individuals acquire behaviors by observing the actions of others, as well as the positive and negative consequences associated with the action. Humans then begin to shape their own behavior based on what they observed (Bandura & Walters, 1977). This theory holds a key piece in the discussion of human development because it

seeks to explain how behavior is acquired and maintained as humans continue to develop over time.

Social Learning Theory is particularly applicable during adolescence when a significant amount of development occurs, both cognitively and socially. This theoretical framework is appropriate for this study because this study's research is focused on adolescent years and how a Latina's social surroundings impacted her decision to pursue and persevere through her journey in STEM. It was also chosen because as Bandura states, we learn by observing others (Bandura & Walters, 1977). Internships, mentorships, and real-world experiences in the lab were reported as a pivotal part of the STEM journey for many participants. The Latinas that provided their stories for this study were able to watch and listen to professionals and realize that a STEM identity can be one that they learn to make their own.

Given that Bandura's theory is highly influential in adolescent years, the researcher used it to support the claim that if a young Latinas is being told she won't be successful in STEM, after time she will believe it. One participant stated, "I just kind of grew up with that. With that seed in my head" when referring to not feeling that a STEM path was for her. Another shared in regard to her underperformance in STEM, "you grew up with that misconception [that you can't be successful] in STEM" and it took many years, exposure, and positive experiences to change the way they saw themselves.

Bandura's Theoretical Framework emphasizes the importance of credible and influential mentors in development (Bandura, 1993). When a young person can observe a professional and learn from what they are seeing that young person will be able to reproduce the actions themselves (Bandura & Walters, 1977). Research Question 2 addresses the need for internships and mentorships as a critical component of STEM career development. Participants shared that

being able to observe professionals in a professional setting allowed them to “see that there's much more than just being a chemist or a science scientist.”

Internships provide a glimpse into the real work experiences of STEM careers. They also provide resources not otherwise available, networking opportunities, mentors and a glimpse into what a career in STEM might entail. Internships also allow for the mimicking that Bandura speaks of, to be put into practice. The ability to put knowledge, interest and passion into something tangible will increase understanding as well as enhance proficiency. Learning and being surrounded by this type of environment will provide longevity in the field because the modeling and mimicking will be of professionals who are currently doing the work.

Chapter V: Discussion

STEM interest is generated during adolescence, which the World Health Organization designates as the ages between 10 and 19. Adolescence is also the time when a young person's perceived abilities are nurtured and solidified, which is why it is such an important time for STEM interest to be supported and encouraged, especially for girls (Ackert et al., 2021; Collins et al., 2020; Howard et al., 2020; S. Jiang et al., 2020; Morton & Parsons, 2018; Sampson & Clayton, 2021; Sayilgan et al., 2022; Young et al., 2019). A STEM journey will not be an easy one for a female adolescent because she will continuously face barriers outside of her control, such as a lack of role models, limited resources and access, and gender discriminations (Falco & Summers, 2019; Fernandez, 2018; Fernández-García et al., 2019; Swafford & Anderson, 2020; Young et al., 2019). If that female is also Latina, she will face microaggressions and unwarranted judgment strictly because of how she looks.

This study focused on the adolescent years of Latinas to determine why there are so few Latinas successfully entering a science, technology, engineering or math related career. Even though boys and girls perform the same in math and science in middle school (Leaper et al., 2012), women are continuously underrepresented in STEM professions, making up only 27% of the predominantly male workforce according to the U.S. Department of Commerce. According to the Pew Research Center, less than 3% of the women in STEM professions are Latina, which causes a ripple effect of continued deficits of mentors and role models to serve as guides. Without these guides there will be no one to assist and support in building the resilience required through college and career.

The researcher chose adolescent years as the focus of this study because that is where the gap in the literature lies. The gap specifically lies in what Latinas, who are currently working on

a STEM major, felt supported them the most in their STEM journey. The researcher aimed to gather this necessary data through three research questions:

RQ1: What common STEM experiences do Latinas have in their K-12 years?

RQ2: What common STEM experiences do Latinas have outside of school?

RQ3: What educational practices in school increase belonging for Latinas to ensure STEM retention?

Summary of the Results

This chapter contains a summary of findings for the study's three research questions, which analyzed Latinas pursuing STEM occupations, and the aspects of their adolescence that helped or hindered their pursuits. The key findings are below:

1. Mentors provide a critical level of support, particularly if the mentor is the same gender and same race as the mentee. Mentors provide guidance and advice from their own personal experiences, serve as positive role models, and offer support and encouragement (Brue, 2019; Misra et al., 2022; Sanchez et al., 2019; Young et al., 2019). Having a mentor can foster confidence and resilience in Latinas as they work towards a STEM goal and provide invaluable networking opportunities and resources to ensure retention and success.
2. Out-of-School programs can be eye opening experiences that inspire, educate and empower Latinas. STEM out-of-school programs provide hands-on experiences, provide access to resources, and foster a supportive and collaborative environment (Donmez, 2021; Price et al., 2019; Wade et al., 2021; Young et al., 2019). The feedback from the participants in this study regarding after-school programs included taking college level

classes while still in high school, internships, summer programs, and after-school clubs such as robotics.

3. A lack of support was shared consistently across all participants. Most of the Latinas in this study did not feel supported by their family, their peers, their school counselors, or others in their life when it came to their pursuit of STEM. The reasons ranged from a lack of understanding about what a STEM job entails, to the doubt that they would be able to handle such a challenging career choice. Because of this lack of support, many of the participants were forced to seek out STEM opportunities on their own and look for resources for learning in isolation.

A qualitative study was the most appropriate for this work because qualitative research best captures participant perspective and experiences, resulting in a study that stands on first-hand accounts and direct participant voice (Y. Jiang et al., 2021). The encounters that the participants had, both positive and negative, molded who they currently are and heavily impacted the identities that they formed over time (Eisenhart & Allen, 2020). With Bandura's Social Learning Theory guiding the study from the learned behaviors perspective, the researcher analyzed the data and will share the findings in detail below.

Research Question 1

The first research question asked: What common STEM experiences do Latinas have in their K-12 years? This question sought to generate memory recall from previous experiences in STEM. The researcher knew that Latinas would have a variety of lived experiences, but she wanted to see what they had in common that could support future work relating to this study's goal.

Current literature shows that representation in STEM is essential for Latinas for several reasons. Seeing someone who looks like them succeeding in a STEM career validates that they too can belong in that career (Crane et al., 2022). Many current and past research studies have reported that one of the greatest predictors of success for women in STEM is correlated to same-gender and same-race role models because of the level of psychosocial support it provides (Crane et al., 2022; Jackson et al., 2013; McGee & Bentley, 2017; Reding et al., 2017; Steinke et al., 2022; Yu et al., 2021). Role models also assist in the breaking down of stereotypes, challenging of biases and demonstration that intelligence and ambition are not limited by race or gender (Morton & Parsons, 2018).

The researcher found that the literature around role models has a gap because role models are reported as a main support in multiple studies, but this study found that mentors are, in fact, what young Latinas need. Role models and mentors do not hold the same role. While role models are inspirational, mentors are actively working with and developing their mentee through sharing of personal experiences as well as sharing of advice for how to handle challenging situations (Ferguson & Martin-Dunlop, 2021; Wright et al., 2021). Mentors engage directly with mentees and offer tailored advice and constant communication, which is especially important when the mentee is a Latina who is navigating unfriendly territory (Howard et al., 2020). The potential for connections with mentors is there because Latina STEM professionals want to be more actively involved with younger generations (McGee & Bentley, 2017). They want to support the youth who are following their professional STEM path to ensure higher retention rates of females in the field by creating relational connections (McGee & Bentley, 2017).

Furthering the gap in research around role models and mentorship is that when prior studies do analyze Latina mentorship in STEM, they tend to analyze college and career years,

not the formidable K-12 years. Same-gender and same-race college faculty members, for example, have proven to be instrumental in their mentorship of college students (Castellanos, 2018). Unfortunately, there is a shortage of Latina mentors working at STEM colleges, due largely in part to a scarcity of Latinas in the field in general. Mentors in the workplace support the navigation of professional life obstacles by way of venting sessions, shared experiences, advice, and a sense of community over a shared situation (Petersen et al., 2020). While this data is important, and trickles down into the K-12 years, there needs to be more emphasis on adolescent year mentorship so that more Latinas actually enter the field and can in turn become mentors for others.

This study fills a gap in literature around role models and their impact on an adolescent's K-12 years. The gap is filled through reporting that the participants felt that mentors, not role models, were a primary source of support in their STEM journey, during high school specifically. When the participants shared stories about their mentors, they expressed that the support they received was generated through active engagement and opportunities to learn hands on in the field, primarily through internships. Another literature gap that was answered is that while the literature does state the importance of same-gender and same-race role models or mentors, the Latinas who were interviewed did not specifically state that having someone who looks like them gender and race wise was necessary. In fact, the mentors that did make strong connections with the participants were of the same gender, but not of the same race. This is important because Latinas are underrepresented in the STEM field, which leaves a deficit of mentors. If STEM professionals of other races and ethnicities can serve as strong mentors, there will be more mentorship connections and therefore an increase in Latinas in STEM as the future of STEM continues to advance.

Bandura's Social Learning Theory states that individuals learn through interacting, observing, and modeling (Bandura & Walters, 1977). If Latinas can interact with STEM mentors, especially if they are the same race and same gender, they are more likely to be successful in the field (Howard et al., 2020). Having a mentor will not only combat isolation, but mentors also fight a feeling of imposter syndrome too (Ackert et al., 2021; Hunt et al., 2021; McCullough, 2020). The participants in this study shared that they relied heavily on mentors to guide them through their journey. This study revealed that mentors play a critical role in Latina STEM development and helped them understand what a professional STEM career entails. Having someone to talk to was eye opening and gave them better insight into all of the potential paths a STEM job can take them.

Research Question 2

The second research question asked: What common STEM experiences do Latinas have outside of school? Out-of-school time (OST) provides an enriching experience beyond the structured classroom setting (Nation et al., 2019). The After School Alliance states that out-of-school programs are particularly beneficial and important for underserved communities, because after-school programs give students a safe space and the opportunity to explore different interests. This study sought to analyze the impact that out-of-school programs had on the participants who attended them.

Current and prior literature explores the benefits of out-of-school time for students on the basis that OST is a different setting than a classroom, leading to a more exploratory type program (Morton, 2021; Yu et al., 2021). The literature also spends time analyzing how out-of-school time programs create a sense of community among students with shared interests (Ackert et al., 2021; Donmez, 2021; Young et al., 2019) which is important, especially for marginalized

communities. While these are both critical components to STEM retention, this study analyzed out-of-school programs in different settings other than the typical after-school program such as the YMCA or Boys and Girls Club. Furthering the gap related to out-of-school programs is that the OST programs that have been frequently studied tend to serve younger students. They also often serve as a place for students to go if their parents are working and they need care after school hours. This study sought to fill the gap by looking into OST in older students, and found that experiences off of campus and in the real world were strong predictors of STEM success. The participants in this study shared about influential experiences in internships and college classes as their out-of-school experiences, which gave them the confidence to enter in the field. This is the case because the Latina participants were actually able to be immersed in it. In addition, the out-of-school time advanced their knowledge of science, technology, engineering and math, and gave them a preview of what their future could look like, as well as an opportunity to work with professionals who can speak firsthand of what the STEM world involves.

Internships were consistently reported as a source of support for the Latinas in this study. STEM internships not only provide practical experience, but they also show young people how STEM can be used in the real world. Interning is an opportunity to see all the different paths a STEM career can take and is critical for networking, learning the language, and observing professionals in their day to day. The participants in this study credited internships with the realization that “there is so much more to being in a lab.” Participants also shared that internships are where they found the instrumental mentors who gave them advice on how to be successful. Some of the participants also shared that they still communicate with their mentors, despite not interning anymore, because their mentors were such pillars of their development.

Out-of-school time offers a less restrictive environment where students have the freedom to explore and has been proven to be instrumental in filling gaps and increasing interest in STEM topics (Donmez, 2021; Eisenhart & Allen, 2020; Price et al., 2019; Young et al., 2019). Out-of-school program availability varies, and comes in multiple forms, such as robotics club, summer camps or college classes. Three of the Latinas in this study recalled their time in a Robotics club, one of them even traveled out of town to compete in statewide competitions. Another participant shared that robotics club is how she "grew in" to the STEM field. In addition to robotics, participants also shared positive experiences with taking college classes while they were in high school. Two of the Latinas in this study stated that a biology course they took, as part of a dual enrollment program with their high school, solidified their determination to pursue STEM. One of the participants, who is working on her Biomedical degree, stated the college level Biology course, "made her feel like it was the right major for [her]."

Bandura's Social Learning Theory states that behavior is learned through observing the environment (Bandura & Walters, 1977). Observational learning is not always immediate and requires time, repetition and mimicking to become an ingrained part of development (Bandura & Walters, 1977). For this reason, out-of-school time and the exposure to the real world that it provides is significantly contributory to retention in STEM. According to Bandura and Walters (1977), new skills are acquired through observing others' behaviors, and the rewards and consequences that follow. Through this process of observational learning, adolescents can gain job-applicable skills, and learn how to communicate, socialize, and problem solve, which are all inherent needs in a STEM profession.

Research Question 3

The third research question asked: What educational practices in school increase belonging for Latinas to ensure STEM retention? This research question aimed to address educational practices in the classroom that could have contributed to the participants feelings of confidence and longevity in the STEM field. Adolescents spend much of their day in the classroom, which is why the researcher felt it was an important context to analyze. The question, however, did not gather the feedback the researcher had hoped for, as actual in class time was not something that the participants recalled fondly. This lack of positive experiences resulted in Research Question 3 going mostly unanswered.

In the results of this study, the discussion around educational practices focused heavily on the out-of-school time rather than content being delivered by teachers in a school setting. The researcher did not lead the participants in any direction; their answers organically cycled back around to out-of-school time when questions related to educational practices were posed. One participant did attribute her math skills to the foundation her teachers laid out for her in adolescence. It is interesting to note that the same participant also attended Gifted and Talented Education (GATE) schools for elementary and middle school. This could potentially lead to a future study regarding school placement and the effects that has on an adolescent moving into a STEM career.

Much of the literature around educational practices focuses on the importance of culturally responsive teaching in the classroom (Morton & Parsons, 2018). Culturally responsive teaching and instruction acknowledges diverse backgrounds and perspectives and puts emphasis on how important they are to education. Being culturally responsive in STEM creates a more inclusive environment that is equitable for all learners (Gay, 2002). Academic success for

students, particularly those who have been traditionally marginalized in school such as Latinas, can create a positive academic identity and sense of belonging (Gay, 2002). This sense of belonging will lead to more persistence, higher attendance in school, and positive learning outcomes for Latinas who are interested in STEM (Muniz, 2019). For the participants in this study, having culturally responsive teachers and programs while in school could have produced a more positive recall of time in the classroom. The acknowledgement of diverse backgrounds and the resulting inclusive environment would have increased feelings of belonging and increased the likelihood of retention in a challenging field such as STEM.

Recommendations for Future Research

This study revealed multiple ways that Latinas found support in STEM. The literature, participants, survey, interviews, feedback, and other input can all contribute to building a stronger, more diverse STEM workforce where Latinas feel valued and welcomed. Below are further potential studies that can contribute to the effort of Latina retention in STEM.

1. Access to mentors is essential for a Latina because mentors provide exposure to the field, networking connections, and an increased sense of community. These three components are building blocks that can lead to higher retention rates and sustainability in the STEM workforce. It would be important for further studies to look into the relationship of a same race and same gender mentor-mentee relationship specifically to further analyze if that makes a significant difference in retention rates.
2. Latinas must have access to real world STEM experiences so they can see how that career is applicable in day-to-day life. Further research would analyze STEM professionals who had early professional exposure to the field, by way of internship or

college level class, to analyze the implications of an external program impacting a future career pursuit.

3. Students spend immeasurable hours of their lives inside the classroom, making it an opportune time to nurture a STEM passion. The interviews in this study did not yield significant findings related to in-class educational practices. Further research would benefit from analyzing the way teachers deliver STEM content, and what the instructional practices are like in the classroom.

Implications for Professional Practice

This research study found different ways to increase Latina retention in STEM. The data specifically revealed the importance of exposure through mentors and after-school programs such as internships and STEM clubs. Girls and boys perform the same in math and science in elementary school, and as they get older their interest starts to deviate and females tend to turn to more nurturing careers because this is often what they are encouraged to pursue. Early access to STEM professionals and introductions to the different paths in STEM careers, will support Latinas as they continue their interest in STEM. This is important so that they don't give up on their dream and settle for a different career path they might not have the same passion for.

Being immersed in a STEM environment, and the exposure it provides, can increase retention because it provides a space where Latinas can learn and thrive. In this study, many participants made statements that suggest they didn't realize what a STEM career could look like until they were involved in some way. This is something that needs further research to find out what the misconceptions of STEM careers are, and why the misconceptions exist. This work would be a baseline for creating new ways to introduce young children to STEM. The words *science, technology, engineering* and *math* all hold their own meaning. There is so much more

meaning behind each word, however. Finding ways to bring the many potential career pathways out of those words, and beginning to teach them to adolescents when they are in elementary school, could potentially keep more girls invested in a STEM career.

When it comes to female adolescent interest in STEM, ensuring cultural sensitivity and cultural relevance would be the next step to ensuring Latinas learn about the field and continue to grow in it. Culturally relevant education respects the diversity of learners and uses examples, materials, and instructional methods that are relatable to Latina students. Culturally relevant education will also acknowledge that there are biases and cultural stereotypes that exist for Latinas, and showing support will help address the barriers and ensure they do not block any more aspiring STEM professionals. If Latinas can see the support they receive, they will feel more welcomed in the environment and start to build community. Within this community is the opportunity for networking, mentoring, role models, new learning, and potential career paths in the future.

This study's research questions inquiring into STEM in the classroom did not reveal memories that were reflected on fondly. This is cause for more inquiry because school is meant to be an avenue for students to learn, and the older they get, they learn with a finite focus on career. If STEM is not a career that is being introduced or encouraged, it could explain why there are so few women, specifically Latinas, who end up making a different choice. The lack of memories relating to educational practice in STEM could lead to an exploration of the curriculum that is being delivered to students across the country. In addition, if the curriculum is in fact encouraging students to stay in STEM, it would be important to focus on the curriculum and method of delivery to Latinas. More specifically, it would be necessary to assess if Latinas are being encouraged less than their classmates, and if so, why and by whom. Latinas have

important ideas that they can share with the world, but if they aren't given the chance in the first place, then STEM advancements for them will be forever lacking.

Conclusion

Unlike their male counterparts, Latinas have a difficult time pursuing a career in STEM. Latinas are often left to seek out their own opportunities for academic and professional growth, while balancing the pressures of cultural expectations and family needs (Brue, 2019; Rodriguez et al., 2021; Stevenson et al., 2019; Wilkins-Yel et al., 2022). Doubting their own abilities is the result of a lack of access to support networks and little support when they express interest in science, technology, engineering or math related fields (Y. Jiang et al., 2021; Reding et al., 2017).

Mentorships and internships play an important role in transitioning from high school to college and career (Li Huang et al., 2021; Yu et al., 2021). Latinas often struggle to find their place, even in higher education, which is why support networks are so critical (Powless et al., 2022). Exposure to industry professionals and the real-world work environment is invaluable for developing skills and self-confidence (Brue, 2019; Misra et al., 2022). Latinas must be able to see themselves, or those who look like them, in the field they are striving to be a part of (Nation et al., 2019).

To support the current and future generations of Latinas looking to break into the field of STEM, it is imperative that they are given a chance to be successful by starting the support of their journey young (Pattison et al., 2018). After-school programs that introduce young girls to science, technology, engineering, and math will give them the foundation they need to feel confident (Wade et al., 2021). This support cannot let up as they get older. Latinas must still have access to mentors, role models, and experiences that allow them to see themselves in the

role of a STEM professional (Chang, 2017). While the microaggressions and gender discrimination will undoubtedly be something they face when they do enter the workforce, it is possible to continue this work and give Latinas the tool to be able to navigate their future careers with confidence and resilience (Armstrong & Jovanovic, 2017; Ferguson & Martin-Dunlop, 2021).

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Appendix A

Introductory Email

Date

Dear [College's Dean Name],

My name is Emily Melzer, and I am a doctoral student at Northwest Nazarene University. I am currently in the process of working on my PhD, which focuses on studying ways to increase retention of Latinas in STEM. My next step in the process is preparing for the data collection phase, which I am hoping to be able to do at [site name].

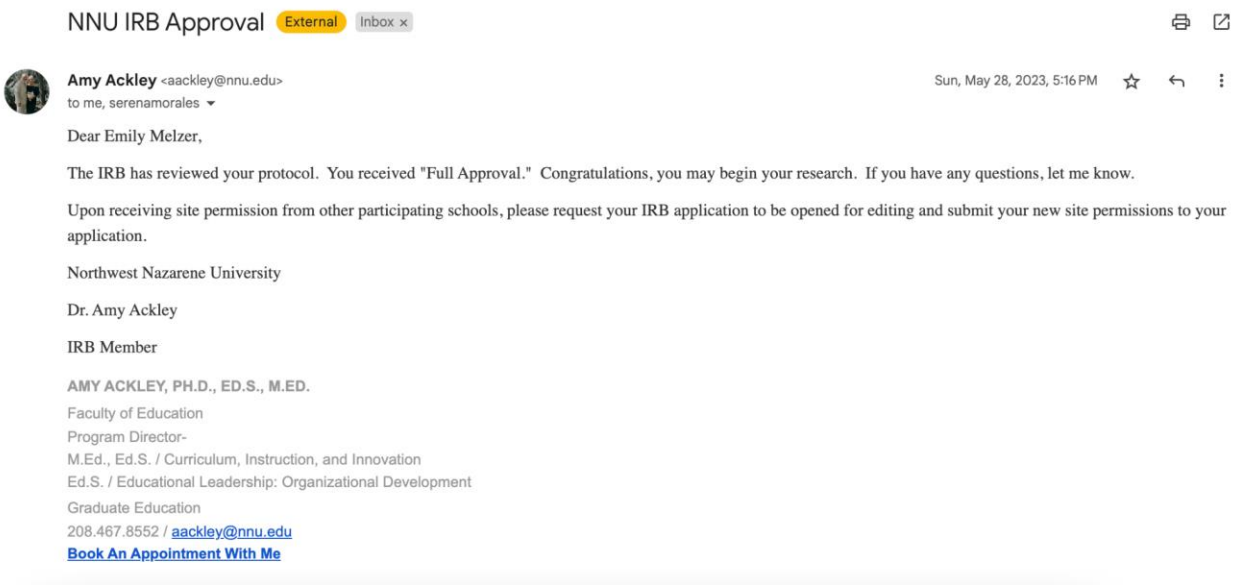
I would like to inquire about obtaining permission to send a short survey to the students in the [university's STEM school]. The survey is an adjusted scale that asks about feelings of belonging in adolescence, and consists of 15-20 questions. I will also give participants the option to participate in a follow up interview, should they feel it is something they would like to do.

I am aiming for data collection to occur in the fall of 2023, so please let me know if this is a possibility for your site and if so, what steps I would need to take. Thank you so much in advance.

Sincerely,
Emily Melzer
emelzer@nnu.edu
760-519-4397

Appendix B

IRB Approvals



NNU IRB Approval External Inbox ×

Amy Ackley <aackley@nnu.edu> Sun, May 28, 2023, 5:16 PM
to me, serenamorales

Dear Emily Melzer,

The IRB has reviewed your protocol. You received "Full Approval." Congratulations, you may begin your research. If you have any questions, let me know.

Upon receiving site permission from other participating schools, please request your IRB application to be opened for editing and submit your new site permissions to your application.

Northwest Nazarene University

Dr. Amy Ackley

IRB Member

AMY ACKLEY, PH.D., ED.S., M.ED.
Faculty of Education
Program Director-
M.Ed., Ed.S. / Curriculum, Instruction, and Innovation
Ed.S. / Educational Leadership: Organizational Development
Graduate Education
208.467.8552 / aackley@nnu.edu
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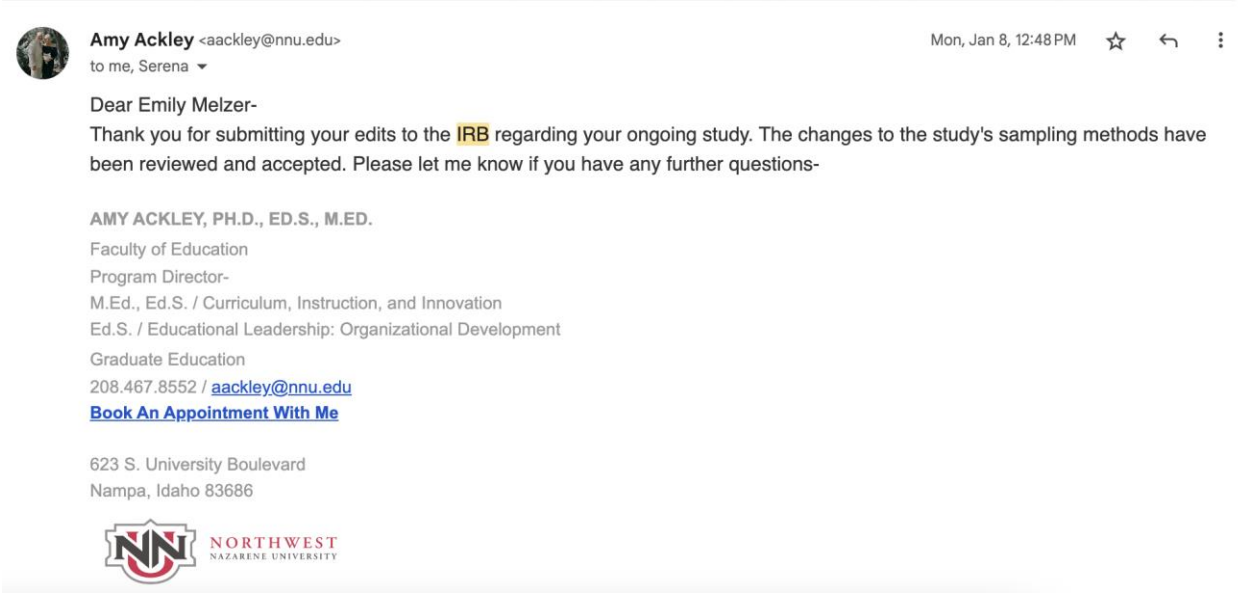


Amy Ackley <aackley@nnu.edu> Mon, Jan 8, 12:48 PM
to me, Serena

Dear Emily Melzer-
Thank you for submitting your edits to the IRB regarding your ongoing study. The changes to the study's sampling methods have been reviewed and accepted. Please let me know if you have any further questions-

AMY ACKLEY, PH.D., ED.S., M.ED.
Faculty of Education
Program Director-
M.Ed., Ed.S. / Curriculum, Instruction, and Innovation
Ed.S. / Educational Leadership: Organizational Development
Graduate Education
208.467.8552 / aackley@nnu.edu
Book An Appointment With Me

623 S. University Boulevard
Nampa, Idaho 83686

NORTHWEST NAZARENE UNIVERSITY

Appendix C

Participation Recruitment Email

Hello,

My name is Emily Melzer, and I am a doctoral student at Northwest Nazarene University. I am conducting a research study on the adolescent experiences of Latinas in STEM, and how their experiences relate to their retention in the field. I plan to survey undergraduate Latina students who are currently enrolled in a STEM based college at (*change out for each university*).

If you are interested in participating in this study, your time and commitment would be a 10-15 minute online survey. In addition, you may further volunteer to participate in a 20-30 minute follow up interview through Zoom. All responses will be kept confidential and pseudonym names will be used, including for your university.

To access the survey, please click on the link below. By clicking on the link, you consent to your responses being used in the study. If you have any questions, please email me at emelzer@nnu.edu. Thank you in advance for your time and consideration.

Sincerely,
Emily Melzer
Educational Leadership Doctoral Student
Northwest Nazarene University

Participation in this study is voluntary. This is not a university activity.

Appendix D

Informed Consent

A. Purpose and Background
As a doctoral student at Northwest Nazarene University, I am conducting a qualitative research study. This study will explore strategies to increase female Latina retention in STEM by analyzing experiences of belonging for current Latina STEM students. Findings from this research will identify ways to increase STEM female Latina participation in STEM fields.

B. Procedures
Should you agree to participate, the following will occur:

1. A survey will be sent to the email address you provide between August 2023 and September 2023. The survey will take approximately 10 - 15 minutes to complete.
2. You will be asked for consent to participate in the study. Consent will be obtained by your decision to click on the survey link attached in the email.
3. You may be contacted for a follow up phone interview, should you agree to participate. Follow up interviews will be audio recorded and you will be asked to sign a consent form for the use of your quotes in the study. Any quotes that are used will not use your name and remain confidential.
4. Participation is voluntary and anonymous.

C. Risks/Discomforts
The risks of this study are minimal. Your responses will remain confidential, and the findings will use a pseudonym. All data will be stored on a password protected computer and will be destroyed after 3 years. Should there be any questions you prefer not to answer, please leave them blank.

D. Benefits
There are no financial benefits for participating in this survey, but the goal is for your responses to benefit young Latina females who want to pursue STEM careers.

E. Questions
If you have any questions about participating in this survey, feel free to contact the researcher, Emily Melzer at emelzer@nnu.edu or 760-519-4397.

F. Consent
You will be given a copy of this consent form for your records.

Participation in research is voluntary. You are free to decline to be in this study, or to withdraw from it at any point. This research study has been approved by the Northwest Nazarene University Human Research Review Committee in May, 2023, approval #0341.

By clicking on the survey link below, you are providing consent to participate in this study:

(survey link will be attached)

Appendix E

Follow Up Interview Email

Dear [participant name].

Thank you for participating in the survey, Adolescent Latina Belonging in STEM. Your input is invaluable; thank you for taking the time out of your schedule to answer the questions.

You are receiving this email because you opted to participate in a follow-up interview to further explain your initial answers to the survey. In order to ensure we find a time that works, please sign up on Google Calendar by clicking on this link: [link will be inserted at a later date].

Thank you in advance, I appreciate your time and look forward to talking to you.

Sincerely,

Emily Melzer
Educational Leadership Doctoral Student
Northwest Nazarene University

Appendix F

Consent to Audio Recording

This study, *Exploring the Adolescent Experiences of Latinas in STEM and How It Relates to Retention* involves the audio recording of your interview with the researcher, Emily Melzer. Neither your name nor any other identifying information will be associated with the audio recording or the transcript. Only the researcher will be able to listen to the recordings.

The tapes will be transcribed by a third party and erased once the transcriptions are checked for accuracy. Transcripts of your interview may be reproduced in whole or in part for use in presentations or written products that result from this study. Neither your name nor any other identifying information (such as your voice or picture) will be used in presentations or in written products resulting from the study. All data will be destroyed after 3 years. Please read the statement below, and if you consent, sign and date the document.

By signing this form, I am allowing the researcher to audio tape me as part of this research. I also understand that this consent for recording is effective until January 2027. On or before that date, the tapes will be destroyed.

_____ _____

Participant's Signature Date

Appendix G

University Approval

Research Support Services

May 23, 2023

Northwest Nazarene University
Attention: IRB Committee
Helstrom Business Center 1st floor
623 S. University Boulevard
Nampa, ID 83686

RE: Research Proposal Site Access for Ms. Emily Melzer

Dear IRB Members:

This letter is to inform the IRB that the Administration at [redacted] University has reviewed the proposed dissertation including the purpose of the study, participants, survey and interview procedures, member checking, and data analysis protocol. Ms. Melzer has permission to conduct her research at the institution and with the students at the university. The authorization dates for this research are July 2023 - April 2024.

Respectfully,

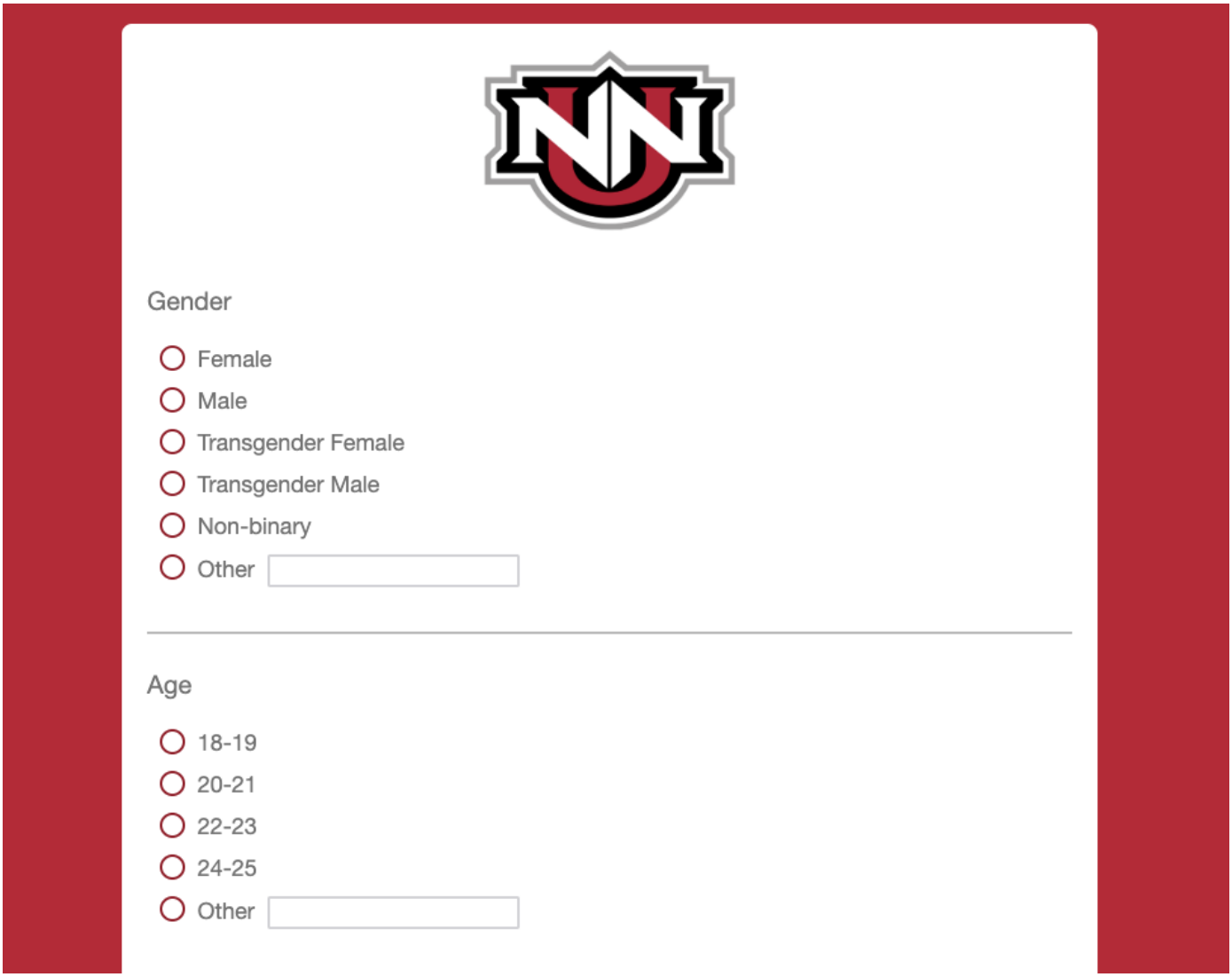
Rick[redacted]

Assist. Vice President
Research and Innovation

Research Support Services Division
of Research and Innovation
[redacted]
San Diego, CA [redacted]
Tel [redacted]
Email: IRB@[redacted]

Appendix H

Qualtrics Survey



Major

- ○ Biology
- ○ Biological Sciences
- ○ Physics
- ○ Biochemistry
- ○ Computer Science
- ○ Mathematics
- ○ Political Science
- ○ Chemistry
- ○ Environmental Science
- ○ Earth Science
- ○ Engineering
- ○ Physics
- ○ Astronomy
- ○ Geology
- ○ Statistics
- ○ Other

Thinking back to your experiences in grades K-12, what sticks out when it comes to STEM (science, technology, engineering, and math) classes?

In what ways did your experiences at school impact your experiences in STEM classes?

In what ways did your experiences at home impact your experiences in STEM classes?

In what ways did your experiences in after school programs impact your experiences in STEM classes?

Did you feel like you belonged in your K-12 science classes? Why or why not?

What do you remember about the way STEM content was delivered in school? Do you feel you benefited from it? Why or why not?

What advice or information would you give to yourself when you were younger (8-14), in relation to a pursuit of STEM?

Are you willing to participate in a one on one, 10-15 minute interview with the researcher at a later date? If so, please enter your name and email address below. If not, please leave the space blank.

Appendix I

Member Checking Email

Hello,

Thank you for your interview participation in my study, "Exploring the Adolescent Experiences of Latinas in STEM and How It Relates to Retention." Your input is tremendously valuable and will add to the literature surrounding this important topic.

There were four predetermined categories that I created, prior to starting the data collection process. The predetermined categories were:

Common STEM experiences in K-12 years

Common STEM experiences outside of school

Educational practices that increase belonging in STEM

Bandura's Social Learning Theory

After the survey and interview results were coded a few times over, three more emerged. The three categories that emerged were:

Importance of internships, career immersion, and mentorship

Community, first generation and family

Transition from high school to college

After looking at all of the categories and data, I narrowed it down to four overarching themes. The four final themes that I established, based on your input, are below:

Feelings

Determination

Expectations

Safe Spaces

If you believe these findings do not accurately reflect your voice, input, or experiences shared during your interview, please respond to this email. Thank you again for your support of this study.

Sincerely,

Emily