Latinx College Students in STEM: An Ethnographic Study that Explores Institutional and Student Related Factors of Academic Success and Struggle

By

Jesus J. Renteria

A dissertation submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

(Educational Policy Studies)

at the

University of Wisconsin—Madison

2020

Date of final oral examination: January 21, 2020

The dissertation is approved by the following members of the Final Oral Committee:

Stacey J. Lee, Professor, Educational Policy Studies, Adviser (Chair)
Linn Posey-Maddox, Associate Professor, Educational Policy Studies
Nicholas Hillman, Associate Professor, Educational Leadership & Policy Analysis
Nancy Kendall, Professor, Educational Policy Studies
Alberta M. Gloria, Professor, Counseling Psychology

Dedication

I dedicate this dissertation to my mother, brother and sister for always believing in me and supporting me throughout my life. To my wife and children for their unconditional love, encouragement, and support. And to all Latinxs—may your voice, lived experience, and endless potential speak through my work.

Acknowledgements

My educational achievements and intellectual growth was made possible by the people in my life who inspired, supported, motivated, encouraged, and challenged me day-in and day-out. I would not be where I am today if not for you.

I would like to thank my mother, who is one of the strongest people I know. She encouraged and supported me throughout my life, and somehow always found the strength to lift me up. My work and educational success is my way of showing gratitude and appreciation for your sacrifice, hard work, and for always believing in me.

I would also like to thank my undergraduate advisers, Dr. Jeanett Castellanos and Dr. Belinda Campos, for mentoring me and teaching me the foundations and tools of conducting quality research. Most importantly, I thank you both for encouraging me to pursue a graduate degree.

To my graduate adviser, Dr. Stacey Lee, thank you for your guidance, support, and wisdom. Most importantly, thank you for engaging with me critically and challenging me intellectually. Your advice and support has been essential in my academic development, and for that I am forever grateful.

To Dr. Alberta Gloria, thank you for being part of my academically. You have been tremendously supportive and encouraging. Furthermore, thank you for your mentorship and working with me on research projects/papers that focused on helping Latinx communities. My experience with you and your research team was very valuable, and your advice and guidance is greatly appreciated.

Thank you Linn Posey-Maddox, Nick Hillman, and Nancy Kendall for challenging me and pushing my thinking, both as a scholar and as a student in your class. Your feedback and support has been very influential and essential to my professional growth.

I would like to thank all my graduate school peers/friends who not only helped stimulate my thinking and pushed me to be more critical and thoughtful, but who also served as an extension of my family and cared for my well-being.

A special thanks to the department of Educational Policy Studies and the Education Graduate Research Scholars (Ed-GRS) Advisory board for awarding me the Advance Opportunity Fellowship (AOF). Thank you to the William T. Grant Foundation for also awarding me the Mentor/Mentee Fellowship. The support, encouragement, resources, mentorship, and research training I received from these organizations/departments played an important role in my academic development.

Last, but definitely not least, I would like to give a special thanks to my wife for encouraging and supporting me during my entire graduate career. You've worked hard to support our family, and waited patiently while I finished my dissertation. Thank you for never giving up on me.

Table of Contents

Abstract

Concerns around Latinx participation and success in STEM in higher education have been raised by policymakers, practitioners, and scholars. There is a need to explore the challenges that Latinx students face as STEM majors in higher education. The purpose of this study is to provide insight on the experiences of Latinx STEM students and explore how they navigate college. Furthermore, this study will also explore how institutional policies and practices play a role in shaping the experiences of Latinx students in STEM.

The findings suggest that Latinx students encounter an unwelcoming, unsupportive, and competitive environment in STEM—an environment that is described as the culture of science. The culture of science exists across multiple institutional practices and policies that create obstacles and challenges which can hinder the persistence and success of Latinxs in STEM. More concerning is that the culture of science is embedded in the discourse of meritocracy and individualism, which often focuses on individuals for their academic struggle while omitting how institutions themselves reproduce inequality. As a result, not only are Latinx students blamed for their academic struggle in STEM, but many Latinx students who continue to struggle often get weeded-out of STEM due to strict practices and policies that serve the interest of the university.

Latinx students, however, are not passive, but rather reactive to institutional practices and policies. The findings suggest that Latinxs bring with them community cultural wealth that empowers some to succeed. However, for some Latinx students, these same cultural values are often not enough to overcome the educational inequalities that they face. Furthermore, certain cultural values, such as having *ganas*, can also work against Latinxs who may feel pressured to

persist without any help, despite facing overwhelming challenges. Furthermore, while family was a supportive network for many Latinx students, those who embraced the rhetoric of having *ganas* were reluctant to share their struggle with their families out of fear of disappointing them or out of fear of burdening their family with unnecessary stress. As a result, many Latinx students often find themselves isolated and left alone to navigate college.

Chapter 1

Introduction

For more than half a century, science-based innovations have fueled the U.S. economy, making the U.S. one of the world's leaders of this innovative industry (Atkinson & Mayo, 2010). However, recent trends suggest that science-based innovations by the U.S. are declining (Atkinson & Mayo, 2010; National Academy of Science, 2016). Part of the reason is related to the United States' inability to produce a Science, Technology, Engineering, and Mathematics (STEM) base workforce (Atkinson & Mayo, 2010; Kuenzi, 2008; Stine & Matthews 2009; Terrell 2007). Many scholars, politicians, and practitioners have stressed the importance in creating STEM educational opportunities and resources to increase STEM success with the hopes of increasing the STEM labor force and remaining a global leader in science-based innovations (Lacey & Wright, 2009; Kuenzi, 2008; Stine & Matthews 2009). As a result, policymakers, researchers, practitioners, and educational institutions themselves, both K-12 schools and colleges across the country, have begun to place greater value on STEM education and have created programs to help students become academically prepared and succeed in STEM.

Despite growing awareness of the importance of STEM, along with programs to help students, there are serious concerns regarding STEM attrition rates in college. For example, between 2003 and 2009 nearly 48% of STEM students seeking a bachelor's degree and 69% of STEM students seeking an associate's degree either changed majors or left college without completing a degree by spring 2009. More concerning is that there are racial, class, and gender discrepancies in STEM participation, especially in higher education (Anderson & Kim, 2006;

College Board, 2016; Herrera & Hurtado, 2011; U.S. Department of Education, 2016). In particular, racial minorities and low-income students, as well as womxn, continue to be underrepresented in STEM related fields in higher education (U.S. Department of Education, 2016). Furthermore, students in general who major in STEM are more likely to leave STEM fields and switch to non-STEM disciplines at higher rates than their counterparts (Griffith 2010; Hill, Corbett, & Rose 2010; Huang, Taddese, & Walter 2000; Lowery, 2010; Shaw & Barbuti 2010; Strayhorn, 2009). There have been many initiatives created to increase the access, persistence, and success rate of racial/ethnic and working class minorities in STEM, however, many initiatives take on a deficit approach in that they frame students as the "problem" and create programs that focus on helping improve the student. These initiatives have failed to fully address the role that institutional policies and practices play in the racial/ethnic and class discrepancies in STEM college participation and graduation.

If the goal is to increase the amount of U.S. STEM workforce, particularly among racial minorities, we must understand the challenges and obstacles, particularly the institutional forces, that are preventing racial minorities from obtaining the credentials needed for these prestigious careers. Currently, we live in a very racially and culturally diverse society, one that has a large Latinx population. While it is important to understand the struggles of all racial minorities, there are unique challenges and obstacles pertaining to different communities of color. With that being said, this study will focus on Latinxs because according to the U.S. Census (2015), Latinxs are the largest and the fastest growing minority population in the U.S., and therefore it is important to have a STEM workforce that can both understand the culture and their needs, as well as one that is representative of the U.S. population.

Currently, the population of Latinxs living in the U.S. is over 55 million (U.S. Census, 2016). It is estimated that the Latinx population will increase drastically from 49.7 million Latinxs in 2010 to 132.8 million in 2050 (Saenz, 2010; U.S Census, 2010). Despite the large number of Latinxs living in the U.S., only 4.2 million (14%) of Latinxs hold a bachelor's degree or higher (U.S Census, 2015). In examining the educational achievement among Latinxs in general, research has shown that 66% of Latinxs graduate high school, compared to 82% of whites (National Center of Educational Statistics, 2016). Among those that do graduate high school, only 59% of Latinxs enroll in college compared to 71% of whites. More concerning is that among those that do enroll in college, only 53% of first-time, full-time Latinxs earn a four-year degree within six years, compared to 63% of Whites (National Center of Educational Statistics, 2016). These disparities are also found in STEM majors in higher education. For example, research suggests that though Latinxs are equally likely to enroll in college as STEM majors compared to White students, on average only 16% of Latinxs who do enroll as STEM majors complete their degree within six years, compared to 25% of White students (Crisp & Nora, 2012). These racial discrepancies are present across many STEM fields (NSF, 2016a). For example, the National Science Foundation (2016) found that among those awarded a science or engineering degree in 2012, only 10% of those degrees were awarded to Latinxs compared to 72% of White students. It is clear that there are racial discrepancies in STEM persistence and success rates in college.

The purpose of this study is to provide insight on the experiences of Latinx STEM students, and highlight the personal and institutional challenges and obstacles they face as STEM majors and how they navigate college. In addition, this paper will describe how personal and institutional factors play a role in what has been described as a process of "weeding-out" Latinxs

from STEM majors. The two guiding questions for this study are: 1) in what ways do institutional agents, and the institution itself, hinder or promote academic success for Latinx students? And 2) what are Latinxs experiencing in college as STEM students, and how do they navigate college and make sense of the challenges they face as STEM majors?

Literature Review

What we do know about STEM students and their experience with persistence and success, as well as challenges and struggle in higher education? Are there are unique challenges that Latinx students face as STEM students? Various bodies of literature have offered different perspectives and theories to explain student success and struggle in STEM in higher education, some of which focus on a particular group, such as racial minorities. Most studies that examine the persistence and success of students in STEM have mostly focused on college readiness factors, such as their college entrance exam scores and high school grade point average (GPA), as well as non-cognitive factors, such as motivation. However, very few studies have focused on institutional policies and practices. This is also the case for studies that focus on Latinx STEM students in college. The following literature highlights these findings, many of which suggest that STEM success and struggle in college depends on the actions and personality traits of students.

Pre-College Educational Inequality

Academic Preparation and College Readiness

One of the largest body of work on college persistence and college success, particularly as it relates to STEM, focuses on academic preparation and/or college readiness factors (Garcia

& Hurtado, 2011; Griffith, 2010; Hernandez, Schultz, Estrada, Woodcock, & Chance, 2013; Ironsmith, Marva, Harju, & Eppler, 2003; Maltese & Tai, 2011; Nauta & Epperson, 2003; Perez, Cromley, & Kaplan, 2014; Royster, Gross, & Hochbein, 2015; Tyson, Lee, Borman, & Hanson, 2007; Zusho, Pintrich, & Coppola, 2003). College readiness is defined as students' ability to enroll and succeed—without remediation—in a college course at a postsecondary institution that offers a baccalaureate degree or helps students transfer to a baccalaureate program (Conley, 2007). According to Conley (2007), the most common approach for measuring college readiness is by examining students' high school GPA, achievement exams, college admission exams (ACT or SAT), and whether or not a student participated in rigorous courses, such as AP and honors classes. Research that focuses on the relationship between these measurements, which are used as benchmarks of college readiness, suggest that being academically underprepared increases the risk that students will struggle academically, fail classes, and/or leave college (Royster, Gross, & Hochbein, 2015). For example, a recent study found that students who were not college ready were more likely to be placed in remedial college level classes and less likely to persist beyond their first year compared to students who were academically prepared to take college level courses (Stewart, Lim, & Kim, 2015). Similarly, studies focusing on STEM college persistence and success also indicate that students who have low academic preparation, low standardized test scores, and perceive greater academic difficulty in STEM classes are less likely to persist in STEM and are more likely to change majors or leave college entirely (Lowery, 2010; Kokkelenberg & Sinha 2010; Mau, 2016; Ost, 2010; Rogers-Chapman, 2014; Shaw & Barbuti, 2010; Wang, 2013; Whalen & Shelley II, 2010).

What is troubling is that underrepresented minorities, such as low-income and racial/ethnic students, are more likely to be academically underprepared and thus more likely to

struggle academically and leave STEM or drop out of college (Roderick, Nagaoka, & Coca, 2009). With regards to studies on Latinx students in STEM, several studies have indicated that Latinxs who come to college academically underprepared to take college level STEM classes are less likely to persist and succeed in STEM and college (Cole & Espinoza, 2008; Crisp & Nora, 2009; Garcia & Hurtado, 2011; Paschal & Taggart, 2019). One explanation for why low-income and racial/ethnic minority students, including Latinx, are academically underprepared for college is that many come from K-12 schools that have poor quality teachers and lack resources and opportunities (Condron & Roscigno, 2003; Darling-Hammond, 1998; Maramba, 2011; Museus, Palmer, Davis, & Orfield & Frankenberg, 2014; Reimers, 2000). Though there are academically well-performing students at poor K-12 schools, the quality and rigor of education may not be the same as the education students receive at more affluent schools. As result, many underfunded and poor quality K-12 schools are not academically preparing Latinxs and other racial minorities to take college level STEM classes, and therefore are placing them at a academic disadvantage compared to their peers who went to quality high schools.

The college readiness ideology is very prominent in research, and scholars continue to conduct studies that focus on college readiness to help explain college persistence and success (Royster, Gross, & Hochbein, 2015), including persistence and success in STEM (Malin, Bragg, & Hackmann, 2017; Means, Wang, Young, Peters, & Lynch, 2016), without critically examining the quality of education students are receiving in their high schools, nor their ability to access such advance classes (Oakes, 2005). Instead, the rhetoric of being academically underprepared, or not being college ready, influences policymakers and institutions to create policies, programs, practices, and recommendations that suggest ways to "help" students become college ready, or

recommend that they attend less prestigious institutions that best suits the needs academically underprepared students (Le, Mariano, & Faxon-Mills, 2016; Scrivener & Logue, 2016).

At the high school level, there are several programs intended to help low-income and racial minority students become college ready. For example, there are several college preparation programs that are dedicated to helping students become college ready (Cates & Schaefle, 2011). However, studies that focus on the impact of pre-college programs have mixed results (Ford, 2010; Gandara et al., 1998; Slavin & Calderon, 2001; Watt, Powell, Mendiola, & Cossio, 2006). Take for example Upward Bound, a pre-college program that focuses on helping low-income and racial/ethnic minorities not only become informed and academically prepared for college, but also provide them with financial resources to succeed in college (Upward Bound, 2019). One study has shown that participants in Upward Bound are four times more likely to earn a four-year degree compared to students from similar backgrounds who did not attend Upward Bound (Fields, 2001). In contrast, other studies suggest that while Upward Bound does have positive short-term impacts on college persistence, in the long run there is no impact on college degree attainment (Attewell et al. 2006; Calcagno & Long, 2008).

The mixed results from pre-college preparation programs demonstrate that they often do not do enough to support minorities students, and the responsibility to get students college ready often falls on the hands students or higher education institutions. The growing awareness about the challenges with being college ready and students needing remediation in higher education have forced institutions to take initiatives in helping students become college ready. Some of the ways that they are tackling this is through various programs, such as transition programs. Transition programs are intended to help high school students who are placed in academic

remediation transition into college by offering summer or semester/quarter preparation classes. One example is the City University of New York (CUNY) Start program.

CUNY Start[1] is a college transition program that offers students, who have been identified as needing remedial education, an opportunity to temporarily delay matriculation and enroll in a one semester developmental program that provides intensive math, reading, and writing instruction with the hopes of developing student's basic skills (Scrivener & Logue, 2016; Scrivener et. al., 2018). The goal of the program is to help academically underprepared students become ready to take college level courses. Despite the existence of these transition programs, there is little known about their effectiveness and impact on college readiness, college persistence, and college success (Barnett, Fay, Pheatt, & Trimble, 2016). However, some initial findings suggests that these transitional programs have little to no academic benefits (Trimble, Pheatt, Papikyan, & Barnett, 2017). Still, more research is needed in order to understand what these programs entail and if they are effective in helping academically underprepared students persist and succeed in college.

Overall, research suggests that Latinx minority students are more likely to attend poor high schools that have few resources, poor teacher quality, and lack in academic opportunities to academically prepare them for college level classes. As a result, many Latinx are entering college academically underprepared to master STEM classes in college, and thus are likely to struggle academically. As will I describe later in chapter 4, being academically underprepared continues to be a major factor for why Latinxs struggle academically in STEM.

[1] More information can be found at http://www1.cuny.edu/sites/cunystart/program/cuny-start/

Problematizing the Student

Non-Cognitive, Personality Traits

Traditionally, college readiness factors, particularly those relating cognitive abilities, have been used to examine STEM college persistence and success. There are, however, other non-cognitive factors, such as motivation and self-efficacy, that have been examined in relation to STEM persistence and success in college (Ayree, 2017). In fact, there a large number of studies that examine the relationship between personality traits and college persistence and success in STEM, especially among racial/ethnic and low-income minorities (Carpi, Ronan, Falconer, & Lents, 2017; Litzler, Samuelson, & Lorah, 2014; Museus, Palmer, Davis, & Maramba, 2011). However, many of these studies place the onus on students, problematizing them by suggesting that they do not have the personality traits to persist and succeed in STEM, while simultaneously failing to acknowledge institutional challenges and obstacles. Take for example MacPhee, Farro, and Canetto (2013), who examined the relationship between academic self-efficacy and college persistence among underrepresented minorities (race, class, and gender) in STEM. They defined academic self-efficacy as "confidence in one's ability to accomplish academic tasks" (Pg.348). They found that students with multiple minority statuses (e.g. being low-income and being a racial minority) had lower levels of academic self-efficacy, which was related to lower test taking skills, lower GRE scores, and lower cumulative GPA. In addition, they found that in general women had lower academic self-efficacy, however, over time their academic self-efficacy improved to that of the level of men. Drawing on their findings, MacPhee, Farro, and Canetto (2013) suggest that their needs to be interventions to enhance underrepresented minorities, especially women's, self-efficacy in order to help support them and increase their college persistence and success in STEM. The rhetoric used in their article

suggests that it is the student's lack in high self-efficacy that partially explains the challenges with persistence and success in STEM, and by suggesting ways to "fix" the student is problematic because it places the blame on students.

Motivation is another personality traits that scholars have focused on to help explain why racial minorities either succeed or struggle in STEM (Burtner, 2005; Cromely, Perez, & Kaplan, 2016; Graham et al., 2013; Huang, Taddese, & Walter, 2000). For example, Hernandez et. al. (2013) examined the relationship between motivation and educational achievement among high achieving Latinx and African American college students in STEM. Drawing on goal theory, they found that students who expressed high performance-avoidance goals (e.g. avoid demonstrating incompetence to peers) were less likely to persist in STEM compared to students who expressed high performance-approach goals (e.g. goal of mastering knowledge). In essence, racial minority students who were motivated to master the knowledge as oppose to being motivated to not fail are more likely to persist in STEM. They also found that Latinx and African American students who were involved in research and had faculty mentors were more likely to have high performance-approach goals. They suggest that colleges and universities need to help racial minority students become engaged in research and develop mentor/mentee relationships with faculty so that they can develop performance-approach goals, which in turn can help them persist and succeed in STEM. Though I am not against their suggestions for developing networks between racial/ethnic students and faculty and providing students opportunities to be involved in research, it is important to note that again the onus is placed on student motivation, in this case being motivated by performance-avoidance goals.

Self-efficacy and motivation are only two among many non-cognitive factors that have been examined in relation to STEM academic persistence and success. When scholars,

practitioners, and policy makers solely focus on non-cognitive, personality traits and do not acknowledge the institutional and structural challenges that underrepresented minorities face, in this case Latinxs, then they risk reinforcing a deficit rhetoric that places blame on students. This can lead to the creation policies, practices, and programs that aim to "fix" the student rather than working on existing policies and practices, as well as structural and institutional issues, that are hindering the persistence and success of Latinxs and other racial minorities in STEM. If scholars are to focus on non-cognitive factors to explain STEM persistence and success they should do so with an understanding and awareness of institutional challenges and obstacles.

Academic Support, Campus Climate, and Financial Assistance

Scholars have also placed some attention on how the college campus environment influences STEM persistence and success among racial minorities, including Latinx students (Bonous-Hammarth, 2000; Hurtado et al., 2007; Soldner, et. al., 2012). For example, some studies that examine faculty/student interactions suggest that there is a disconnection between professors in STEM (most of whom are white men) and racial minority students, arguing that racial minorities have difficulty relating to professors (Johnson & Sheppard, 2004; Price, 2010). In fact, Price (2010) found that racial minority students are more likely to persist in STEM if they have a course taught by a member from their own racial background. More recently, Bensimon, Dowd, Stanton-Salazar, & Dávila, (2019) found that having Latinx faculty in STEM who can provide various forms of support for Latinx students can help increase their STEM participation, persistence, and success. Other studies have found that racial minority students who are involved in research during their first year are more also more likely to persist and succeed in STEM (Lopatto, 2004; Hurtado et al., 2008; Hurtado, Newman, Tran, & Chang, 2010). It appears that having racially diverse faculty, along with developing strong professional

mentor/mentee relationships between faculty and racial minority students, can help increase the persistence and success rate among racial minority students in STEM.

Campus climate is also another factor that has been examined in terms of its relationship to STEM college persistence and success. A large number of studies have indicated that Latinxs, especially those attending predominantly white universities (PWI), are likely to experience hostility, isolation, exclusion, microaggressions, and discrimination as college students (Gusa, 2010; Hurtado & Ponjuan, 2005; Johnson, 2012; McCabe, 2009; Minikel-Lacocque, 2012; Reid & Radhakrishnan, 2003; Solorzano, Ceja, & Yosso, 2000; Yosso & Lopez, 2010; Yosso, Smith, Ceja, & Solórzano, 2009). For example, Yosso, Smith, Ceja, and Solórzano (2009) argue that microaggressions[2], which are subtle or explicit degradations or putdowns, are overwhelmingly experienced by Latinxs in college, and that these microaggressions create a hostile environment for them. In contrast, having a welcoming and diverse campus climate helps racial minorities develop a sense of belonging to the university, which can increase their college persistence and success in STEM (Garcia & Hurtado, 2011; Strayhorn, 2018). For example, Hurtado et al. (2007) found that among racial minorities in science, there was a negative correlation between perceiving their college or university as one that is hostile and highly competitive and their ability to adjust academically and develop a sense of belonging, which Hurtado et al. argue can hinder the persistence and success of racial minorities in STEM.

Finally, research has also examined the impact of financial aid and/or financial support, or the lack thereof, on college persistence and success, both among non-STEM and STEM

[2] Microaggressions can come in the form of verbal and non verbal affronts (interpersonal microaggressions) by other students and professors, such as interpersonal attacks. They also come in the form of racial jokes, which are offensive verbal remarks with questionably humorous intentions. Finally, they also come in the form of institutional microaggressions, which is the institutional maintenance of excluding Latina/o culture. (Yosso, Smith, Ceja, & Solórzano, 2009. P.672).

majors (Dika & D'Amico, 2016; Goldrick-Rab, 2016; Perna, 2006; Whalen & Shelley, 2010). The lack of financial support has been cited as an obstacle to student persistence and success in higher education (Gross, Zerquera, Inge, & Berry, 2014). Studies have found that greater financial support, specifically increases in federal need-based aid such as the Pell grant, influences Latinx student's college success (Chen & DesJardins 2010; Crisp & Nora, 2010; Crisp, Taggart, & Nora, 2015; Gross, 2011).

Overall, research suggest that having a racially diverse faculty in STEM, providing research opportunities for first year racial minority students, creating and sustaining a welcoming environment that is racially inclusive, and providing academic and financial support all help increase the chances that Latinx students will persist and succeed in STEM (Cole & Espinoza, 2013; Hurtado, Newman, Tran, & Chang, 2010; Lichtenstein et. al., 2007; Palmer, Maramba, & Gasman, 2013; Stage, Lundy-Wagner, & John, 2013; Strayhorn, 2013; 2018; Watkins & Mazur, 2013; Whalen & Shelley, 2010). Furthermore, increasing institutional resources that focuses on improving campus climate, recruit faculty of color, and increase research participation opportunities can help decrease attrition rates among Latinxs who are majoring in STEM.

While past studies in STEM and higher education retention and success are insightful, many of these studies did not question the mechanisms, programs, practices, and policies within institutions and how they promote or perpetuate educational inequality. Nor did they seek to understand how Latinxs, or other racial/ethnic and/or low-income students, navigate this system that often times may be foreign and overwhelming. Drawing on social reproduction theory, community cultural wealth, and LatCrit can help illuminate how institutional system work to reproduce inequality, and describe ways in which Latinx college students draw on their cultural capital to navigate this system.

Theoretical Framework

Social Reproduction Theory

I draw on Bourdieu's (1977) theory of Social Reproduction because this theory allows an understanding of how systems—in this case higher education—sustain and contribute to social inequality by examining power relations and how they validate or exclude different forms of capital. Bourdieu's theory of social reproduction focuses on class analysis that aims to explain inequalities in educational stratification (Bourdieu & Passeron, 1977). According to Bourdieu (1977), schools and the agents within them (e.g. teachers, administrators, etc.) aid and support reproduction by both rewarding students who possess elite cultural capital and by creating an environment that reflects elite and middle class values and practices, while excluding and marginalizing students from working class backgrounds.

According to Bourdieu, there are two main forms of capital, which are cultural capital and social capital. *Cultural capital* (Bourdieu, 1986) is defined as the forms or collection of elements, such as education, knowledge, skills, and taste that one acquires through previous generations or by being a part of social class. Cultural capital exists in three forms: embodied, objectified, and institutionalized. In the embodied form, cultural capital is both consciously acquired and passively inherited. In this form, cultural capital is acquired through various forms of socialization. Taste and language are two examples of how cultural capital is embodied. The second form is objectified, which takes on more of a physical form, such as a scientific instruments or physical items that reflect status (e.g. valuable painting). These cultural capital goods can be used to both acquire economic capital or to serve as a symbolic recognition. The

final form of culture capital is institutionalized, which consists more of institutional recognition usually through the form of education credentials.

Social capital is defined as the "aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition–or in other words, to membership in a group–which provides each of its members with the backing of the collectivity-owned capital" (Bourdieu, 1986. P. 51). Tapping into one's social capital can be a useful strategy for building economic capital and obtaining various opportunities. According to Bourdieu (1986), both economic capital and human capital is shaped and influenced by cultural capital and social capital.

Bourdieu's theory of social reproduction is not complete without considering *Habitus*, *Fields*, and *Symbolic Violence*. These are important concepts to Bourdieu's theory of social reproduction; however, many scholars fail to incorporate the aforementioned concepts into their studies. Habitus[3] refers to the dispositions, taste, habits, beliefs, values and personal characteristics that are developed through life experience and socialization. Habitus is not permanent or fixed; rather, it is a constant changing and developing process of structuring and restructuring, which in turn influences an individual's perceptions and social mobility. An individual's habitus can be either useful or detrimental in navigating social environments. These social environments are often referred to as fields by Bourdieu (1990).

[3] Habitus is defined as a "Systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations that can be objectively adapted to their outcomes without presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them. Objectively 'regulated' and 'regular' without being in any way the product of obedience to rules, they can be collectively orchestrated without being the product of the organizing action of a conductor (Bourdieu, 1990; P. 53).

Fields are social or institutional arenas, or environments, in which people utilize their different forms of capital and both express and produce their habitus in exchange for power, privileges, advancement, and opportunities (Bourdieu & Pierre, 2005). Fields appropriate power to different people, depending on what forms of capital and what type of habitus are valued within that field. One may have power in one social arena and be powerless in another. Power within fields can given or denied through symbolic violence. *Symbolic Violence* is defined as "the violence which is exercised upon a social agent with his or her complicity" (Bourdieu & Wacquant, 2002; P. 167). Symbolic violence is the result of social agents who ignore or reinforce a social order or social hierarchy, assuming that it is natural and thus legitimizing such a social order and social hierarchy. For example, symbolic violence occurs when social agents assume that individuals from working class backgrounds are less intelligent than middle and upper-class individuals, and thus treat working class individuals as such. Symbolic violence is an act of non-recognition, or acted upon unconsciously, and it reflects a person's habitus (socialization, beliefs, and life experiences).

In general, social reproduction theorists have argued that structures and institutions within society work to reproduce social classes and limit opportunities for social mobility (Bourdieu, 1973; Bowles & Gintis, 1976). Bourdieu and Passeron (1990) argue that institutions actively recognize the dominant culture, and by practicing that dominant culture they inevitably take on power that serves as a form of exclusion for those who do not possess that culture nor have the networks to penetrate those institutions. Schools, including higher education, are organized to provide individuate, technical knowledge according to a class hierarchy, which reinforces class structure by preparing different groups of people for different types of occupational roles (Apple, 1982; Bowles & Gintis, 1976). According to Collins (2009), schools

value the cultural knowledge of the middle and upper class, and they shape their pedagogies and curriculum to reinforce and privilege dominant culture while simultaneously molding lower class according to those standards.

Applying Bourdieu's theory of social reproduction to this study of Latinx college students will help uncover if, and how, higher education institutions policies and practices serve as a tool for social mobility or reinforce social reproduction. Drawing on this theory will also shed light on what types of cultural capital and social capital are valued in higher education and if Latinx college students have such capital and are using it. Finally, this theory will allow this study to explore how Latinxs habitus influences how they navigate and understand higher education hegemonic policies and practices.

While Bourdieu's theory of social reproduction can provide insight on class relations, one of its weaknesses is that it does not explicitly incorporate race, although various other scholars have done so. Furthermore, some scholars have raised concerns with the way cultural capital rhetoric has been used to describe the cultural capital found in communities of color as a disadvantage rather than viewing their cultural capital as an array of knowledge, skills, and abilities (Carter, 2005; Larrotta & Yamamura, 2011; Yosso, 2005). This view of cultural capital have led scholars, such as Gloria Ladson-Billings (2000), to ask: whose cultural capital is valued whose is not, and who makes these decision? To challenge the traditional interpretations of Bourdieu's cultural capital, Yosso (2005) introduced an alternative concept called community cultural wealth, which draws on Critical Race Theory (CRT).

Community Cultural Wealth

According to Yosso (2005), community cultural wealth is described as an "array of knowledge, skills, abilities and contacts possessed and utilized by Communities of Color to survive and resist macro and micro-forms of oppression" (Pg.77). Yosso (2005) describes six forms of capital that are used by communities of color to nurture and foster community wealth, which are *aspirational, navigational, social, linguistic, familial, and resistant* capital. Aspirational capital refers to the "ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers" (Pg.77). Navigational capital refers to skills used to navigate social institutions. Social capital refers to the network of people and community resources. Linguistic capital refers to the "intellectual and social skills attained through communication experiences in more than one language and/or style" (Pg. 78). Familial capital refers to the "cultural knowledges nurtured among familia (kin) that carry a sense of community history, memory and cultural intuition" (Pg.78). Finally, resistant capital which refers to the knowledge and skills developed through oppositional behavior that challenge social inequality.

The six aforementioned forms of capital found in community cultural wealth are not mutually exclusive or static, but according to Yosso (2005), they are a dynamic process that builds off one another to create and sustain community cultural wealth. Drawing on Yosso's (2005) concept of community cultural wealth is useful in this study because it will capture how Latinx students draw on community cultural wealth and their forms of capital to navigate college. To help capture the voices of Latinx students and how they draw on community cultural wealth, I will also be drawing on LatCrit.

LatCrit

According to Bernal (2002), "LatCrit is a theory that elucidates Latinas/Latinos' multidimensional identities and can address the intersectionality of racism, sexism, classism, and other forms of oppression" (P.108). LatCrit[4] draws on both Critical Race Theory (CRT) and Critical Theory, and extends those theories by including the examination of issues of language, immigration, ethnicity, culture, identity, phenotype, and sexuality (Bernal, 2002; Yosso, Villalpando, Delgado Bernal, & Solórzano, 2001). LatCrit is a theoretical framework that considers the intersectionality of Latinxs, which enables scholars to better understand the experiences of Latinxs and also examine the various forms of oppression they encounter (Solorzano & Delgado Bernal, 2001). Davila and de Bradley (2010) suggest that LatCrit can serve as an important tool to understand and challenge inequitable educational systems that plague Latinx students.

LatCrit scholars have argued that institutional and structural practices and policies have created educational inequality (Davila & de Bradley, 2010; Solorzano & Yosso, 2001; Yosso, 2006; Yosso, Villalpando, Delgado Bernal, & Solórzano, 2001). In response, LatCrit was developed as a way to challenge hegemonic ideology and practices in schools that have often silenced, marginalized, and oppressed Latina/o students. LatCrit empowers Latina/o students and provides them an opportunity to voice their life experiences, including their challenges and opportunities within higher education. I plan to draw on LatCrit to not only serve as vehicle in voicing the experiences of Latinxs, but also examine institutional programs, practices, and

[4] According to Solorzano and Bernal (2001), CRT and LatCrit theory both draw from *critical theory*, which focuses on the oppressive aspects of society in order to generate societal and individual transformation.

policies in order to understand if institutions serve as gatekeepers or gateways towards STEM success.

Purpose of Study

There are racial and class discrepancies with persistence and success rates of STEM majors in higher education. In particular, research on Latinxs in STEM suggest that they many students have, and continue to, face struggles and challenges in completing a college degree, especially those in STEM related fields (Hurtado et al., 2008; Hurtado, Newman, Tran, & Chang, 2010). This is important because individuals who graduate with a STEM degree are able to access more prestigious and higher paying jobs compared to those who earned non-STEM degrees (NSB, 2016). For example, the median yearly income for science and engineering occupations in 2012 was $78,270, compared to a median yearly income of only $34,750 for all other U.S. occupations (NSF, 2016b). Thus, if obtaining a STEM degree is a pathway towards greater social mobility, the lack of representation of racial and class minorities—many of whom are first-generation college students in STEM fields—exacerbates social inequality and limits social mobility for these populations. Therefore, it is crucial to understand the challenges and obstacles experienced by Latinxs in STEM majors as well as understand the mechanisms that hinder or promote their educational success.

There are also micro activity and macro forces that interact with one another, creating a complex relationship between human agency and social structure. Latinx students bring with them their intersecting identities and life experiences, all of which influence and impact their experience in higher education. These intersecting identities, specifically gender, race, and class, intersect in powerful ways and they shape how people see themselves, how they see others, how

they interact with the world and how the world interacts with them. Similarly, higher education is also an institution that often reflects white hegemonic values, beliefs, and practices while also undermining the values of different cultures. Very few studies have focused on how institutional programs, practices, and policies affect student retention and success particularly among Latinx students. This dissertation builds on previous research that has focused on Latinx STEM students in higher education by focusing on factors relating to their persistence and success in STEM, and how institutional policies and practices also contribute to both the success and/or struggle of Latinx students in STEM.

Research Questions

This dissertation has two main focuses: The first focus is to examine the experiences of Latinx students in STEM and how they understand and navigate the higher education system. The second main focus examines how institutional practices and policies, specifically those relating to STEM, promote or hinder success for Latinx STEM students. The theoretical frameworks that guide this study are Bourdieu's theory of social reproduction, Community Cultural Wealth, and LatCrit. These theories offer ways in understanding of how Latinx students, who have historically been underrepresented in higher education, navigate higher education, as well as how the higher education institutions functions, serves, and rewards those who reflect their ideology, values, and beliefs of the system. The following research questions guided this study:

Question 1: In what ways do institutional agents, and the institution itself, hinder or promote academic success for Latinx students?

A) What are some practices carried out by professors, faculty, and administrators, specifically those in STEM areas, that promote or hinder success?

B) What are some institutional policies that promote or hinder success?

C) How do institutional agents make sense of Latinx college student success or struggle in STEM?

Question 2: What are Latinxs experiencing in college as STEM students, and how do they navigate and make sense of the opportunities or challenges they face as STEM majors?

A) Who are they (habitus)?

B) What are they experiencing in class with regards to the material, other students, and the professor/instructor?

C) How do they make sense of success and struggle?

D) How do they make sense, and respond to, institutional practices and policies?

D) What types of Community Cultural Wealth do they have, and are they able to make use of it to help them navigate their STEM major and college in general?

E) Are there any gender or class differences in their experience, or their understanding of STEM success or struggle?

Chapter 2

Methods

Research Design

For this dissertation, I drew on critical ethnography to explore two interrelated areas: 1) exploring and understanding the experiences of Latinx college STEM students, and 2) exploring and understanding how higher educational systems promote or hinder the success and persistence of Latinx STEM students. Critical ethnography is a useful approach that not only captures the perspectives of participants and about the world they live in, but it also examines the ways participants react and resist oppressive structural forces. In addition, critical ethnography is also a useful approach/way to examine structure of the higher education system and examining how the different ways they operate that may or may not hinder success for students.

Critical ethnography requires understanding and challenging social inequalities, disrupting hegemonic discourse and illuminating the lives of those who have long been silenced. In the field of education, Carspecken (1995) describes critical ethnography as having value, arguing that "we are all concerned about social inequalities and direct our work toward positive change. We also share a concern with social theory and some basic issues it has struggled with since the nineteenth century. These include the nature of social structure, power, culture, and human agency" (Carspecken, 1995; Pg. x). It is clear that critical ethnographers in education, or researchers in general, must be explicit on their position and take a social and political stance.

One of the key approaches to critical ethnography is that it focuses on both larger, social structures and the agency of individuals or groups of people (Lapan, Quartaroli, & Riemer,

2011). According to Lapan, Quartaroli, and Riemer (2011), it is important to illuminate both structure and agency in the analysis of a critical ethnography. In illuminating structure, Lapan, Quartaroli, and Riemer (2011) suggest that this involves "showing how economic, political, social, historical, and cultural institutions and norms operate in any given context and confine the options available to individuals" (Lapan, Quartaroli, & Riemer, 2011; P. 377). In illuminating agency, it is important to highlight how people are not constrained or determined by structures, rather that individuals have choices and often resist structural forces that are oppressive (Lapan, Quartaroli, & Riemer, 2011).

Another important approach to critical ethnography is to highlight patterns and practices that stand on their own locally, but also reflect much larger, macro phenomena patterns and practices (Lapan, Quartaroli, & Riemer, 2011). According to Lapan, Quartaroli, and Riemer, (2011), critical ethnography attempts to both highlight how oppressive practices play out at the local level, and also to draw on these micro practices to shed light on macro structures and institutions. In this study, I examined both the experiences Latinx students had as STEM majors, as well as the practices and policies upheld by institutional agents and how these either promoted college success or exacerbated educational inequalities. Furthermore, I also examined how Latinx students reacted and responded to these practices and policies, and the effects those policies, practices, and decisions had on their college experiences.

I will also be drawing on what Weis and Fine (2012) describe as critical bifocality, which grew out of critical ethnography. According to Weis and Fine (2012), critical bifocality is a way to make visible the relationship between groups and structures of power, social policies, history, and also large sociopolitical formations. Critical bifocality can be a tool used to outline how dispossession and privilege transcend through local, national, and global context and

demonstrate how power within different contexts may lead to unequally redirected resources and opportunities across different spaces and groups. It is a lens used to criticize, untangle, challenge, and examine neoliberal policies and practices. It can also be used to explore different contexts and their relation to micro and macro policies and practices.

Research Site - *The Field*

The University of California, Pleasantville (UCP) is situated in large city I call Pleasantville, which is part of larger racially and economically diverse county that is home to millions of people. Pleasantville consists of nearly 250,000 people, with the majority of its residents identifying as Whites (near 50%), followed by Asians (over 40%), and Latinxs/Hispanics (less than 10%). The residents of Pleasantville are mostly middle income individuals/families, with the median household income above $90,000. Pleasantville is home to the Pleasantville Company, a private real estate company that is governed by an independent board of directors. The real estate company owns a large portion of property in Pleasantville, and they have conducted large-scale urban planning that controls residential, business, and entertainment/shopping development. This includes the area around UCP, where the Pleasantville Company owns the majority of the land and therefore controls business establishments and residential development, as well as how much to charge (rent) in these areas. The immediate surrounding areas near UCP have a variety of fast food restaurants and shopping options, however, there are very few non-fast food restaurants and even fewer social and entertainment options (bars, nightclubs, entertainment venues, etc.) in close proximity to UCP. While research on the proximity of bars and clubs to colleges suggest that having these entertainment/social options near colleges increases risky and unhealthy behaviors (e.g. binge drinking) among college students (Weitzman, Folkman, & Wechsler, 2003), the reality is that

over time these entertainment/social options have become a norm and are a central hub for socializing and developing social networks, friendships, and/relationships among college students (Bogle, 2008). For students who want to participate in entertainment/social activities they often have to leave the area near UCP and drive, or take some form of transportation, 5 to 10 miles away for entertainment options.

Perhaps concerns over student unhealthy and risky behaviors, along with potential property damage (e.g. broken windows, graffiti, etc.) that can arise from those risky behaviors, motivated the Pleasantville Company to limit such entertainment/social developments. After all, Pleasantville is known as one of the safest cities in California, and research has shown that property value and rental prices are affected by crime (Gibbons, 2004; Lynch & Rasmussen, 2001; Tita, Petras, & Greenbaum, 2006; Troy & Grove, 2008). Therefore, minimizing property damage or other crimes serves the city's status and economic interest by keeping their title as a "safe city" and thus having more control over the price of their real estate properties. Nevertheless, these limited entertainment/social options discourage some students from staying on campus during the weekend. In fact, many students who attend UCP and who live on or near campus often go home or away from the city during the weekend. Students and institutional agents often describe UCP as a commuter school. This is important to note because a number of studies have suggested that students, especially low-income and racial minority students, who go home or leave campus multiple times throughout the quarter/semester often struggle in balancing their study/homework time and their time with their family and home responsibilities (Baker & Robnett, 2012; Moncada-Davidson, 1996). Other studies suggest that students who leave campus are also less likely to develop important social networks and less likely to feel like they belong or fit in with the university (Tinto, 1993)—all of which impact student's college persistence and

success. Yet, contrary previous studies, many students at UCP do end up going home or leaving campus during the weekend, and many of them are not struggling in balancing their responsibilities, nor do they feel disconnected from the university, like previous studies suggest. Perhaps there are some students who do go home and therefore struggle being integrated into college and developing relationships on campus, yet it is hard to imagine that this is the case for all the students at UCP who go home or leave campus during the weekend. Overall, many students are not socially or academically affected by leaving campus, like Tinto's (1993) theory of departure suggest. Rather, as I will discuss later in chapters 3, 4, and 5, there are multiple layers of challenges that independently and collectively affect Latinx students ability to persist and succeed as STEM majors in college.

UCP is part of the UC system in California that consists of nine universities, many of which are nationally recognized to be among the best in the nation, with most universities ranking in the top 100 best colleges and universities (U.S. News, 2019). Like other UC's, UCP is also known for their academic and research excellence, as well as their dedication to propelling their students and communities into a prosperous future. UC's are competitive schools to get admitted into, many of which have strict admission requirements. For example, according to the UC's annual Accountability Report[5] (2018), students attending UC's have strong high school GPA's and college entrance exam scores, with a large number of admitted student (above 60%) entering college with a 3.8 high school GPA or above (see figure 1). UC's are also recognized for having a very diverse community of students (see figure 2). Like most UC's, the student demographic makeup of UCP is very diverse as well. According to the racial categories and demographic data provided by UCP, Asian's represent the majority of the students (near 35%),

[5] The UC Annual Accountability Report provides a comprehensive assessment of the UC system's progress, as well as details about their student demographics and academic background.

followed by Latinxs (near 25%), Whites (near 10%), and African Americans (less than 5%). UCP is also recognized as a Hispanic Serving Institute[6]. Most of the students attending UCP are California residents (greater than 75%), while less than a quarter of the student population are students from different states or countries. There are more female students enrolled at UCP than male students, and more than 60% of students attending received some form of need-based aid in 2017. The institution was chosen because it is a Hispanic Serving Institution and because I had a supportive network of academic professionals working/attending UCP who served as great resource.

UCP is a large campus that has a great balance of buildings and natural landscapes filled with trees, shrubs, rose gardens, and sculpture gardens. Their buildings range in architectural styles. Some of the first buildings developed still stand, and were designed as large, cube shapes that have few windows, but provide a large number of functions. Over the years, UCP has done some renovations and has added plenty of modern buildings that have large windows, lobbies, computer stations, and even coffee shops. Each department on campus had a mixture of these buildings. Most places in the university have few traffic areas where large groups of people hangout. There is, however, one main area near the administrative offices that is hosts to a variety of different student services, fast food restaurants, and coffee shop options, as well as shops for student apparel and class material/books. In the late morning and early afternoon, this area is filled with people talking, walking around, studying, getting food from the fast food restaurants and/or student organization food stands, and/or getting pamphlets or information from student organizations, campus programs, and non-campus related organizations.

[6] To be considered a Hispanic Serving Institute (HSI), a college/university must have at least 25% of their student population identify as Latinx or Hispanic. Once a college or university becomes an HSI they can apply federal and state funding for programs and services for their Latinx/Hispanic student population.

Most STEM departments are scattered around campus, however, most lower-division STEM classes are typically help in a number of selected classrooms, mainly because of their large room capacity. Labs, on the other hand, are often held within their own respective department. The university has a variety of student services, including two main libraries, one modern and state of the art gym, seven main student dormitories, and several small stores and coffee shops around campus.

Participant Selection

Participant selection for this study was based on a combination of purposeful sampling (Patton, 2002) and convenience sampling (Henry, 2009). Purposeful sampling is the method of intentionally selecting individuals in order to understand and examine a central phenomenon (Creswell & Creswell, 2017). According to Patton (2002), the 'logic and power of purposeful sampling lies in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose, thus the term purposeful sampling. Studying information-rich cases yields insights and in-depth understanding rather than empirical generalizations (p. 230). In essence, purposeful sampling allows the research to focus on a group, and examine the experiences and challenges they face in their day-to-day lives.

There are different approaches to purposeful sampling, which includes homogenous sampling, the approached I used for this study. According to Creswell and Creswell (2017), homogenous sampling is the intentional selection of individuals based on their sub-group characteristics. In this study, since I was focusing on both students and institutional agents, this meant selecting two groups of participants, with the first group identifying as a Latinx student and being enrolled, or previously enrolled, as a STEM major, and the second group identifying

as an institutional agent (faculty, administrator, and academic counselor) who works in a STEM department and/or provided services to STEM students. Convenience sampling was also used to select participants. Convenience sampling is a non-probability sampling or non-random sampling. Instead, participants are selected based on geographical proximity, easy availability, easy accessibility, and/or willingness to participate in the study (Henry, 2009).

Participant Recruitment

Student Participation Recruitment

For this study, I actively sought to recruit Latinx students who were either currently majoring in STEM, or at one point during their undergrad where majoring in STEM. The most obvious place to recruit Latinx students majoring in STEM was to attend lower-division STEM classes and recruit students there. For an entire year, I would examine the course catalog prior to the start of a quarter and take notes on the days, times, and locations of lower-division STEM classes that were offered and then I would compile a list of classes that I would attend each day to recruit participants. During the first two weeks of every quarter I would sometimes attend four to five a classes per day to recruit participants. I would first make contact with a faculty member and ask permission to give a 2 minute presentation about my study to the entire class and then ask students who met the requirement and were interested in participating to sign-up or to take a flyer with information about the study and my contact information. After the presentation I would hand out a clipboard to students to pass around. The clipboard had a sign-up sheet as well as flyer. I chose to attach the flyer specifically for those potential participants who wanted more time to think about participating or for those who didn't want to share their contact information with me or other students who might glance at the sign-up sheet. While the clipboard was being passed around, I would often sit in the back and monitor the clipboard. I never lost sight of the

clipboard and I constantly monitored it to ensure I didn't lose it and that the information on it was not being tampered with.

Another way that I recruited student participants was by attending Latinx student led STEM organization events. Again, I would often ask permission to give a quick presentation and ask students to sign-up with me if they wanted to participate. Since many of the events where social events and had no seating structure, I would often carry a clipboard with flyers and a sign-up sheet. During the events I would often walk around and have informal conversations with students, where I would sometimes ask if they were interested in participating. Other ways that I recruited participants was asking academic departments, both STEM and non-STEM, as well as offices for STEM related campus programs, for permission to place research ads with flyers on their bulletin boards. Finally, I also asked participants to share my contact information with any of their Latinx friends in STEM, or Latinx friends who were once enrolled as a STEM major and who might be interested in sharing their experience with me.

Institutional Agent Participation Recruitment

To recruit institutional agent participants, I would usually rely on emails or I would attend office hours, class or faculty offices, and/or attend department offices and request to meet with someone who was available. Faculty were vetted to ensure I was not recruiting adjuncts or graduate students. Typically, I would visit each departments website and look up their faculty (assistant, associate, or professor) and cross reference their name with lower-division classes that were being taught in a given quarter. I specifically chose faculty who were teaching lower division classes because I wanted to recruit faculty who had a fresh perspective on teaching those classes, as well as understood what factors contributed to student success or struggle students in STEM, particularly among Latinx students. Once I compiled a list of faculty I would first attend

their class and ask them, before or after class, if they would be interested in participating in my study. Often times they would ask me to email them with details and to see if they had time to meet. Most faculty were responsive to my email, while only a few never responded to any of my communication attempts. With those that responded, I was able to secure a date and time to meet and interview them for this study.

For administrators and academic counselors, I would either attend the office and try and recruit participants there, or I would email them personally to see if anyone was interested in participating in my study. Administrators who worked in STEM departments, campus programs, or in student services and provided support to students, including STEM students, were specifically targeted for recruitment to participate in this study. Administrators who were selected ranged from working in diversity offices, STEM programs, or a range of student service programs.

Academic counselors were recruited by attending department offices and asking front desk personnel or academic counselors themselves if they would be willing to participate in this study. Academic counselors were purposely recruited from STEM departments only. However, I did also speak with an academic counselor from the undeclared and undecided office in order to explorer the advice and suggestions they gave to students who were weeded-out of STEM. Typically, I would either provide my contact information or gather academic counselors contact information and we would exchange emails. Not all academic counselors were available or responsive to my communications, however, I did manage to recruit an academic counselor from each major STEM department (see table 2 for details).

Data Collection

Data collection consisted primarily of interviews, observations, student demographic background, and documents on university and department-specific policies/practices/procedures.

Interviews

For this study I conducted both semi-structured and unstructured interviews with both students and institutional agent participants. Semi-structured interviews typically lasted one hour. The time, date, and location of the interview was the participants choice. Before the interview began I would always give participants a study information sheet that had all the pertinent information regarding the study, which I asked that they take their time and read over it carefully. Once they agreed to participate I informed them once again that they are not required to answer all the questions, that there was no right or wrong answer, and that they had the right to stop the interview at any time. Once they inform me that they understand their rights and the purpose of the study, I would then turn on two audio recorders[7] and begin the interview. During the interview I tried to facilitate interviews in a manner that was open and welcoming. For student participants, after the interview I would hand them a demographic sheet and ask them to fill out. Once they handed me that document I would then ask if I can contact them again, or I simply asked if they were interested in participating in a more deep and detail, ethnographic study. Student participants who were not interested in being part of the ethnographic study served as key informants for the supplementary interview data.

While attending student organizations I also conducted informal interviews with other Latinx students, some of whom became participants in this study. When I would observe participants with their friends, on campus talking with other students, or at social events talking

[7] I used two recording devices just in case one where to fail for any reason.

with other Latinx STEM students I would sometimes listen to their conversations and when they were discussing something that was relevant to the study I would sometimes ask questions to get a sense about their experience and/or perspective. After these informal conversations I would either audio-record myself or take notes on my notebook about the conversation I had with Latinx students.

With institutional agents, typically the interviews would take place in their office, which had more privacy. Again, I would hand them the study information sheet and ask them read over it. Once they agreed to participate, I would again remind them of the study and their rights and proceed with the interview. Interviews typically lasted 1 hour. Only semi-structured interviews were conducted with institutional agents. I would sometimes have informal conversations with a few faculty members when I went to their class to recruit participants. Usually, these conversations took place before or after class. These informal conversations typically lasted 10-15 minutes. After these informal conversations I would also take notes or audio record myself about the conversation that took place.

All interviews, as well as audio notes on informal interviews, were transcribed. The transcriptions removed any identifying markers, and their names were replaced with pseudonyms

Field Notes

Typically, during a given quarter I will be on campus three to four times a week, usually from 8 am to 8pm, or sometimes as late as 11 pm when participants would either go out with friends or be out late studying the day before a midterm or final exam. While on campus or when I was with participants, I would often take field notes on my observations. To help guide my process of taking good field notes, I used Jeffrey's (2008) approach for taking field notes. Jeffrey (2008) compiled a list of six areas of concentration that ranged in macro and micro forms of

observation to help researchers focus in on their research. The six areas of focus were 1) *acts* (brief actions), 2) *activities* (actions and personal involvement), 3) *meanings* (the terms used by participants), 4) *participation* (a participants involvement in both acts and activities), 5) *relationships* (the connections between people), and 6) *settings* (the environment and context). Using this approach, I would take field notes on the campus environment itself, the actions taken among participants, the interactions between participants and other people, and the environment/context where I was observing participants.

Participant Observations

Participant observations are an important aspect of ethnographies. It involves building trust with participants and making them feel comfortable enough with your presence so that you can observe them with their day-to-day activities and recording information about their lives (Bernard, 2017). Most of my observations took place on campus or areas near campus. In particular, I observed students while they were in class, studying at libraries or anywhere on campus or near campus, attending events or student organization events, hanging out with friends, and/or simply hanging out around or on campus. When I did observe them, I careful examined the context of the situation to determine how involve I could be and see if I could ask questions, engage in conversation, or listen in on the conversations the participant was having.

Since I did recruit a few students from Latinx organization events, I also attended events to observe not only the participants I recruited, but also other students, and the event and location itself. There were two Latinx led organizations that I observed in particular, which were Latinx Engineers with Academic and Professional Strengths (LEAPS) and Latinxs in Sciences (LS). LEAPS was an organization primarily focused on supporting Latinx engineers, but also supported other Latinx students across different STEM fields. LS supported students across all

STEM fields. The student led organizations often held social and professional events once or twice a month, and provided study rooms for members come and study at, once or twice a week. I attended multiple social, professional, and study session events. When students were studying I quietly sat away, yet close enough to the participants I was observing. When observing, I understood that my presence was noticeable, mainly because as I was the only one sitting alone with only a notebook and pen in front of me, while others worked in groups and had with them their STEM course book or laptops. I recognized and respectively understood that this was not my space, and when the study session rooms began to fill up to capacity with students, this happened particularly near midterm or final exams, I would leave my seat/table and let students use that space. When that happened, I would usually sit or stand in the hallway, near the door and observe as much as I could without being awkwardly noticeable.

Notes on participant observations were gathered on notebooks and self-recorded audio clips which were transcribed and removed of any identifying information.

Student Demographic Questionnaire

After semi-structured interviews were administered, student participants were handed a demographic questionnaire (see figure 3) to fill out, which included questions on gender identity, college major, high school and current college GPA, and college standing. There has been an ample amount of research suggesting that socio-economic status is related to college persistence, college success, and variation in college experience (Sirin, 2005; White, 1982; Walpole, 2003). Therefore, questions on parental education, family income, and parental occupation were asked in order to gather information on socio-economic status[8]. However, data on socio-economic

[8] Measuring SES is complex and not universal. Different measures have been used to capture SES, however, parental income, parental education, and parental occupation are the most often used measurements of SES. While parental income, parental occupation, and parental education are useful measures of SES, for this study I also asked

status was not used to examine any relationship (quantitatively) between SES and STEM college persistence or success among Latinx students. Rather, data on socio-economic status was used to describe Latinx students class background and to see how they experienced college as STEM students.

University and Department-Specific Policy/Practice Documents

Documents on university policies and practices were collected and analyzed for this study. Specific documents on policies, procedures, and practices that were collected were: 1) requirements for STEM graduation, 2) requirements for STEM major enrollment, 3) change of major procedures 4) examples of study plans for specific majors, 5) academic probation policies, 6) academic probation contracts[9], 7) time-to-degree policies, 8) and major-specific and university readmissions policies. Documents that contained identifying markers (names of students, institutional agents, or the institution itself) were deleted (e.g. cut out with scissors) and replaced with pseudonyms.

Participant Demographics

Student Demographics

A total of 24 participants were recruited for this study. Of the 24 participants, 9 participated in the ethnographic portion of the study, 2 of whom were transfer students. The other 15 participants, 2 of whom were also transfer students, participated in only the supplemental interview portion of the study. However, there were many instances where I was able to observe participants who participated only in the supplemental interview portion,

---

students explicitly how they identified with regards to their class background, and I used this information to infer their class background. I also cross reference that with information on the questionnaire to see if there were any discrepancies (see table 3).

[9] Document highlighting the requirements needed to get out of academic probation or highlighting the repercussions of failing to meet those requirements.

typically at Latinx student led organization events. When I did see them across different spaces, I did partially observe them when they shared spaces with those in the ethnography study. Fourteen (58%) participants identified as female and 10 (42%) identified as male. From the interview and demographic questionnaire data, a large majority of Latinx participants identify as working class or from a low-income (low SES) families (70%) (see table 1), and 30% identified as middle class. No participant identified as upper class (see table 3 for SES data).

Most Latinx student participants identified as Mexican, Mexican-American, or partially Mexican (88%) and a few others from Central and South America. A majority of Latinxs at UCP are from a Mexican heritage, which is reflective of the participants background in this study. Two Latinx student participants identified as multi-ethnic because they had parents who identified with multiple Latin American countries. Most students were first-generation[10] college students (92%), which meant that they are the first in their family to attend a 4-year college with the goal of obtaining a bachelors degree. However, a few students had parents who attended community college, with a few who earned an associate's degree or certificate (21%), and/or had siblings who were either enrolled in college or had recently graduated from a 4-year college. Only 2 (8%) Latinx students had parents who finished college and earned a bachelor's degree.

[10] First-generation college student is a student whose parents have not completed a bachelors degree. Students who have parents that completed an associate's degree, or obtained a certificate degree at a community college are also considered first-generation college students because their parents never obtained a bachelors degree.

Table 1: Student Demographics

N	Pseudonym	Age	Self-Identified Gender	Latin Cultural Background	Self-Identified Class[1]	Self-Reported H.S. GPA	Self-Reported College GPA [2]	First Generation College Student	College Major	Undergraduate Class
Latinx Students Who Entered UCP as Freshmen										
Ethnography Participants										
1	Ana	19	F	Mexican	Working Class	3.9	1.8	Yes	Material Science Engineering	Freshman
2	Lupe	18	F	Mexican	Working Class	4.1	3.0	Yes	Biological Sciences	Freshman
3	Yvette	19	F	Mexican	Middle Class	3.9	2.2	Yes	Biological Sciences	Freshman
4	Patricia	22	F	Mexican	Working Class	3.7	2.4	Yes	Public Health	Senior
5	Sandra	18	F	Mexican/Salvadoran	Working Class	3.6	2.3	Yes	Undecided/Undeclared	Sophomore
6	Enrique	21	M	Mexican	Middle Class	3.9	3.3	No	Engineering	Junior
7	Francisco	21	M	Mexican	Middle Class	4.2	3.2	Yes	Math	Senior
Supplemental Interview Participants										
8	Jose	22	M	Mexican	Middle Class	4.0	3.0	Yes	Aerospace/ Mechanical Engineering	Senior
9	Olivia	20	F	Mexican	Working Class	4.0	3.0	Yes	Chemistry	Junior
10	Eva	18	F	Multi-Ethnic	Working Class	3.9	2.2	Yes	Public Health/Pre-Med	Freshman
11	Mario	19	M	Mexican	Working Class	3.4	2.0	Yes	Biological Sciences	Freshman
12	Kathy	18	F	Mexican	Middle Class	4.0	2.7	Yes	Undeclared/Chemistry Affiliated	Freshman
13	Yolanda	20	F	Honduran	Middle Class	3.4	2.8	No	Chemistry and Environmental Science	Junior
14	Juan	20	M	Mexican/Nicaraguan	Working Class	3.7	2.3	Yes	Biological Sciences	Junior
15	Nancy	19	F	Mexican	Working Class	3.8	2.5	Yes	Biological Sciences	Sophomore
16	Diana	20	F	Mexican/Guatemalan	Working Class	3.8	2.6	Yes	Engineering	Junior
17	Javier	22	M	Mexican/Honduran	Working Class	3.7	2.5	Yes	Public Health	Junior
18	Melissa	21	F	Mexican	Working Class	3.6	2.7	Yes	Public Health	Junior
19	Jasmin	18	F	Salvadoran/Guatemalan	Working Class	3.8	1.9	Yes	Biological Sciences	Freshman
20	Miguel	21	M	Mexican/Colombian	Working Class	3.6	2.5	Yes	Sociology	Senior
	Average Age	*20*				*3.8*	*2.5*			
Latinx Students Who Entered UCP as Transfer Students										
Ethnography Participants										
21	Carlos	31	M	Multi-Ethnic	Working Class	1.9	1.7	Yes	Math	Junior
22	Vicente	20	M	Mexican/Salvadoran	Middle Class	3.1	3.3	Yes	Chemical Engineer	Junior
Supplemental Interview Participants										
23	Jorge	24	M	Mexican	Working Class	2.1	1.3	Yes	Math	Junior
24	Claudia	24	F	Mexican	Working Class	3.7	3.0	Yes	Biological Sciences	Junior
	Average Age	25			*Average GPA*	*2.7*	*2.3*			
	Total Average Age	***21***		***Total Average GPA [3]***		3.6	2.5			

Notes:
[1] Self-Identified class gathered from interviews. (Research explicitely asked each student how they identify economically/class background)
[2] Self-Reported college GPA was collected at first interview. Some students GPA changed during the 1-year study.
[3] Combined GPA of students who entered college as freshmen and students who entered college as transfer students.

Approximately 7 (30%) of Latinx student participants were freshmen, 2 (8%) were sophomores, 11 (46%) juniors, 3 (13% seniors), and four (17%) were transfer students. All Latinx students participants were California residents and attended high schools in California. The average high school GPA for students who entered UCP as freshmen was 3.8, and the average cumulative college GPA for these participants was 2.5. For transfer students, their average high school GPA was 2.7 and their average cumulative college GPA at UCP was 2.3. The next section are a description of the Latinx student participants in the ethnographic portion of the study.

Ethnographic Student Participant Profiles

Ana

Ana is a 19 year old Latina who identifies as Mexican-American. She born and raised in south Los Angeles, and she attended a local public high school not far from her home. Her mother works as a care-taker for the elderly and those with disabilities. Her mother doesn't earn much money, but it was her father who was the head of the household and brought in most of the family income. Ana's father attended community college and had earned his associate degree and a certificate as an electrician. Up until 2016, her father was the head of the household and was responsible his family needs, until he passed away. When Ana first spoke to me about her father's death she began to cry. She looked at me and I simply said "it's ok to cry, I completely understand." Out of respect to both Ana and her father I didn't ask too many questions regarding her father's death, but from what I gathered in my conversation with Ana her father's death was financially, emotionally, academically devastating for her and her family. Her fathered passed away before the fall quarter began, and Ana had to manage her first year in college while simultaneously mourning and adjusting to her father's death. I met Ana in the engineering department office where she was trying to speak to an academic counselor to discuss her academic standing and talk about possibly changing majors from Material Science Engineering to Aerospace engineering.

Sandra

Sandra is a 19 year old Latina who is a first-generation college student. She was born and raised in South Los Angeles. I first met her at a Latinx student led organization social event. She identifies as half Mexican and half Salvadorian Latina who practices and embraces both cultures.

She described her parents as traditional and hard-working individuals who are from a working class background. While her parents never attended college themselves, they have been very supportive of her education and they constantly encourage her to aspire for great success. She attended a charter high school, which she described as "regular high school." She was initially a Bio major but changed her status to an undeclared/undecided student when her academic counselor advised her to change majors after she had failed chemistry and was placed on academic probation. Her goal was to work her way back into the Biology department, and for that reason she continued to take STEM classes and be involved in the STEM student led organization.

Lupe

Lupe is an 18 year old Latina who is a first-generation college student majoring in Biology. When I recruited participants in different STEM classes she was one of the first students who signed up to participate in my study. Lupe grew up in Coachella, a desert valley in Southern California. Both her parents are from Mexico, who she identifies as working class. As a young girl she always interested in STEM, saying "I really love science, I've always loved science since freshmen year in high school when we dissected pigs—I felt like that was what I wanted to do." Unfortunately, she attended a high school that she described as a "low-income high school" that "didn't have didn't have AP physics or any other AP classes that you would find in better off high schools." Despite the lack of AP classes and resources at her school, both her and sibling graduated and attended college.

Lupe has three siblings and she is the youngest in her family. All three of her older siblings are college educated and at the time of the interview all three of them were working on obtaining a Master's degree. Despite having siblings who went to college, none of them studied

STEM, and therefore could not help Lupe understand her STEM class material. Since she lacked the support and the educational foundation needed to navigate STEM in college, when she began taking STEM classes she often struggled in class and had difficulty with lectures.

Carlos

Carlos considers himself a multiethnic and multiracial Latino. His nuclear family consist of members who have roots in Nicaragua, Puerto Rico, El Salvador, Mexico, and United States. His complex identity is a result of a fusion family members who come from different backgrounds, so describing himself was complicated for him. He simply sees himself as a diverse individual who was blessed to grow up in a diverse, and culturally rich family. He has 5 stepsisters, all of whom are racially diverse. I was lucky to meet Carlos at an event hosted by the Ethnic Studies department.

Carlos grew up in Long Beach and La Puente. Unlike most students at UCP, Carlos was an untraditional student. He was 31 years old when I met him, and he was living on campus with his wife and two children, at a dorm for graduate and undergraduate students with families. Carlos attended a low-resourced high school that he states didn't provide the education and resources needed to succeed in school and attend college. He finished high school with a GPA of 1.9. After high school he worked both as a warehouse worker and a construction worker. He made decent money, but he knew that his lack of education had economic limitations, so he decided to go to community college. Carlos started community college 9 years after graduating high school. He transferred to UCP after completing his admission requirements at his community college, and graduated with a GPA of 3.7.

At community college he decided that he was going to major in Math when he transferred to UCP. He shared with me his passion for math, telling me that he enjoyed it very much as a kid, but lost sight of that passion up until his young daughter needed help with her math homework. He tried to help his daughter with her math homework, but soon realized he didn't have the knowledge or tools to help her. He reflected on his past experience with math classes and became aware that math wasn't properly taught to him. Carlos said, "math wasn't something that was taught to me correctly, or in a way that I was going to be able to retain it, and that sort of inspired me to go into the math field." His past experience motivated him to make a decision to become an agent of social change by becoming a math professor and empowering students.

Yvette

Yvette is a 19 year old Mexican-American Latina who grew up in Central Valley, California, an area known for its agricultural industry. She is a Sophomore majoring in Biology, and her career goal is to become a Physician Assistant (PA). I recruited Yvette from a STEM class. Yvette and her siblings are the first in their family to attend college. Her brother is undocumented and graduate from a Cal State university, and was working towards getting a credential at a private university. Her sister attends college at a Cal State and is currently working towards a bachelors degree. All three of them attended a underfunded high school, which Yvette described as school that provided little information about universities and instead encouraged their students to go to community college. Despite the limited support, Yvette and her siblings all graduated high school and earned their way into four-year universities.

Yvette comes from a loving family who have supported her throughout her education. Both her parents came to the United States as young adults, in search for a better life. As a young

girl she remember her family struggling economically, until her father was able to purchase real estate, which he used to rent out and use the extra income to provide for his family. She plans on using her earned income as a PA to one day help her family.

Patricia

Patricia is a 22 year old Mexican-American Latina who comes from a working class background. She grew up with her mother and her seven siblings. Her father was in out and off picture due to his criminal background and legal status. According to Patricia, her father was constantly being deported or placed in jail, and thus he could not provide for his family as much as he would've liked to. Growing up, her family struggled to make ends meet, with most of her siblings and herself working to help her mother pay for living expenses. Despite their financial struggles and life challenges, Patricia and her family remained very close and were very supportive of one another. What was most impressive is that four members in her family, including herself, managed to overcome many obstacles and earned their place in college.

I met Patricia at a student led organization professional/social event. When I met her she was majoring in Public Health, but she began UCP as a Math major before switching majors. Patricia is a very upfront and transparent individual, and when she had something to say she made sure to express her thoughts and feelings. She is a strong Latina and she doesn't give up easily. She attributed her persistence in schooling to her personality and her beliefs of not giving up and always working hard. She is very energetic and enthusiastic individual, which was contagious. Her personality and energy always lifted her friends up when they needed it. It was an amazing experience to witness her ability to help others, and it was a privilege to have met her and to observe her fascinating life.

Enrique

Enrique is a 21 year old Latino who identifies as a Mexican-American. When I met him he was junior at UCP, majoring in Mechanical Engineering. He comes from a middle class family and both his parents attended college and earned degrees. His family owns a small business and they have supported Enrique and his siblings while they attended college. He is the youngest in the family and he has two older sisters, both of whom are college educated. Enrique was unique in that he was one of a few participants who had college educated parents. During our conversations he often reflected on how supported his sisters were to his success in college because they helped him navigate the process of applying and persisting in college.

As a student, he enjoyed studying and often performed academically well. He was very proud of his academic success, which I found admirable. He surrounded himself with like-minded individuals who came from different racial backgrounds. Most of his friends where males who he had a very close connection with. Enrique was one of a few Latinx students I met who had a racially mixed group of friends. He enjoyed being a student and was looking forward to applying and attending graduate school.

Francisco

Francisco is 21 years old and he is a senior, majoring in Math. He and his siblings are the first in his family to go to a four-year college. Both his parents migrated from Mexico at a young age and both attended a community college in the United States, but neither every finished. Growing up, Francisco family struggled economically, but now his family is better off. He was one of a few students who worked part-time at the university as an office assistant, however, he still received financial help from his parents.

Francisco is among the few student who was academically successful. When he started college he was placed in dorm room with two other math majors, so they were able to develop both a strong friendship and a reliable study group. He and his roommates, who were racially diverse, often worked together, took classes together, and often helped another with questions. When I met them they had a genuine friendship, and surprisingly were able to manage their time very well. While they hung out and did social things, they understood that homework and studying were a priority.

Vicente

Vicente is a 20 year old half Mexican and half Salvadorian Latino majoring in Chemical Engineering. He grew up in Santa Ana, a large city in southern California. He identifies as middle class, stating that his "parents have always had stable jobs and never had to worry about finding work." Though his parents divorced when he was a teenager, both his parents continue to provide for him and he never felt that his family struggled financially. Prior to attending UCP, Vicente attended community college and then transferred. He decided to go to community college because he had failed calculus in high school, so he had no option but to attend community college and earn his way into UCP.

I met Vicente at CASA, a campus program dedicated to helping racial minority students with their academics and providing resources and information on research and internship opportunities on campus. I was observing another participant who knew Vicente, and it was through that connection that I was able to recruit Vicente. Since Vicente was a recent transfer he had very few friends. But that didn't bother him, stating that he has a lot of friends back home. He also believed that having few friends in college was a good thing because it allows him to

focus more on his studies and less on social activities. It took some time to get him to open up and get comfortable with me observing him, but once he got used to it he really enjoyed talking with me and sharing his experience.

Institutional Agent Demographics

A total of 10 faculty members were recruited to participate in this study. Of those 10, 4 (40%) were from the chemistry (physical science) department, 3 (30%) where from the biology department, 2 from the math (physical science) department, and 1 from the physics (physical science) department (see table 2). Most professors were from the physical science department, which is home to various STEM disciplines like math and chemistry. Faculty from these areas were primarily recruited because a large majority of STEM majors must fulfill lower-division STEM requirements in these departments. For example, nearly all STEM majors must fulfill at least one math requirement, which is usually Calculus. Of the 10 faculty, 6 (60%) were female and 4 (40%) were male participants. There was a wide range of faculty experience that ranged between 3 years and 22 years. While I did not directly ask for their racial/ethnic identity, from the information and observations gathered during the interviews, my subjective understanding was that 7 (70%) faculty members appeared to be white, 2 (20%) Asian, and 1 (10%) Latinx.

Administrators on campus ranged in profession, with some being directors of programs, assistant deans, staff from campus programs, and staff in STEM departments. While their professions differ, all administrators provided support and services specifically for STEM students. Understanding the degree of their involvement, resources, and support in helping students was important for this study. A total of 7 administrators were recruited to participate in this study. They ranged in years of experience at the university, with the least being 4 years of experience and the greatest being 37 years of experience. All participants were identified as

female. Efforts were made to recruit male administrator participants, yet there were few available for recruitment. When I did try to recruit men in administration, most could not meet or did not respond to my communication attempts. Similar to faculty racial/ethnic identity, I did directly ask for their racial/ethnic identity, however, through the conversations and observation, my subjective understanding was that 4 (57%) were Latinx, 3 (43%) were African American.

Table 2: Institutional Agent Demographics

	N	Pseudonym	Gender	Department Affiliation	# of Years in The Field
Faculty	1	Dr. Chan	Male	Physics	14
	2	Dr. Johnson	Female	Chemistry	22
	3	Dr. Smith	Female	Chemistry	10
	4	Dr. Jones	Male	Chemistry	17
	5	Dr. Bell	Female	Chemistry	5
	6	Dr. Sinha	Male	Math	3
	7	Dr. Andrews	Female	Biology	11
	8	Dr. Moore	Male	Math	5
	9	Dr. Parker	Female	Biology	25
	10	Dr. Salazar	Female	Biology	9
Admins	11	Dr. Ramirez	Female	Student Services - Engineering	31
	12	Dr. Wilson	Female	Student Services - Engineering	37
	13	Laura Pena	Female	Student Services - Transfer Center	7
	14	Dr. Jackson	Female	Student Service - Diversity Program	5
	15	Maria Gomes	Female	Student Services - Biology	4
	16	Dr. Robertson	Female	Student Services - STEM Diversity Prog.	9
	17	Barbara Ortega	Female	Student Services - Resources and Support.	6
Academic Counselors	18	Mario Saldana	Male	Engineering	2
	19	Olivia Sanchez	Female	Pharmacology	7
	20	Anita Rodriguez	Female	Biology	3
	21	Becky Miller	Female	Physical Science	4
	22	Christine Schwartz	Female	Nursing	15
	23	Selena Castro	Female	Undeclared and Undecided	35
	24	Jennifer Park	Female	Computer Science	6
Total # Participants	24		**Gender Percentage**	Male 21% Female 79%	

Finally, seven academic counselors were recruited to participate in this study. All academic counselors were from different departments on campus. While I tried to recruit more participants from each department, often times there were only a handful of participants to

recruit from each department. For example, the physical science department only has four total academic advisers. Though I emailed all academic counselors from this department, only one academic counselor responded and volunteered, stating that she spoke with her colleagues who suggested that she be the "spokesperson" for the physical science department. Of the 7 participants, only 1 was male (14%) and the rest were female (86%). Through my conversations and observations, I learned that the male academic counselor identified as Latino. He was also a prior student in the department before becoming an academic counselor himself after graduating from the same university. Three (43%) academic counselors identified as Latina, 1 (14%) identified as Asian, and 2 (29%) identified as White. Half of the academic counselors identified as Latinx. Like administrators and faculty, the academic counselors ranged in experience, with the least experience being two years and the most experience being 35 years.

Data Collection, Procedure, and Analysis

It is important to note that qualitative data collection, procedure, and analysis is not linear, rather it is a fluid and circular process whereby the researcher is consistently in the process of collecting, making sense, analyzing, and re-analyzing the data, especially as new revelations and/or new themes emerge. I initially began data collection by observing and taking field notes of everything I saw and experienced. As a researcher, I had an idea about some of the things I would expect to find (given the literature), but it is also imperative for qualitative research to be open minded to new findings/themes. After collecting observations and field notes, I would often explore my data to see what was taking place, and as I began to find common themes I started to explorer those themes as my observations went on. This was the same process I used for my interviews.

When I conducted my initial interviews with students and institutional agents I began with a semi-structured interview protocol, however, with new findings the questions in the semi-structure changed and I began to ask questions surrounding some of the more dominant themes that were beginning to emerge during my initial phase of analysis. My process typically consisted of conducting an interview, then transcribing the interview, and then examining it for themes using NVivo, which is a qualitative computer software tool. After exploring the data and examining it for themes emerge, I would use what I found to help guide my questions for the next interview. Many of the broader questions from the initial semi-protocol interviewed remained, however, as I progressed through the ethnography I began to add more questions regarding themes that were emerging from the data I had collected.

One thing that I want to make transparent about being a dissertator conducting research is that my data collection and analysis were not done in isolation, rather, I would often have discussions with my advisors, via telephone or in person, where I would describe what I was seeing and who shared with me their thoughts on my data, as well as gave me suggestions on how to move forward with my data collection and analysis. As experts in the field of qualitative research, my advisors were essential in my development as a qualitative researcher.

Interview, observations, and field notes were transcribed, and any identifying information was removed and replaced with pseudonyms. Once information was organized and transcribed, I then transferred the data into NVivo in order to conduct qualitative analysis. The data was analysis was broken down into three different stages that were non-linear and circular. Meaning, each stage was revisited for the purpose of eliminating isolated themes and re-examining dominant, consistent themes.

The first stage consisted of reading line-by-line in order to describe the data and identify symbols, meanings, themes, and patterns. The second stage went beyond descriptions and consisted of identifying larger concepts, common themes, and shared experiences, as well as revealing complex relationships and complex systems. To achieve triangulation, a variety of data sources (interviews, observations, documents, etc.) were individually and collectively analyzed to gather and validate themes. Finally, the third stage consisted of sense-making and interpreting the data that was guided by past research and theory. The findings were then broken down into three data chapter findings.

Positionality

Critical ethnography requires the researcher to understand, reflect, and be critical of who they are and how they influence research. One must account for their positionality when conducting research. According to Madison (2005), positionality refers to the self in relation to others, and "forces us to acknowledge our own power, privilege, and biases jus as we are denouncing the power structures that surround our subjects (Madison, 2005, P. 7). When conducting ethnography, Fine and Weis (1996) suggest that ethnographic researchers must be critical and self-reflect on their research and understand how they relate to the "other." Fine (1994) writes about this process of "working in the hyphens," stating that qualitative research has reproduced a colonizing discourse of "othering" and that researchers need to interrupt ways of othering. Fine (1994) states that researchers need to take action and examine ways in which the self-other collaborate in the politics of everyday. Fine (1994) argues that working in the hyphen allows us as researchers to question methods, ethics, and epistemologies as they speak "of" and "for" others, while also "occluding ourselves and our own investments, burying the contradictions that percolate at the self-other hyphen (Fine, 1994, P.70).

As a researcher, I must also be reflective about my lived experiences and identity and how this might impact the research. Inevitably, participants will react to my positionality, which will often influence the way they perceive, interact, and react to my presence. I also understand that positionality will also influence the research that is being done, how it's done, what frameworks or epistemologies they bring with them, and what knowledge is produced. With that being said, I am critical of who I am and how I will interact with my research. I am Mexican-American who comes from a working class background. I lived with my mother, brother, and sister for most of my life. My father, a traditional machista[11] who was very aggressive, was forced out my family due to criminal activity, which forced my mother, who was a stay at home parent, to work and be the primary provider for our family. My father's aggressive personality influenced me to be the exact opposite of who he was. Fortunately, I have a strong, caring, and loving mother who respects all forms of life, and it is her values and character that I try to mirror each and every day.

Like many of the participants in this study, I grew up in poor neighborhoods and went to underfunded schools, where I was tracked into substandard classes. My siblings and I rarely had any support at school, and my mother was rarely engaged in our education, mainly because she was struggling to make ends meet. She naturally assumed, like many Latinx parents, that school was primarily responsible for our education, and that it was up to my siblings and I to get ahead in school, not realizing the institutional challenges and struggles that Latinxs face in school.

[11] According to Torres, Solberg, and Carlstrom (2002) Machista is a multidimensional construct that revolves around Latino masculinity and personality traits, such as "assertiveness; concerns about and obsession with achieving status, power, and control at any cost; individualism; aggression, toughness, competition, and winning; rigid self-sufficiency, an adventure seeking nature, willingness to take risks; and stoicism and an emotionally restricted nature constituted to avoid all things, actions, and reactions that are potentially 'feminine' (P.13). A traditional machista is one that is characterized as one who authoritarianism, has a high need for family respect, and control.

With the lack of guidance and support, both at home and in school, it was no surprise that my siblings and I struggled academically. My brother dropped out of high school, and my sister graduated high school but stopped out at community college. I graduate high school, attended community college, transferred to a four-year college, obtained my bachelors degree, and earned my Ph.D. Throughout the years it became very apparent to me that the struggles and challenges my siblings and I experienced were not isolated events, rather many of my fellow community members, who were also working class Latinxs, also struggled with obtaining educational resources, support, and guidance. As a result, many struggled to obtain a college education and college credential. My experience with education, along with the struggles and challenges that members of my community faced, motivated me to seek answers, find solutions, and create systematic changes to help my community.

Chapter 3

The Culture of Science: Limiting Social and Cultural Capital, and Reinforcing Meritocracy

Conducting ethnographies requires researchers to immerse themselves in the environment of their participants. For this study, it was important for me to observe students at the university and follow/observe them across multiple spaces, which included observing them in their classrooms, libraries, dorms/apartment, and other areas both on and off campus. I first began collecting data in mid January, 2017, which was the winter quarter at UCP. Students initially felt awkward with the idea of me observing them across different spaces, but after a few conversations and once we got to know each other students typically opened up and were comfortable with me observing them. One of the first participants I met on campus was Sandra. I met her during the winter quarter, in early February, at a Latinx STEM student led organization social gathering.

The social gathering was focused on network building. Food was served, which is always a good incentive to draw students in. At the gathering, I saw students walking around, eating their food, and greeting and talking with other students. This was a perfect situation for students to venture out and build friendships and networks. I was among the crowd, observing people and socializing while simultaneously actively recruiting participants. Sandra was one of the students who signed up to participate. During the winter quarter she was taking a Bio class and I asked if she would be willing to let me observe her during class and she agreed. I asked for the detail of the class location, as well as the time and day of the week the class met. After she gave me those details I informed her that I would sit away from her so she wouldn't feel uncomfortable and so that the observation would be more natural. She was fine with those conditions. On the day of

the observation I arrived 15 minutes early and stood outside the classroom. It was 9:45AM on a Wednesday in early March, and I was sitting outside one of the main Biology department buildings, where the class was being held, waiting for the previous class to finish before entering and observing Sandra during her class session. While sitting outside, I noticed a number of students sitting or standing outside, many of whom were keeping to themselves. Some had earphones on, and so I assumed that they were listening to music or talking with someone. Others were looking through their phones or laptops, probably doing a number of things like being on social media, playing games, or reading something. Only a few students were engaged in conversations with other students. The majority of students simply sat or stood around, nearly oblivious to the presence of their classmates. I wasn't sure why no one was talking. I naturally assumed that it was because many were starting their day and didn't have the energy to socialize.

A few minutes after sitting and observing the classroom door swung open and students from the previous class came pouring out. Some of the students from the next class session waited until the majority of students from the previous class were out, while others managed to squeeze through the body of students coming out and worked their way in into the lecture hall. I waited until the majority of students walked in before walking in myself. As I walked in I was struck by how large the lecture hall was. The room had a high, white painted ceiling, and navy blue carpeted floors. There were sections of tiered seats, which allowed students who sat in the back to look over the heads of other students and see the large screens and small podium used for lecturing. I stood in the back, observing and taking notes while students slowly began filling the room, which had a capacity for 400 people. While observing I also began searching for Sandra. As I looked around I initially noticed that there were more female students than male students. Another thing I noticed was that a majority of students were of Asian descent. There were some

Latinx students, but there were few and far between. There were even fewer African-American students. I expected to see more Latinxs, given that around 25% of the university is made up of Latinxs, but this didn't appear to be the case in this particular Biology class. After a few minutes of observing and searching for Sandra I found her and I made sure to sit at a distance so that I could have a more natural observation, yet not far enough so that I could not see what she was doing or hear what she was saying. At 10:00AM lecture began and I started my observation.

The professor, who appeared to be a middle-aged white woman, wearing a burgundy dress and a black blazer, stood behind the podium and began the lecture as one would think, speaking on the material highlighted on the power-point presentation, which was projected onto a large screen for students to see. I looked around and began observing the class. The majority of the students appeared to be paying attention, while a few others seemed distracted with their phones or laptops. I looked over at Sandra and she seemed to be concentrated on the lecture. Midway through the class the professor presented a problem on the projector screen and asked students to form into small groups of three or four students near them and work together to solve and discuss the problem. I looked over at Sandra and I saw her quickly look around and then begin to write on her notebook. A minute passed and she was still alone, writing on her notebook, perhaps working on the problem on her own I assumed. She didn't engage with anyone, nor did anyone approach her to work with her. I observed her for a few minutes and then I suddenly became aware that I was not approached as well. It was a large class, so I was caught off guard that no one had approached me. I began to wonder why, so I thought to myself that perhaps students somehow knew that I wasn't a student. However, I couldn't see this as a possibility given that the class size was very large and had more 300 students, so it would be very difficult for a student to know, or at least have seen, all other students in the class. So I

assumed that as far as the students knew I was a student myself. I looked around and saw that only a few students were working together. The large majority of students were working alone, trying to figure out the answer for themselves.

I spoke with Sandra after class and I asked her if she had worked with other students, knowing that she didn't. She said no, and then I asked why and she responded by saying "I usually work on my own because no one wants to work with me. And [when they] do work with me they don't always know what they are doing or they just give me the wrong answer." From what I gathered from my conversation with Sandra is that it appears that students feel more comfortable working with people they know, so they sit near their friends and very rarely do they approach strangers to work together. When she did manage to work with other students she felt that the students weren't helpful, and that many got the answer wrong or purposely gave her the wrong answer, suggesting that students were trying to restrict knowledge or information from her. Even when students do work together it's superficial in that forced collaborative work often has very little structure to help facilitate learning or help students develop networks or study groups. Instead, students are expected to simply work together without taking into consideration that not all students understand, or know how to answer, the question. Typically, students work alone and share their answers with the group they are working with, yet they often do not provide the steps they took, or the knowledge they had, to answer to question.

Sandra's experience was not uncommon, in fact, many Latinx students I spoke with shared a very similar experience with their lower division STEM classes, describing them as antisocial, unsupportive, unwelcoming, and competitive spaces. Though some of my initial observations, interview data, and field notes I soon realized that students in STEM majors have to navigate a field described as the *culture of science*. Hurtado and colleagues (2009) describe

the culture of science as a "competitive and hierarchical atmosphere" that promotes intense competition and discourages collaborative learning. Though there were instances of collaborative learning/work, it is often unstructured or has little learning facilitation. While there are a few institutions that are combating the cultural of science across their STEM departments through more collaboration and innovative teaching styles (Chang et. al., 2008; Hurtado et al., 2009), more often than not universities practice a culture of science that elicits competition and discourages students from collaborating in STEM (Hurtado et. al., 2009).

At UCP, there are a number of different ways that the culture of science is both manifested and sustained. The findings from this study reveal that the most common ways that the culture of science is reinforced are through 1) classroom design and structure, 2) grading practices and policies, 3) lack of faculty support, and 4) peer interactions/behavior. The rest of the chapter will describe how each of the aforementioned areas reinforce the culture of science. In addition, I will also describe how Latinx students understand, experience, and respond to the culture of science within each area, and then 5) highlight some the ways that faculty are challenging the culture of science. I argue that each of these areas, individually and collectively, are grounded in the discourse of meritocracy and individualism, which fails to acknowledge how the institutional practices and policies create challenges for Latinx students who may not have the social capital and cultural capital to navigate or overcome the culture of science. In addition, I also argue that while some faculty are actively challenging the culture of science, current institutional policies and practices create challenges in creating and sustaining alternative practices that are more collaborative, interactive, and innovative.

Classroom Design and Structure

At UCP, STEM lower-division classes are mostly held in large lecture halls that serve anywhere between 150-400 students per class, depending on the type of class and time of year (e.g. fall, winter, spring, or summer). The seats are arranged in tiered rows, with each row having about 10-30 seats. The seats are bolted to the ground and are designed to stay still, face forward, and are unable to turn in any direction. The arrangement and design of the seats make it practically difficult for students to interact and collaborate with other students in the class, especially those who are on the other side of the room. Building a network, study group, or any form of academic or social relationship between students in these classes becomes a draw of luck that depends on whether you sit by someone who will welcome and engage you in friendship and/or conversation.

Classes are typically taught by instructors who are faculty, adjuncts, and/or graduate students. Given the large number of students per classes, it is common for instructors to present their class material in a traditional, direct lecture presentation. Most classes are one hour to one and a half hours long, three to four days week. With such a short lecture class, it is not uncommon for instructors and many students to prefer having traditional, uninterrupted lectures. While this teaching practice is prefer by students who comprehend the material and are accustom to the teaching style, for students who are unfamiliar with this style or are having trouble with the material, it becomes a challenge, especially since there is little to no room allocated for raising and answering questions during lecture.

The practice of having traditional, direct uninterrupted lectures becomes even more important for faculty who under a lot of pressure from the departments to go over all the necessary material in preparation for *common final exams*, which are exams created by a group

of faculty members for all students who are taking a specific STEM class. Common exams are a common practice across numerous colleges and departments (STEM and non-STEM), and it was created to both evaluate student learning and also hold faculty accountable for teaching the necessary material to students. Many of the faculty members themselves who teach the class don't know what questions will be on the final exam. Therefore any disruption of the lecture flow will not only set the faculty back from reaching their learning objectives, but it also frustrates students who are less interested in other students' own individual challenges. Any prolong disruption or lack of progress also places faculty at risk of obtaining negative student evaluations for not reaching their goals, which can affect their job security or job promotion.

The concern is that the practice of traditional direct lecture can make learning difficult for students, especially for those who get confused during lecture, or come to the university academically underprepared. In my interviews with Latinx students, many informed me that they have had several experiences in which lecture became confusing for them, or that they simply did not understand the material. One of those students was Lupe, who is a freshmen majoring in Biology. As she explained, "I try really hard to understand the material, but there are times when the professor isn’t teaching in a way that I understand the concept and I have to go back and study it on my own or ask other people." For Lupe and Latinx students like herself, the fast pace and dense material in lectures can be difficult understand. When students are having difficulty understanding the material they are often encouraged by other students and administrators to ask questions during lecture, but classroom policies around time allocated for student questions during lecture vary by professors.

In examining syllabus, as well as observing classrooms themselves, it is clear that faculty have different policies around time allocation for student questions. Most faculty do allow some

time during class for student questions, but when questions do arise in lecture faculty allocate very little time to answer those questions. Faculty know that student questions do take time to answer, and if student questions begin to consume too much time then the professor would insists that students reserve their questions for office or lab/discussion hours. The lack of time, or having no time at all, to answer student questions can give students an impression that faculty do not have time for them, or that they simply don't matter, which can lead to students feeling disconnected, undervalued, and unsupported by faculty. Furthermore, these classroom experiences that students have in their classrooms can affect their ability to approach and engage faculty, both in and outside of classroom.

Having little or no support from faculty can affect a student's ability to understand the class material, which in turn affects their academic performance. In fact, decades of research in student/faculty interactions suggest that having greater student and faculty interactions can facilitate student learning development and enhance student academic performance of all students, including racial minorities like Latinx students (Anaya & Cole, 2001; Komarraju, Musulkin, & Bhattacharya, 2010; Pascarella, 1980; Pascarella, & Terenzini, 1991; Rodriguez, Massey, & Sáenz, 2016; Romsa, Bremer, Lewis, & Romsa, 2017; Umbach & Wawrzynski, 2005). In contrast, lack of student and faculty interaction can create an environment where students feel they are not supported and are undervalued. This was the case for Lupe who shared her thoughts on her professors policies and practices and how she felt unsupported, stating "'my chemistry professor is really hard on us. Like, if you have questions you have to go to office hours or ask your TA. You can’t ask during, or before, or after class. I feel like she doesn’t really care how you do as long as you show up to class and do your work." Similarly, Carlos, a junior

who transferred from community college and is majoring in Math shared Lupe's perspective, stating:

> "[The] professor starts talking, you know the time hits for him to start, and he starts talking and its going, and going, and going. I don't see much of the professors really stop and check up on the students to keep the students engaged. They just keep lecturing. I don't think they really care much if the students are learning or if there is any confusion. I think that's when a lot of students stop showing up to classes."

Like Lupe and Carlos, many Latinx students feel that lower-division STEM classes are more focused on presenting the class material and less interested in helping students learn the material. This is a result of the combination of short class time, large class sizes, and the pressure faculty face in covering the required material needed for students to be prepared for exams. Traditional, direct lecturing that has little time for student questions benefits students who have a certain habitus and cultural capital, which is an individual who is accustomed to this method and are academically prepared, while marginalizing those who do not have this cultural capital. Though decreases in student attendance is common among many large, lower-division classes (non-STEM and STEM) (Frye et. al., 2018), traditional lecture styles could partially explain student disengagement and decreases in student attendance, particularly among those that do not benefit from this teaching style. However, most STEM faculty at UCP who were concerned with attendance often included surprise quizzes during the semester, which helped increase student attendance. Still, surprise quizzes does not fix the underlying issue that students are having trouble engaging and learning in the large, fast paced, direct lecturing STEM class.

To further complicate the practice of traditional, direct lecturing, Latinxs come from a culture that respects education and their institutional agents, such as teachers and professors. Thus, many Latinxs have been raised to respect, follow, and adhere to faculty/teacher rules and teaching practices, despite that some may not agree with it, and/or even if those practices

negatively impacts their learning potential. Furthermore, challenging institutional practices is further complicated by the rhetoric around meritocracy and how Latinxs buy into that rhetoric, believing that academic success solely based on hard work and determination, and have little or nothing to do with the institutional practices and policies that are in place that make it difficult for them to succeed.

Asking questions during class and approaching faculty for help is further complicated by assumption that students are comfortable asking questions. For a lot of Latinx students, being surrounded by hundreds of students can be a very intimidating experience, so much that it does prevent students from asking professors questions in front of a large class. This was true for both struggling and achieving students in STEM. Take for example Francisco, an exceptional student who is a senior majoring in Math and who was one of the few students who has persisted through STEM. Like other Latinx students, asking questions during class wasn't easy, stating "my first year I think I was a little bit more shy because my math classes were at least like 100 people, so raising your hand and asking a question in front of so many people can sometimes be intimidating."

Another common reason why Latinxs do not seek help from faculty during class is because Latinx students believed that raising questions would disrupt the class and/or waste the professor time. For example, Yvette believes that "you can't ask questions on the spot because the professor is focused on finishing the lecture within the time period." Finally, another major reason for some Latinxs hesitate in asking for help in front of the class is due to the fear of asking a "dumb question" and being embarrassed. For instance, when I asked Juan, a junior in Biology, if he asks questions during class he said, stating simply "what if I ask a dumb question and people look at me at me all weird, you know. People judge you fast... so I just wait to ask the

teacher or T.A. after class." Being intimidated and/or embarrassed to ask faculty questions in large lectures, or large STEM lectures, is consistent with previous findings that suggest that not only Latinx students fear asking questions due to embarrassment, but that this is experienced by many students, including other racial minorities (Frederick, 2002; Gasiewski, 2012; Richards & Velasquez, 2014; Geske, 1992; Hurtado et. al., 2009; Iverson, 2002). The unfortunate result is that Latinx students who are struggling in understanding the class material often spend hours trying to grasp class material, which could have been explained in minutes. Challenges in understanding the material are exacerbate when students come from high schools that underprepared because they are simultaneously trying to catch up on their core STEM foundations that they were poorly taught, or not taught at all, in their high school while also learning the new material from their STEM college course by themselves.

Practicing traditional, direct lecture and having little or no collaborative or interactive work leaves few opportunities for students who are struggling with the material to ask questions during class, and thus many have to figure out for themselves both the fundamentals of STEM and their current STEM class material. It appears that many faculty are catering their pedagogy around a certain "type" of student, one who has a solid foundation in STEM and has the knowledge needed to understand the lecture. However, students are coming to the university with different STEM academic preparation, and having a traditional lecture styles forces upon students to be self-reliant, or to practice individualism, which can have detrimental consequences for students who are academically underprepared or struggling with understanding the class material.

Grading Practices and Policies

Grading on a Curve and Grade Distribution

Midway through the semester there were many students who had recently taken a midterm exam. I had spoken to Ana and she was worried about her exam score for her calculus midterm. It was Monday and she had just taken the exam the week before. Ana was especially nervous because today was the day that the professor was going to reveal the scores of the exam to the class. I decided to tag along and go with her to class to witness this process and gage the students reactions. I sat in the back, a few rows behind Ana. The professor walked in and announced that he was going to quickly go over the class exam scores. The professor turned on the projector screen and revealed the class grading scale, as well as the high, low, and average score. I looked up at the screen and saw that out of a possible 100 points the class averaged 62. The highest score on the exam was an 86, and the lowest score on the exam was a 27. Most faculty would be content with obtaining a class average of 75 points out of 100. For many instructors, having an average of 75% on an exam suggest that, for the most part, the exam was fair. However, obtaining a class average of 75 on a STEM exam is rarely the case. Rather, it is more common for a class to average less than 75. When this happens, faculty typically adjust the scores to reflect a normal distribution, which is a practice known as *grading on a curve*. Using Ana's class average exam score, this means that highest exam score, which was 86, will be highest benchmark for an "A" in the exam, and if the professor decides to have a grade distribution that only allows the top 10% of the exam scores to get "A's", which this particular professor did, that means the grade of an "A" ranged between 86-77.4, which reflected the top 10%, or a difference of 8.6 points from a "B," which ranged between 77.3-68.7. In general, when faculty grade on a curve for exams they curve them based on the performance of the whole class.

Grading on a curve is a practiced used to obtain the desired grade distribution. Some professors may choose to not curve the grade for each exam, but rather curve the final grade at the conclusion of the class. At this point, if the grades do not represent a normal distribution then many professors will adjust their grading scales to reflect their departments *grade distribution policy*, which differs slightly by department, but generally they have a grade distribution policy which only allows 20-25% of the class to obtain some variation of "A" (A+, A, or A-). The other 30-35% of class will get a "B", another 30-35% of the class will get a "C", and the last 15-20% of the class will get D or F's. Most STEM departments at UCP understand that it is uncommon for a lower-division STEM class to obtain a normal distribution, let alone a negative skewed distribution[12]. Thus, what the grade distribution policy does is give out a select number of A's, B's, C's, and so forth to students based on their overall score in the class, in order to maintain a normal distribution of overall grades.

Only a few Latinx students were somewhat aware of this grading policy, however most are aware of the practice of grading on a curve. Many Latinxs students I interviewed stated positive things about the practice of grading on a curve, and some have stated that they wouldn't have passed the class without it and that it benefits them. However, many Latinx students still find the practice unsettling and problematic, despite that it benefits them. Ana perfectly captures the concerns that students have with regards to grading on curve, stating:

> "I think that I'm having a hard time, but I know that others are too, and it's hard because of the class grades and when they show the class scores. I don't understand why professors make us fail and then they set a curve. If we fail the exam that means we don't get it, and what does curving do? Like, I feel like

[12] A negative (left) skewed distribution, with regards to student grades, is a situation where the overall class average on an exam or in the class was greater than the expected, normal average which is usually an average of 70-75 out of 100). An example of a negative (left) skewed distribution, positive (right) skewed distribution, and a normal distribution can be seen in figure 1. (Also note that a negative (left) skewed distribution does not necessarily mean that students earned poor grades. In fact, with regards to grades, it is usually the opposite).

> professors set us up for failure. They make the tests extremely hard and then the average score is like an F. So doesn't that mean that we don't understand it? That we didn't grasp it? And then what does curving do? How does curving help in passing the students if they failed the exams? I feel like you can push yourself as much as you want, but here I feel like they are setting you up for failure. And I feel like that brings my self-esteem down. Like, I get an F and even though there's going to be a curve, I don't feel good about it."

For Ana, she believes that the policy of grading on curve does not reflect one's knowledge, and that this policy does a disservice to students because they are not really grasping the material. Similar to Ana, Juan also feels that test do a disservice to students because he feels that they do not reflect the effort and knowledge they gain from studying, stating that:

> "I got a 'B' on my test, yet my score was 56 out of 100. What did I learn? I feel like I didn't learn anything, even though I studied so much. But I can't complain because I got a B, you know... All I can do is move on and prepare for the next exam."

Latinx students are not the only one's concerned about how much students learn under the practice of grading on curve. Some scholars have also argued that grading on a curve is not a useful measurement of student competence in their objective learning (Convington, 1992; Goubeaud, 2010; Wang & Yang, 2003). If grading on curve does not adequately assess student learning of the subject matter, then this is concerning because STEM builds off each other and is dependent on students understand the fundamentals of different STEM fields. Students need to understand the STEM fundamentals if they are to progress, participate, and succeed in more advance STEM classes. In fact, professors have informed me countless times that the greatest factor in student success in STEM is their mastery of the fundamentals. However, with grading on a curve, many students are not focusing on learning to master the subject matter, but rather are focusing on competing and merely performing better than their classmates (Convington, 1992). Overall, these grading practices and policies are concerned more with meeting the

department demands than providing students the cultural capital that is essential for both academic success and for developing a strong foundation for their future careers in STEM.

Though many Latinx students have questioned the practice of grading on a curve, not all Latinx students had trouble navigating this field, and in fact, a few of the Latinx students I spoke with were flourishing and doing quite well. Among the Latinx students who did do well, almost all embraced meritocracy and the competitiveness of STEM, and strived for academic excellence. It appears that when the system works in someone's favor then they become less critical of it, which in turn only serves to validate the current STEM higher education practices and policies. Many students who do well even embrace the competition and were very determined to obtain the highest grade in a class exam, in what some called "setting the curve." One Latinx student who perfectly captured the mastery of navigating this is system was Enrique.

Enrique is a junior at UCP, majoring in Mechanical Engineering. When I asked him about grades and his professors grading policies he spoke about how much he looked forward to setting the curve, and that when he earned the highest grade he felt a sense of great accomplishment. I asked him to describe that feeling to me and he stated:

> "It's a great feeling, man. I mean, I always try and study real hard so that I can get an 'A' in the exam and an 'A' in the class. It's a great feeling knowing that you got the highest grade in an exam..... I remember the first time I set the curve was in my calculus class. Everyone was stressing out and worried about their first midterm grade, but I was confident about mine, you know, because of how much I studied. But I didn't know that I had the highest grade. The professor put our grades out online, I think the night before the class, so I knew what my score was, but I didn't know what my grade was. I had a total of 89 points out of 100, so I knew I had at least a high 'B.' When I went to class he gave us the grading scale and said that the highest scoring test was an 89. When I heard that I was so happy, and I felt so bad ass, you know what I mean. I felt great... and also to be honest it felt great bragging to my friends in my class that I got the highest grade."

Enrique's motive for achieving the highest grade in an exam is both admirable and concerning. On one hand, putting time and effort into studying and aspiring to achieve the highest grade is very admirable and should be praised. On the other hand, his motive was also fueled by the culture of science and his desire to outperform his peers. Enrique had assimilated to the culture of science because it is very pervasive, and in order to succeed in STEM students feel as though they have to adopt that culture and compete against students for the best grade. His sense of the competition gave him great confidence, which was reinforced upon learning that he set the curve in the class. Enrique, however, was only among a few Latinx students who were performing academically well. An overwhelming number of students believed that professors were unfair and had purposely made the exams difficult to weed-out students.

Lack of Faculty Support

When students are struggling academically and finding themselves at the bottom of the grade distribution, one resource that they should have are the faculty who are teaching them the material. However, when students do find themselves with questions with regards to the class material, their performance on a exam, or simply want to discuss their questions with the professor, there are only a few opportunities to ask professors, and even when they do ask they do not necessarily get the help that they need. One way that students ask for help are during the five-to-ten minute intermission after the class is over and the professor is packing up to leave. When class is done, there are usually 10-15 students who surround the professor and ask their specific question. During this time, students gather and listen to each of the questions that are asked and the answers given by the professor. When I spoke to Latinxs about this practice some stated they were uncomfortable, intimidated, or felt embarrassed to ask questions in front of other students and/or directly to the professor. For example, one Latinx student said, "I feel like I

am wasting the professor's time." Another Latinx student said, "I don't like asking questions in front of other students because I feel like they judge you or look at you like you're dumb." While faculty may appear unwelcoming, most have stated that they welcome and respect all questions from any student. Yet, many faculty do not necessarily vocalize that they are welcoming, rather they natural assume that students are aware of this. But students, including Latinx, are not receiving this message, and many continue to feel unwelcomed and intimidated, which refrains them from asking faculty questions. Latinx perceptions of having an unwelcoming, hostile university environment is nothing new, with past research suggesting that this has been an issue that has negatively affected Latinxs and their ability to fit in, persist, and succeed in college (Castillo et. al., 2006; Crisp, Taggart, & Nora, 2015; Fry, 2004; Gloria, 1994; Gloria et al., 2005; Hurtado, Carter, & Spuler, 1996).

Attending office hours is another option students have if they want to obtain help from their professor. While it may appear as a simply way to get help from the professor, what I learned is that attending faculty office hours can also be a very intimidating experience. I recall that as an undergraduate student myself, majoring in social science, most of my experiences with office hours consisted of a one-on-one meeting with the professor. In this study I was surprised to learn that this isn't the case in STEM. Most office hours are never a one-on-one meeting with a student and professor, unless a student specifically request one and the professor deems it justified. This is because it is not feasible to hold office hours for individual students and their academic concerns because of the amount of students they have per classroom. Instead, from the office hours I observed, most office hours are attended by 10-20 students who sit in a room with the professor and ask help in solving homework questions or discussing areas to focus on for exams. Again, Latinx students are forced to sit with other students and reveal their academic

concerns and questions. Similarly to asking questions during class, some Latinx students, like Kathy, "feel embarrassed to ask in front of [other students]," and that it is not a welcoming environment. For example, Ana said:

> "I didn't understand the homework and I didn't understand the lecture. So, like, I went to office hours for help, but I didn't know what questions to ask. So I thought I just could sit and listen to what other students had to say, you know. But when I was at the office hours the professor asked me if I had any questions and I said 'no,' and then he told me not to come to office hours unless I had questions. I was like so embarrassed, and so I never went to office hours again after that."

For Ana, and other students alike, office hours are an unwelcoming space. It is a space where their cultural capital, which is their knowledge of the material and their understanding of how to approach these situations, is revealed and is viewed as inferior to other students and professors. If meritocracy was the goal, for which many STEM professors and students claim it to be, this practice of exclusion at office hours further exacerbates inequality and does not "level the playing field," but rather marginalizes Latinx students by withholding resources and support, which are important for their success in STEM. Furthermore, research has shown that having faculty support and encouragement, and having approachable faculty not only increases student retention among Latinxs, but also help increase their academic achievement, self-confidence, and sense of belonging (Cole & Espinosa, 2008; Espinosa, 2008; Gloria & Castellanos, 2003; Gloria, Castellanos, Lopez, & Rosales, 2005; Hernandez, 2000). Efforts need to be made in both ensuring that students understand that faculty are welcoming and are available for them and their questions, but also ensure that faculty do live up to that expectation and do indeed make an effort to ensure that all students, including Latinxs, feel welcomed.

Limiting Options for Improving Grades

If students perform poorly on an exam, or are generally performing poorly in the class, faculty provide very few opportunities to improve their grade. One option is to provide extra credit opportunities to students, however, almost all faculty believed that it is unfair to only provide extra credit opportunities to low academically performing students, and thus they have to offer it to all students. One way that professors provide extra credit opportunities is by adding extra credit questions on exams or quizzes. This practice, as some faculty have stated, does little to help improve student grades in the end because it will not affect the grade distribution if everyone in the class is doing the extra credit.

Another less popular option is to provide students with extra credit assignments. One reason why this is unpopular is because professors feel that not only is it a lot of work for them to grade, but they believe that some students will find ways to make the extra credit easy for themselves, like cheating and copying from other students, and/or plagiarizing. As one professor stated:

> "Giving extra credit is a mistake. First, just 450 people turning in something, that’s a couple of hours of work just to enter those grades. And second, there is just a bunch plagiarizing on it. There are a bunch of people just copying over the same thing. So that is a hassle."

Another professor gave a very clear example for why she doesn't provide extra credit, arguing that students do a poor job when asked to carry out assignments relating to field that they are studying. In her example, she wanted to give students the opportunity to use the knowledge and skills they learned in class and apply it to their extra credit. Little did she know that students

were not prepared for such a task, and the finished product that received from students, according to her, was a complete mess. The professor stated:

> "So what I did with my students was I asked them to make soap because it was related to what we were talking about. However, in order to make soap you need lye. [Well,] they stopped selling lye at hardware stores. So students had to order it online, and it was only in large quantities. So they ended up working together, and I let them. Well [I didn't realize] that making soap is difficult. You have to get the ratios correct. Most of these students do not have scales to measure things. If you don't get the ratios correct it doesn't work out. So on the day that they turned in their soap I had this image of people walking in with a small size of soap, but no, they walked in with these containers full of liquid. And I was like, 'what am I supposed to do with all of this?! What a colossal,' you know what I am saying."

The fact that faculty have to offer extra credit to all students and that it doesn't change the grading distribution, as well as the extra time it takes to implement and grade the assignment is why extra credit opportunities rarely exists in STEM, according to faculty. However, faculty do provide some opportunities to help boost students grades. One common practice by faculty is allowing students to drop their lowest quiz, lab, or homework score. This practice, however, is not intended to be a form of extra credit, but rather a safety net for students who for whatever reason did poorly on a quiz, lab, or homework. Another common practice is to give students an alternative assignment to replace an exam, quiz, lab, or homework assignment, but this rarely happens, and if it happens it is because of some extreme circumstance. One example is when a student had a family emergency the day of the exam. In this case, the professor gave the student the benefit of the doubt, however, they also believed that it would be unfair to give the student the exam because they were concern that one of their classmates might have informed them about the questions on the test, which would be cheating. Instead, the professor asked the student to write a 10 page paper on a class topic.

Another very uncommon practice is to allow students to drop their lowest exam score, or to have one exam score to count for two. When I asked professors about this specific practice every single one of them said absolutely not, and with good reason. Across all STEM majors, the material learned in class serves as a foundation for classes therefore after. The material learned is built off one another, and failure to understand certain material can create challenges in understanding future class material. For example, students who earn an "A" in one exam might not put much effort in understanding the material for the next exam because they have that option of dropping the lowest exam score. This is a concern for many professors because they feel that they run the risk of under preparing their students for their current and future classes if they drop the lowest exam score, or count one exam for two. As one professor stated:

> "Everything matters. It's not compartmentalized, everything matters. Um, if I get rid of one test, then there's a test that they are not studying for, because they know that; you know what I am saying. 'I did a 90 something on this exam, I don't have to study much on the next one.' That really matters. You can't get rid of the final, so, and I don't do that in the lab either. All of the labs matter. So if you're not doing one of them or you're not turning in a lab report then you didn't learn that material, and if you didn't learn that material it's going to affect your grade."

The most extreme example of an opportunity that professors give students to help them improve their grade is to give them an "A" in the class if they earn an "A" in the final exam. This is an unpopular practice, and none of the professors I spoke with currently practice this. However, a few professors have practiced this in the past, and they stated that it was really unrealistic for low-performing students to obtain an "A" in the final exam, and that it was cruel to give them false hope. As one professor states:

> "I used to have this policy that an "A" in the final is an "A" in the class, and it was really, it was really a cruel thing to do, honestly. Because you cannot get an "A" in the final if you have been failing the class. And I would have these people coming in, just out of their minds, just like asking them to do something

> impossible and giving them a false hope. You know, like sick, you can see it in their faces, just, it was just a cruel, it was almost like I was pulling a cruel trick on them."

Opportunities for improving grades are limited, and among the few that do exist they rarely help students increase their grades. It is no surprise then that providing extra credit is very unpopular among STEM faculty, even among those who advocate for interactive and innovative teaching styles. Though I am not advocating for creating extra credit opportunities or alternative assignments, but not providing students with options or opportunities to improve their grades gives little hope to students who perhaps struggle with exams. This is why some professors argue that having interactive and innovative teaching styles can be helpful for students understand and master their class material, and thus would rely less on extra credit points to improve their grades.

How Faculty Make Sense of Their Practices and Policies

During the 2017 fall quarter, I made arrangements to meet with a professor for an interview. I purposely, and successfully, scheduled an interview two weeks after her class midterm in order to talk with her about her grading policies, and I figured her recent midterm exam would be a great recent experience that she could discuss with me. She agreed to meet with me after office hours on a Friday afternoon. She had asked me to meet her at the office hour location, which was just a few rooms away from her office. On that day, I arrived a few minutes early and peeked in the open door. I noticed that there about 10-12 students gathered in the room, asking questions about lecture and homework. She immediately noticed me and asked me to come in and take a seat while I waited for the office hour session to finish. I observed the room carefully, observing the interactions between students and the professor. Students took turns

asking questions. Most questions and answers took roughly a minute or two. I wasn't there long enough before the professor said that office hours were over.

Most students packed up and left the room, except for one student who continued to sit. He was a tall, thin Asian student with a fair complexion. The professor looked towards the student and asked if he needed anything. The student then pulled out his exam and pointed at it. I wasn't sure if he was pointing at a question or pointing at his examine score. The professor then asked the student to make an appointment with her so that they can discuss it. He looked at the professor and pointed to the exam again. The professor then restated that he needed to make an appointment, speaking in a slow, perhaps condescending, manner as to suggest that English was not his first language. The student sat there, confused and began going through his exam. At this point the professor rolled her eyes and shook her head and said, "no, you need to make an appointment. I have a meeting now [(pointed at me)] and you need to leave." Without saying a word, the student packed his things up and left. I felt bad for the student who was merely looking for help from the professor, but I also understood that the conversation he wanted to have with the professor would have required more time than what the professor had.

After the student left I asked the professor what that was about and she said "he performed poorly on his exam and probably wanted to discuss his score." I then asked if he raised any questions during the office hours, and she responded "no, not really. I don't mind students sitting in and listening, and I thought that that was what he was doing." And then I stated, "it seems like there wasn't enough time to discuss his exam score," which she replied with:

> "It says in the syllabus, that if you have to talk with me or something like that, then I would see you individually, but you have to send me an email so that I can

> schedule in a timely fashion, you know. Don't say you need to meet with me right now kind of thing, cause I might be off doing something else. So it has to be some kind of reasonable reason if you are seeing an individual student. Just the student numbers are much too big to accommodate every student's request for individual attention."

This was not an uncommon feeling among professors. Many professors felt that they had far too many students and very little time to focus on individualized attention, and thus request that students email them with a valid reason for why they need to meet with them on a one-on-one basis. This observation further solidified Latinx students experiences by illustrating how some professors are unapproachable and unwelcoming. After her comment, I then followed with questions regarding how students generally performed in her recent midterm, and she said that her "exams are always a bit tough, so students usually score below average," but then stated that she curves the exam to help their overall scores. This was a perfect segue in the interview to begin talking about her grading practices and policies.

When I asked professors what their thoughts were on the practice of grading on a curve, most stated that it actually helped students, given that most students never meet their expectations. Professors, as they claim, do not enjoy failing students. In fact, many wished that all their students did well in their classes, claiming that they had no problem awarding all students "A's" if they had rightfully earned them. The problem, as they see it, is that students just don't meet classroom performance expectations. As one professor stated:

> "There's no reason why I should be giving 20-30% [of my students] A's, you know. I'd be happy to give 80-90% of [student]s A's if [they] performed at that level, but they are not performing at that level. So I don't, as a faculty, I don't see that as a problem at all. If 90% of my class earned an A in my class I would give it to them, [but] that has never happened, [and] that's why we have the bell curve."

The aforementioned quote illustrates how dominant meritocracy exists among faculty in that they place the onus of student success on student's own ability and talent, rather than questioning the exam itself and/or how adequately they prepared students for exams.

While many professors placed the onus on students for not performing academically well, very few professors stated that grading on a curve is a problem, and that it reflects more of the professors inability to communicate with students the pertinent information needed to study for the exam or excel in the class. As one professor stated:

> "I am so against curving. [My department's] official curve is 20-30% A, 30% B, 30% C, and everyone else gets a D or an F. And I oppose that because that sets up competition between students, and it's not productive. They are competing to be one of those 50% students that gets an A or B, and it's not equal opportunity. I also disagree with the faculty who say, 'well, the average on my exam was 50%, so I am just going to make that 50% a B+.' To me that says that they are not aligning their teaching goals with their assessments on how they teach, and faculty don't want to hear that. They say, 'well it's not my teaching, it's the students, the students don't study enough.' And I ask, 'well did you make it clear to the students on what to study?' And they say, 'well, it's in the syllabus,' and I say, 'well did you tell the students? Did you write the points that the questions will be asked on?' "

Again, this passage highlights the disapproval that some faculty have with the practice of grading on a curve, however, this particular faculty revealed the same frustration shared with students in that some professors are unclear about the material that will be in the exam, and that their exam practices are unfair. Still, many professors do not challenge this practice and continue to practice grading on a curve in order to adhere to their department's policy.

The practice of grading on a curve is not always in the hands of faculty, but rather in the hands of their respective departments. According to one professor, grades are "determined by the department," and that "for the big undergraduate courses, we need to maintain a B minus

average, and we need to curve." When describing this policy he stated his disapproval for it, saying that he doesn't "have a choice about this" and that he "doesn't particularly like it," nor does he think it's good." Grading on a curve is not an uncommon practice across the nation, especially among STEM departments that do have some control over faculty's classroom practices, particularly with grading and exams (e.g. having common exams). While some faculty do find it problematic that departments have such control over some of their practices, a large number of professors seem to be content with this practice because it removes the pressure and responsibility away from them in justifying their own individual classroom policies. While some faculty do disapprove of the policy, very few ever challenge it and continue to practice and accept it as "something that just happens," as one professor explained.

Creating a grade distribution based on the collective performance of students in a class and not on merit contradicts meritocracy and its value of hard work and mastery of knowledge, for which many universities prides themselves on. What is taking places is that STEM departments are creating an arbitrary form of meritocracy that disguises what's truly happening in STEM. Some students are passing classes not fully understanding the class material, and when they reach the next class they begin that class already behind. This arbitrary standard of meritocracy is setting them up for future failure because grading on a curve does not truly measure student learning, and students who faced challenges in lower-division STEM classes will only continue to face challenges in future STEM classes, unless they receive some form of academic support. In fact, studies have shown that some of the best predictors of graduating with a STEM degree is their level of success in STEM courses (Chen, 2013; Ost, 2010; Rask, 2010). The faculty I interviewed very well understand how important it was for students to master the class material. One faculty went as far as to suggest that students who earned a "C" or less in a

foundational science class should repeat that class before taking a more advanced science class. Yet, many continue to practice grading on a curve and avoid tackling the real challenge that is facing students and their ability to learn and understand the class material.

Peer Classroom Interactions - Conflict or Opportunity for Collaboration

When I spoke to faculty at UCP, almost all stated that they encouraged students in their classes to work together and form study groups. They firmly believed that students can benefit from working with each other. This is because many faculty understand that most careers in STEM rarely have individuals working alone. Rather, most people who work in the STEM field work with, and/or rely on, team members. Yet, some faculty do not recognize the contradiction between the culture of science embedded in class and their suggestions for students to work together, in that one promotes student competition while the other promotes student collaboration. What this reveals is that many faculty are not fully aware of how divisive and dominant the culture of science is, and it's so divisive and competitive that it trumps any effort placed in promoting any student collaboration. This was true for many Latinx students I spoke with, who shared with me the challenges they had in seeking help from other students in class.

Generally speaking, approaching students in class can be overwhelming for a lot of students. Various disciplines have highlighted how various social and psychological factors, such as academic self-efficacy (Karabenick & Newman, 2013; Ryan, Gheen, & Midgley, 1998) can hinder or promote students' willingness to approach other students and collaborate. However, very few studies have discussed whether students are receptive to, and/or willing to, work with other students. It becomes increasingly more challenging for students to collaborate with other students when they do not reciprocate and/or are open to working with them, as was that case for many Latinx students in the lower-division STEM classes. Many Latinxs shared their stories on

how some students were unwelcoming or unhelpful when they approached them for help. Sandra, shared a good example on how difficult it to work with students in class, particularly among those from different racial backgrounds. Sandra stated:

> "I don't know if it's my appearance or, I don't know. I don't know what it is, but, um, like sometimes the professors makes us discuss with our partners, like the questions that she puts up, and I just sit anywhere. Most of the time I find myself sitting next to Asian [students], and I feel like I am the one who always has to approach them and say, 'oh, hi, my name is Sandra, what do you think about this question?' But they like never approach me and ask me, 'oh, what do you think?' And I am introverted, so it is really hard for me to say hello, but I kind of just do it. Even after I approach them they are usually not someone that I want to switch numbers or anything like that."

Establishing cross-racial collaboration might have something to do with comfort and relating to the other person, as Sandra described when I asked her thoughts on why her Asian classmate didn't want to work with her, stating "I feel comfortable with my own people and maybe they too." This is not surprising, given that research has shown that when Whites are a racial minority there is more intraracial (within same racial group) interactions in social and academic settings at universities than there are interracial (between different racial groups) interactions (Cowna, 2005), which at UCP Whites are a minority. Furthermore, past research has also indicated that different racial groups have different levels of comfort in interacting with different racial groups, with Asians having a greater discomfort and Latinos having a lower discomfort in interacting with students from different racial backgrounds (Mack et al, 1995).

While comfort may be a reason for why some students do not engage in interracial interactions, the description of "comfort" is vague and it does not entail what exactly it is about other racial groups that makes people less willing to engage with, develop networks/friendships, or work with students that are racially different from them. There is, however, a large body of research suggesting that there are both subtle and overt racial prejudices and/or stereotypes that

are reflected in the attitudes and behaviors of people, including students, and their interactions, or lack thereof, with people from different racial backgrounds (Brown, 2011; Dovidio, Kawakami, & Gaertner, 2002; Dovidio, Gaertner, Kawakami, & Hodson, 2002; Gaertner & Dovidio, 1986; 2005; 2014; Smith, Bowman, & Hsu, 2007). In the U.S., Latinxs have been the subject of harsh and cruel stereotypes that have not only tarnish their reputation, but it has created animosity towards Latinxs by different racial groups who accept and/or do not challenge existing stereotypes of Latinxs (Chavez, 2013). Therefore, it may be that students from different racial/ethnic backgrounds may consciously, or subconsciously, hold negative stereotypes about Latinxs, and thus feel uncomfortable socializing or engaging with Latinxs at the university. This may be due to racially segregated communities, which decreases exposure to different racial communities and limits their interaction with different racial communities, which could lead to prejudice attitudes that are not questioned or challenged.

Racial segregation doesn't only take place in communities, but in shared spaces as well, like schooling. In high schools, policies and practices, such as tracking, serve to reinforce racial and class segregation. In particular, Asian and White students are often placed in more rigorous classes compared to Latinx and African American students (Oakes, 2005; Ochoa, 2013). Ochoa (2013) argues that Asian and Asian American students are often academically profiled as model minorities whereas Latinxs are often positioned as less committed to education, and as a result a tracked in schooling according to these stereotypes, which reinforces ideas about academic ability and educational aspirations. This could explain why some students at UCP, particularly Asian and/or Asian American students, may not want to associate or work with Latinx students because of the negative stereotypes that view Latinxs as less intelligent or less committed to their education.

Negative stereotypes about Latinxs often permeate into the university setting, and many Latinx student often have negative experience while attending college. Studies that focus on the experiences of Latinx students at university campuses reveal that many Latinx students do experience aversive racism[13], overt racism[14], and racial microaggressions[15] (Hurtado, 1994; Hurtado, Milem, Clayton-Pedersen, & Allen, 1998; Hurtado, & Ponjuan, 2005; Minikel-Lacocque, 2013; Solórzano, 1998; Yosso, Smith, Ceja, & Solórzano, 2009). This could partially explain why Latinx students in this study had a difficult time finding a group of students to work with during in-class assignments, more specifically working with students from different racial backgrounds. When I spoke with Latinx students about working with other students in class many had mixed experiences when working with students from different racial backgrounds during in-class assignments. Some Latinx students did managed to work very well with other students in class, while other Latinx students felt that information and resources were one directional, stating that while they had no problem sharing their knowledge and information with students, they felt that those same students did not necessarily reciprocate to the same level. More specifically, some Latinx students felt that non-Latinx students intentionally gave them incomplete or incorrect information, or completely refused to work with them. It was not uncommon for these same Latinx students to also feel as though some of their peers were trying to jeopardize their academic performance. Someone who experienced this was Jorge, a Mexican-American third year transfer student from Central California, who detailed his experience with exclusion and isolation when he worked with a group of students in class. He stated:

[13] Aversive racism is defined as "a subtle, unintentional form bias that can have pernicious effects" (Gaertner & Dovidio, 2005; Pg 615).

[14] Overt racism is defined as intentional and obvious negative attitudes, behaviors, and beliefs about different racial groups.

[15] Microaggressions are defined as "subtle insults (verbal, nonverbal, and/or visual) directed toward people of color, often automatically or unconsciously" (Solorzano, Ceja, & Yosso, 2000; Pg 60).

> "I remember one time I walked up to this group of Indian and Asian guys and asked if I could join, you know, to work on the class problem. They looked like they were really friendly cause they were laughing and talking to each other, so I thought it would be cool to join them. They said 'yes' and so I sat down and I thought it was all cool, but then when we started working on the problem and they only talked to themselves... I realized right away that they were trying to exclude me, or just didn't care that I was there. They never asked for my help. I tried to give some answers but they just shrugged it off, like assuming I was wrong, you know. I was so pissed... I don't know, I mean, maybe they were friends and they didn't want outsiders. I don't know, man."

Even when students are accepted into a group it doesn't necessarily mean that their input will be accepted, or that they will be responsive to them. Another example of severe exclusion was the experience that Claudia had, who was asking help from another classmate and received none, stating:

> "I feel like there's this huge pressure to put people down. Like, if someone asks you for help, don't do it. Like, you know what I mean? [I asked a student] 'do you understand what's going on?' And they're like, 'I don't know.' And I just feel that's not okay, cause like I firmly believe that if someone is asking you a question you should answer it, and like you can't receive anything without asking, you know what I mean? And if I'm asking you for help it's genuine. Like, 'can I just have a moment of your time and answer it for me?' And I feel like there's a big push to not help others. It's a competition thing. It's like, 'if I help you to understand it you might do better than me, and I don't know if I want that.' And it's so sad that it comes down to that."

Claudia's experience is a result of an ugly consequence of the culture of science in that fierce competition and meritocracy can create a hostile and unwelcoming environment that discourages collaborative learning and academic development.

While Latinx students had both positive and negative experiences with working in interracial group in-class assignments, one thing that was noticeably different was that when Latinx students managed to find and work with other Latinx students they generally had a positive experience. Many of the Latinx students observed and interviewed expressed preference

in working with other Latinx students because they felt that they were more approachable and welcoming. For example, Nancy, a sophomore student who is majoring in Bio, stated:

> "When I have to work in groups I usually look for people who look like me, who are Hispanic... You know, it doesn't matter if you're Mexican or Salvadorian, or whatever, as long as you can speak Spanish and want to work with me I'm down... So I usually get up and look around when the teacher asks us to work in groups. If I see a Latina then I'm going to try and work with you... and usually we have a good connection and get along really well."

It's not surprising that Latinx students prefer to work with other Latinx students. Latinxs come from a cultural that draws strength on core Latinx values, such as *familismo*[16] and *comunidad* [17], both which are an important system of interpersonal connections, and both that are valued forms of familial and social capital described in Yosso's (2005) concept of community cultural wealth. These core Latinx values transcend into the lives of Latinx college students, who tend to be more open and welcoming of other Latinxs, and who they believe are genuinely interested in helping one another. Castellanos and Gloria (2007) argue that *familismo* and *comunidad* and other systems of interpersonal connections are important for Latinx college success, stating that "Latina/o students who engage in learning settings which are consistent with their cultural values and practices, would have an increased sense of connection, well-being, and persistence toward graduation" (pg. 8). Though some Latinx students had a difficult time finding a Latinx classmates to work with during class, many of them did manage to find study groups outside of classrooms through either student organizations and/or through their dormitory. Claudia is an example of a Latinx who didn't find someone in class to collaborate with, but fortunately she met Latinxs in her Bio dorm who she could study with or rely on for help. She

[16] *Familismo* (family) is a Latinx value that "involves loyalty, solidarity, cooperation, and reciprocity among family members and is physically manifested through extended kinship systems that include nuclear, extended, and nonrelated family" (Gloria & Castellanos, 2009. Pg. 14)

[17] *Comunidad* is the value of caring for and having the responsibility to community (Gloria & Castellanos, 2009).

stated, "I grew close to the other Hispanics and they were the ones that helped. I could easily be like 'can you explain this to me?' There is something there that I feel more comfortable talking to them about and who can help me with it." Overall, she felt that she could count on other Latinxs for help.

From the conversations and observations I had, only a few Latinxs students managed to work in groups during class exercises. Of those that worked in groups, most worked in groups with other Latinxs, while only a few others worked with groups with students from different racial backgrounds. Most Latinx students who did work with students from different racial backgrounds already had a preexisting relationship with those students, many of whom had developed those friendships in their dorms. While working in groups was beneficial to a few students who were able to form or join a group, most Latinx students worked alone during in-class assignments/problems. This highlights the importance of Latinx students working together, and establishing student groups, organizations, or clubs that focus on establishing these relationships. Still, one must be critical in maintaining a healthy balance between interracial and intraracial communities. While it is important for Latinx students to seek other Latinx students in order to develop study groups and/or create social networks that serve as forms of academic and social support, it is imperative for them to understand the importance and value of working with diverse groups. Isolating themselves to their own racial and cultural group will exacerbate any tension, stereotypes, prejudices, or bias that they have about others.

Challenging the Culture of Science

Interactive and Innovative Teaching Styles - The Practice of Flipping Classes

From the many conversations I had with faculty and administrators on campus, there were only a few who were concerned with the lecture styles and grading policies, stating that the current practices of traditional lecturing and grading on a curve limited the development of student learning and student achievement. Given this concern, the very same small amount of faculty and administrators concerned about student learning sought to make changes. One way they did so was by experimenting with more interactive and innovative learning styles of teaching, which is known as flipping a class. In traditional lecture based classes, students are expected to come to classes prepared by reading the class material and doing their homework assignments. In flipped classes, student engagement and discussions in class are heighten, and there are more creative ways of learning STEM. In some flipped classes, students typically work together on their homework and lab assignments, and there is more faculty-student interaction and student collaborative opportunities. Typically, these classes are also smaller than traditional lecture based classes.

The creative and innovative styles of teaching flipped classes differ from professor to professor, mainly because there is no handbook on how to create and implement these teaching styles. As a result, faculty who practiced these different styles of teaching often implemented what they thought was effective teaching and learning styles. One professor stated that she did "cycles of doing open ended questions and let student['s] debate it for a little bit." She would also "walk around and listen to them and find out where they are not understanding things and maybe give them a mini lecture and then follow up with another question." She made it a habit to do a

combination of small lectures, interactive activities, and group discussions. Another professor would use online, interactive activities, as well as use online discussion forms to have students discuss and help another answer topic questions. Despite the difference in implementation, almost all the faculty argued that these interactive and/or innovative styles of teaching and learning had promising results regarding student learning. According to faculty who practice innovative and interactive teaching styles, the students who benefit the most from these styles are students are underrepresented minorities, students who are underprepared academically, and students who usually place somewhere in the middle of the grading scale, meaning students who typically earned C's or B's.

The University of Michigan has been practicing flipped classes for some time now. Sahin, Cavlazoglu, and Zeytuncu (2015) recently conducted a study that focused on student experiences with flipped calculus classes. They examined whether these classes had any effect on student academic achievement. When they compared the quiz scores of students from flipped and non-flipped classes they found that students in flipped classes achieved significantly higher quiz scores than students in non-flipped classes. In addition, not only did students perform better on quizzes in flipped classes, but students in flipped classes stated that these classes better prepared them for future STEM classes. While flipping classes does show promise, unfortunately flipping classes at UCP continues to be a challenge. Only a few faculty had practiced different forms of creative and innovative styles of teaching and learning. Not all faculty at UCP are on board with implementing new and creative teaching styles, and many were against changing current practices. Furthermore, current university practices and policies do not favor changes, rather creating changes may lead to serious repercussions for faculty who choose to be more interactive and innovative.

The Challenges with Flipping Classes

During my interviews with faculty, I often asked them for their opinions on flipping classes and incorporating more interactive and innovative teaching styles and learning practices. Their response usually fell into one of three responses: concerns over feasibility, issues with comfort, and/or lack of evidence supporting flipping classes. Among professors who questioned the feasibility of flipping classes, many argued that carrying out such practices were difficult given the size of classes, the short amount of time for each class, and the lack of technology that the university had. As one professor stated, "there are so many things you can do to teach chemistry in a small class. There's so many interactive things you can do, online things. All these cool, hands on things you can do that can't be done on paper quizzes. None of it of which you can do in a class of 450 people." Another professor stated that "there isn't simply enough resources for smart classrooms. Even with the few that we have, some professors have trouble working them properly, or they simply don't work at all." Access and knowledge of technology was a concern and a challenge, even among professors who did engage in innovative and interactive teaching styles. However, the challenge with class size was not an issue for professors who flipped classes. Rather, professors who flipped classes argued that it had more to do with being comfortable. Instead, those who they believed that practicing interactive or innovative teaching styles is a lot of work and that it's time consuming, and that lecture based faculty prefer to place their energy and priorities on their research.

Being comfortable, or preferring straight lecturing practices, was another common theme among most professors who practiced traditional lecture styles. In my conversations with faculty, most argued that traditional lecturing is good practice, especially for freshmen and sophomore who they believe need to understand the fundamentals before they can engage in more critical

and creative work. For faculty who support traditional lectures, being innovative or interactive is viewed as unnecessary when their primary goal for the class is to teach students fundamentals, fundamentals that do not need to be argued or discussed, but rather understood and memorized.

Some faculty who support traditional lectures also suggested that there is a generational gap between faculty and students, and that this could pose a problem with faculty/student interaction. As one faculty stated, "I am very comfortable lecturing because I've been required to do so much of it. And, um, particularly with lower division students I am not as comfortable with discussions because I have trouble eliciting conversations among students [because] students are reluctant to speak up in class." Other faculty members believe that students are simply not interested in being academically engaged or being interactive. For example, a faculty member in Biology believes that students "want to learn passively [and] don't want to have to do anything. They don't want to have to take time to do that." These assumptions that some faculty have of students in being passive learners and not being relatable are merely misconceptions that are used to validate their practices of traditional lecturing and their justification for not engaging in more interactive and innovative teaching styles, despite that they may be beneficial to all students.

Other than feasibility and comfort, the lack of evidence is another reason for why faculty choose to stick with their current practices. Many faculty are simply not convinced that flipping classes has any real impact on student learning or achievement, and they argue that traditional lecturing works well. Indeed, a comprehensive literature examination conducted by that DeLozier and Rhodes (2017) suggests that there is no direct evidence with regards to flipping classes and student learning outcomes. In their research, they found among the 28 studies that they examined, only 11 (less than half) focused on student performance measurements, and only

5 studies reported comparable student learning outcomes with both formats (DeLozier and Rhodes, 2017). Most studies, however, focused on student evaluations and their perceptions on learning in flipped classes (DeLozier and Rhodes, 2017). It is difficult to measure flipped classes, mainly because the types of interactive and innovative teaching styles are not universal, but rather created by individual faculty who implement lesson plans according to what they believe will facilitate learning. Since each teaching style is creative, it may be difficult to measure exactly what works and how it works. However, from the conversations I had with faculty who have implemented interactive and innovative teaching styles, all of them have stated that these practices do benefit students academically, especially students who generally have low or middle academic performance, meaning students who typically get D's, C's, and B's. According to one professor who practiced flipped classes, she found that the class "helped everyone," and that "those who came a standard deviation below average it helped more. And those that came in with 2 standard deviations below it helped even more." While the positive experiences of a few faculty members who have engaged in interactive and innovative teaching styles are promising, more research on flipped classes and their effectiveness is needed before faculty and scholars can say with certainty that these methods work. DeLozier and Rhodes (2017) argued that active forms of learning should not be ignored, and that other techniques in flipped classes, such as collaboration, group work, or problem-based learning can be beneficial. Furthermore, the work being done at Michigan is promising, and their research can hopefully shed more light on if and how flipped classes do help students perform academically better.

The most prominent, and also most concerning, theme for why faculty, specifically pre-tenured faculty, do not do more flipped classes is due to concerns over job security and

promotions, such as obtaining tenure[18]. For example, faculty who want to do more innovative and interactive teaching styles get a lot of resistance from other, more senior faculty who advise them that it's too much work, that those methods don't work, and that they are simply wasting their time and hurting their chances of obtaining tenure. As one professor stated, "it was highly suggested that I cut all that off as a pre-tenured, and I think that that is a common theme, like I heard over and over again, that pre-tenured faculty should not do a lot of changes." Another faculty member stated, "they are telling pre-tenured faculty 'don't do innovative learning styles because you're going to have a problem."

One reason why faculty, specifically faculty with seniority, advise pre-tenured faculty to refrain from innovative and interactive styles of teaching is because they believe that not all students will like these styles, and that students may give them bad reviews on their teaching evaluations. The concern is that student evaluations are considered when pre-tenured faculty are being evaluated for tenure. Despite the potential benefits of flipped classes, not all students like this style of learning, and there are a number of students who will push back and fight against innovative and interactive teaching styles. Some faculty suggest that some students who give negative reviews about flipped classes because they see it as unnecessary for their learning.

Overall, interactive and innovative, or flipped, classes shows promise, but unfortunately there are institutional practices and policies, as well as agents, that stand in the way of making positive, systematic changes. Traditional, lecture-based faculty question and challenge flipped classes, and discourage junior faculty from practicing them, while the institution itself provides little incentive to establish and maintain flipped classes. Worst off, faculty who are willing to flip

[18] Tenure is an appointment by which an individual is awarded a permanent position, which can only be terminated under extreme circumstances. For faculty, obtaining tenure not only secures their job, but it also provides more opportunities for academic freedom.

classes run the risk of getting poor faculty reviews from students, which can affect their job security and promotions. Given the lack of support, and the risk associated with flipping classes, UCP may not be seeing flipped classes for a while. The lack of institutional support for innovative teaching styles only serves not only to validate current practices and policies that promote the culture of science and meritocracy, they further marginalize students who can benefit from flipped classes. It seems contradictory that higher education institutions limit collaborative and interactive styles of teaching and learning when most STEM careers require people to be innovative and work teams.

Chapter Conclusion

Thus far, I have focused on the culture of science and how it is created, sustained, and reinforced through classroom structure, grading practices and policies, lack of faculty support, and through peer interactions. More importantly, I described how Latinx students understand and respond to the culture of science. The findings reveal that the culture of science is very well alive in STEM. There is a sense of competition and hostility between students, so much that some are willing to withhold information and resources that will help other students with the class material. This is challenging for many Latinx who come from a culture that embraces community, yet with the culture of science they are thrown into an environment whereby students compete with other students, and refrain from working collaboratively. What is concerning is that the practices, policies, and environment sustained by the culture of science can further marginalizes Latinx students who are not accustom, or simply do not know, how to navigate the culture of science. What we see is that Latinx students are often excluded and isolated in STEM, and often have to rely on themselves to persist and succeed in STEM. Furthermore, the lack of faculty support, along with their grading practices and policies only

further marginalizes Latinx students are forced to focus on competition rather than mastering the knowledge. For example, grading on a curve does not accurately measure student learning, and these practices overlook the important goal of ensuring that students learn the material. Passing students along based on these grading policies fails to really teach them the necessary information and knowledge needed to not only help students succeed in class, but help them succeed in their future STEM classes and STEM career. While there are faculty who are pushing against the culture science and embracing and advocating for flipped classes, there is very little institutional support and/or incentives to do so. Rather, conducting flipped classes comes with the risk of job security, which is why senior faculty often advice junior faculty from changing the current practices.

Perhaps what is most troubling about the culture of science, along with its practices and policies, is that it is embedded in the ideology of meritocracy and individualism. Meritocracy is the notion that achievement or goals are highly dependent on personal talent, strong work ethic, and effort, while individualism is the notion of being self-reliant (Guinier, 2015). The discourse around meritocracy is often used as a tool of access and rewards across multiple social contexts, such as access to employment and higher education. This discourse of meritocracy is heavily embedded in the practices and policies in higher education. Universities across the nation often rely on merit[19] requirements, such as GPA and college admission exams (e.g. ACT or SAT), in granting students admissions or merit based aid.

In STEM, meritocracy is often used as a tool in not only admitting or restricting students into their various STEM programs, but it is also used to evaluate graduation requirements (meeting minimum GPA requirements within STEM) or disqualifying students from obtaining a

[19] Merit is often associated with intelligence or ability, rather than social and economic background (Guinier, 2015).

STEM degree. At the surface level, most people would agree with the idea of meritocracy in that only those who work hard should be rewarded. However, there is a growing concern among practitioners and researcher that meritocracy and individualism do not acknowledge structural challenges or inequalities that can prevent certain individuals from reaching their goals (Liu, 2011). According to Liu (2011), "meritocracy is often referenced as a positive concept that should be aspired to in various aspects of society. The belief that institutions should be governed by people chosen on the basis of merit, perhaps as defined by education and ability, rather than other factors, such as wealth or social class, is one that seems to resonate with the public" (pg. 385). In STEM, the rigor and one's ability to master it is associated with meritocracy in that only those who work hard and pull themselves up by their bootstrap can succeed. Yet, this ideology fails to understand how institutional policies and practices, like the ones mentioned in this chapter, contribute to the challenges Latinx face in navigating and succeeding in STEM. By not critically examining meritocracy and individualism, both institutional agents and students themselves may be inclined to place the onus of academic failure, or lack of academic success, on students and not understand how institutions play role in STEM attrition rates (Liu, 2011). In fact, most faculty, administrators, and both academically successful and struggling students I spoke with often stated that merit was an important key factor for succeeding in STEM (see chapter 4 and 5).

What the meritocracy discourse also fails to acknowledge or understand are how educational institutions are not equal and do not have the same resources, quality teachers, and opportunities, and therefore many underfunded, poor K-12 schools often fail to help their students develop a solid educational foundation that is needed to thrive in higher education. As a result, Latinx students who come from poor high schools struggle not because they are not

talented or skillful, but because both their STEM foundation was subpar to begin with due to the lack of their high school preparation. Furthermore, institutions assume that meritocracy and individualism are normal, yet this ideology contradicts to the cultural values and practices of Latinxs who are more of a collective group that is supportive and helps one another. This contradiction creates an educational setting and experience for Latinxs that is incongruent to their cultural values (Castellanos & Gloria, 2007; Gloria & Robinson-Kurpius, 1996; Gloria & Pope-Davis, 1997). It shouldn't be a surprise then that Latinx students draw on their community cultural wealth to navigate college by seeking other Latinx students and mentors who foster positivity in their lives, as can be seen in the groups and clubs they created to help one another, which I will elaborate further in chapter 5.

The culture of science, along with faculty practices and policies that sustain it, are but a few of the reasons that explain why some Latinx students are weeded out of STEM. To get a clearer picture we must understand the process of being weeded-out, which is a very complicated system that involves many institutional agents, as well as different institutional practices and policies that have not been discussed. The next chapter I will describe how and why institutional policies and practices contribute to the weeding-out process.

Chapter 4

Weeded-Out: Institutional Policies, Practices, and Perceptions That Contribute to the Process of Weeding-Out Latinxs From STEM Majors

In late February, 2017 I decided to begin recruiting academic counselors, faculty, and other university administrators for my study. A few STEM departments were clustered together, while others were scattered around campus. I decided to begin near the cluster section, hoping I could cover more ground in one day. I began in the engineering section of campus. I walked around the area and noticed the offices for the department, where many of the academic and peer counselors offices were located, so I decided to walk in and see if I could speak to someone. The entrance of the office faced a set of couches and chairs that circled around two large coffee tables. I entered the room and quickly looked around. I first noticed a young lady sitting down, presumably a student waiting to speak to someone. I looked to the right and I saw a large front counter with a young man, probably a student, standing behind it. He was speaking in a soft voice to a young woman in front of him, probably another student. I sat down, gave them their space, and waited for the conversation to end before approaching the front desk.

As I waited, I could hear the faint voices of the young man and the student he was speaking with. I didn't want to be intrusive, so after a few minutes of waiting I decided to take this opportunity and look around the room. The first thing I noticed was a bulletin board next to the entrance/exit door. The board was filled with all sorts of flyers on various information. Since I had time, I decided to take a look at the bulletin board. I stood in front of the board, examining it from left to right, top to bottom. Most of the board was covered with upcoming campus events, campus programs, student organization information, travel abroad information, and research participation opportunities. I wasn't surprised by this content since these types of information and

opportunities are commonly found on bulletin boards across most departments at the University. However, one flyer stood out above all the others. The flyer read "Cheating is wrong!" It was a flyer created to both highlight the importance of having academic integrity, but also to deter students from cheating by describing the severe repercussions associated with violating the academic integrity policies, which can include being suspended or dismissed from the university. I found it troubling that amongst all these amazing and educational opportunities was this flyer, in plain view. I couldn't help but think that the primary purpose is to prevent any form of cheating, and that upholding academic integrity was their secondary purpose.

As I sat back down I began asking questions like, "how common is cheating in STEM? And are the rates of cheating different than other, non-STEM classes or departments?" After a few minutes of thinking to myself I heard a soft noise coming from my right. I looked to my right and I noticed her, the student who I initially saw when I entered the room. Her head was slight covered by her hooded sweater, but I could still see her face. She had a dark, brown complexion. Her hair was black, and she had a nose ring. I looked closely at her face and I suddenly realized that she was crying. A few tears ran down her dark, brown cheeks. She used the sleeve portion of her sweater to wipe away the tears. I had no idea why she was crying, and I felt extremely terrible for observing her as she wept. Soon after the front desk personnel said "next" and she got up, wiped away her tears one last time and worked her way to the front desk. I overheard her say that she wanted to speak to an academic counselor, but the front desk personnel stated that they were all busy and that the only people available were the peer academic advisors. She agreed to see one of them and then walked over to their section in the office. The peer academic advisor were all sitting behind the front desk personnel. They were visible to everyone in the room, and they could be heard if they spoke loud enough. I was

surprised to see this setup because it appeared that students had very little privacy. At this point the front desk personnel looked at me and said "Hi, how can I help you?" I looked over at him and began speaking.

I greeted the front desk personnel and asked if I could speak with an academic counselor. I got the same response, "their schedule is full today." I then asked if I could make an appointment to speak with someone, and he then asked if I wanted to talk about my academics. I informed him that I was a researcher and that I wanted to hear their perspective on Latinxs and their experiences in STEM. He seemed confused and asked if I could hold on for one second while he spoke to one of his supervisors. As I stood there, I overheard part of the conversation the young lady was having with the peer academic counselor. They were discussing her major and her options. I wasn't trying to be intrusive, but the conversation was loud enough that I could overhear nearly everything. During their conversation, the young student asked the peer advisor, "so I can't change majors to Aerospace Engineering?" The peer academic advisor replied, "no," stating that she would have to apply to change her major. She replied, "but I'm already in Engineering," and the peer advisor said, "yes, in Material Science Engineering, which is different than Aerospace." He then explained to her that she has to meet the requirements then submit a request to change her major. Changing majors is sometimes complicated because students must fulfill certain requirements. In STEM departments, students are not only required to fulfill certain lower-division STEM classes, but they must do so with a minimum GPA, which is usually a 2.0 GPA. Even then, certain STEM programs, like the nursing program, have limited spaces, so changing majors can become very competitive and difficult to get into because the pool of applicants is large, and the program usually admits only a few students who have high GPA's (e.g. 3.5-4.0 GPA). This reminded me of when I used to work for a pre-college program

at a local high school. I would often hear students talk about how they wanted to apply for college as an undeclared major because it is "easier" to get admitted into the university and then change to a STEM major once they were enrolled at the University. Most were misinformed about the process and requirements needed to changing majors, and very few knew the obstacles and challenges that awaited them in their pursuit to declare a STEM major once admitted as an undeclared major. For the young lady speaking to the peer academic adviser, the challenge of changing majors had just begun.

As the peer academic adviser was discussing the options with the young lady, the front desk personnel's supervisor approached the desk and gave me a business card. He asked me to email the person on the card and to make an appointment to speak with her. I happily agreed and moved on. I packed my things up and walked to the door. As I opened the door I saw the young lady again, standing behind me and waiting to pass through the exit door. I walked through the door first and held it open for her. I decided then and there to take this chance and speak with the young lady, while simultaneously hoping that she wouldn't find my actions as weird or intrusive. I said to her, "can I ask you what happened in the office?" She responded, "I tried to change majors but they wouldn't let me." I then asked if she was Latina, and she responded "yes." This was a wonderful opportunity to hear about her experience, so as we were walking I informed her about my research study and asked her if she would be willing to share her story with me. She looked away for a second, then looked backed me and awkwardly said "ok."

The student was Ana, the young lady who's father passed away prior to starting college. After briefly speaking with her I asked if her father's passing made it difficult for her to concentrate in college. She said partially, but that it was mainly that classes were difficult and she trouble understanding the material. I asked if she had sought out other campus resources, like

tutoring, and she responded "I couldn't afford it." Students who want UCP based tutoring need to register and pay their fees, which are usually a little over $100 per quarter for each subject matter. Meaning, if a student wanted to get tutoring for Math and Chemistry they would have to pay more than $200. While for some people $100 may not be much, for Ana who just lost her father and was from a working class family, it was something that she could not afford.

Since Ana didn't get any academic support and was dealing with family matters, she ended up failing a few of her STEM classes in the fall quarter, and now in the winter quarter she was failing and underperforming in other STEM classes. She was placed on academic probation after her first quarter and was asked to sign a contract, a contract that she was struggling to meet. She was worried that if she continued to struggle academically that she would get disqualified from Engineering, and so she decided to try and meet with an academic counselor to see if maybe she could change to Aerospace engineering or to see what else she could do and weigh those options. Unfortunately for Ana, all counselors were busy that day and she had to speak to a peer counselor, who she described as "unhelpful." Most academic counselor request that students make appointments with them in advance. However, most departments have peer counselors, most of whom are students themselves in that department. The peer counselors provide basic services and information to students. Since no academic counselors were available, Ana decided to make a appointment to meet with someone. I asked if we could speak after her meeting with her counselor. She agreed and we decided to schedule a date to meet again.

Ana and I met again a week later, once again near the Engineering department area, since we were both familiar with the area. We spoke briefly about her weekend and her experiences thus far in college and in her STEM classes. After we spoke on those topics I then asked her if

she had spoken to her counselor and she said "yes." I then asked what advice they gave her, and she said "nothing good." I asked, "can you tell me more," which she responded:

> "I went to the counseling for engineering because I wanted to talk about some options, like what I should do. Maybe like withdraw for the quarter because my dad passed away. [The academic counselor] would tell me to withdraw. I felt like he was telling me that I couldn't do it and I didn't think that was helpful. So I went to the counseling center for the colleges and that didn't help either. They just told me to change majors."

Each college has their own policies regarding medical or compassionate withdrawal[20], all of which are also dependent on when the withdrawal takes place. Before withdrawing, a student often meets with an academic counselor who informs them of the impact that withdrawing has on their financial and academic responsibilities. Even with a medical and/or compassionate withdrawal, some students will still be responsible for fees and may still receive a "W" (withdrawal) on their transcripts, depending on when they withdrew and what administrative decisions were made. Still, many academic counselors continue to provide withdrawing as an option for students, not fully understanding the financial impact it can create among students, especially those from low-income families. For students from affluent backgrounds, withdrawing from college may seem like reasonable choice, but for working class minorities, like Ana, who receive grant aid, withdrawing from college would require students who receive grant aid to pay back any "unearned" grant aid to their federal/state program for the amount that she did not complete. For Ana, since it was past mid quarter and she could no longer receive a full refund, she knew that she would be partially responsible for paying back a certain amount. However, that wasn't the main reason for why she decided to not withdraw or change majors. Instead, Ana

[20] Medical withdrawal general refers to a student's inability to continue with school due to serious injury or illness, whereas compassionate withdrawal generally refers to a student's inability to continue with school due to extraordinary reasons that are not related to the student's mental or personal wellbeing, such as a death in the student's family.

felt that she would've disappointed her family, particularly her father, if she withdrew, and that she would've have lost so much time and money if she withdrew. Ana wasn't ready to make this sacrifice, so she decided to push through, despite the advice given by the counselors, and despite the obstacles and challenges that were in her path.

The experience Ana had with academic counselors are not unique. When students do struggle academically and are placed on academic probation they are often asked by their departments to speak with an academic counselors on campus to talk about their academic struggles. Each department has their own group of academic counselors who help students with their academic plans, questions, and/or concerns. From the interviews I had with academic counselors, all of them claim to make recommendations based on their best intentions. For academically struggling students, this means finding ways to get them back on track, helping them persist at the university, and having them graduate, even if it means having them change majors. The most common recommendation academic counselors give to academically struggling students is to advice them to change their major to a non-STEM major because academic counselors assume that those majors are less demanding and easier, and thus students are more likely to persist and succeed in those majors. Academic counselor's recommendations are a reflection of the policies and practices of the institution, and many are under a lot of pressure to follow them. However, many do so without critically examining those policies and practices, or taking into consideration the potential personal consequences that Latinx students will experience in making the decision to change majors.

In the previous chapter, I discussed how the culture of science, along with the lack of institutional support, contribute to the struggle Latinx students face as STEM majors. These factors only tell a partial story as to why Latinx students who struggle academically depart from

STEM majors. The process of leaving STEM, or being weeded-out of STEM, is more complex and consists of a combination of university practices and policies carried out by institutional agents that weed Latinx students out of STEM. In this chapter I will discuss 1) how increases in accountability demands have shaped institutional policies and practices that contribute to the process of weeding-out Latinx students from STEM, and 2) reveal how institutional agents continue to draw on student centered factors, such motivation and meritocracy, along with a deficit cultural discourse, to explain why Latinx succeed or struggle in STEM.

I argue that these policies and practices create a system that serves those who come from wealthier backgrounds and/or who have greater cultural and social capital, thus have more resources and support. Similarly, these policies and practices simultaneously reinforce and exacerbate educational inequalities for underrepresented minorities, in this case Latinxs, who are more likely to come from poor high schools that have few resources and forms of support, and thus more likely to struggle academically and be pushed out of STEM.

Institutional Policies and Practices

The Influence of Accountability Demands

Over time, there has been a steady rise in accountability among higher education institutions across the country who are pressured to increase their performance (Kelchen, 2018). According to Kelchen (2018), "federal and state governments, accrediting agencies, the private sector, and even faculty, staff, and students within a given institution are pushing for colleges to improve their performance" (Pg. 3). Kelchen (2018) argues that there are three main reasons for why colleges are facing increased pressure, which are: 1) federal and state governments are concern about the rising student debt due to tuition and costs of attendance, 2) challenges with

sustaining public funding for higher education, 3) concerns over the quality of education across U.S. colleges and universities, and the way it affects their rankings and ratings. Overtime, these mounting pressures have forced universities and colleges to create strict practices and policies to meet the accountability demands and increase, or maintain, their college prestige, rankings, and/or ratings, even if these policies and practices go against their core values of access, success, and educational quality (Kelchen, 2018).

Increases in accountability and the pressure to meet demands is nothing new. Concerns around educational accountability has a long history in K-12. After the release of *A Nation at Risk* in 1983, a report that revealed the severe academic underachievement among students in the U.S. compared to other countries, the U.S. underwent a national educational reform movement fueled by what Apple (2004) described as a "political spectacle," which aimed to increase standardized-test scores. Despite the intentions to increase student achievement, most reform movements had few well-thought out plans, and many of these plans did not understanding nor consider the issues in schooling, which eventually led to damaging effects (Apple, 2004). Many educational reforms, such as *Goals 2000* and *No Child Left Behind (NCLB)*, had high promises but little support to meet their demands, and as a result not only did these reforms fail, but these reforms forced schools and their teachers to abandon programs, curriculum, and pedagogies that were working for their schools and replace them with reductive models of accountability and test taking strategies, which took control over pedagogy and curricula (Apple, 2004; Darling-Hammond, 2007; Darling-Hammond, Noguera, Cobb, & Meier, 2007). In higher education, knowing what we know now about educational reform and accountability, there are reasons to have concerns about accountability demands in higher education and how they both impact institutional practices and policies, and may further exacerbate educational inequality.

STEM departments across the country are often held to high educational and achievement standards. Much like K-12 educational reforms and their emphasis on test results, concerns about STEM test results and performance in higher education take priority over pedagogy and curricula. As a result, higher education institutions followed similar trends in K-12 educational reforms in that they have created policies and practices that meet the various accountability demands. However, most of these policies are not design to help students. Instead, these policies serve more the interest of the university by creating a system by which students are forced out if they do not adhere to the university and department demands. Two specific policies I will discuss are 1) time-to-degree and 2) academic standing and probation policies. After highlighting these policies, I will then describe how 3) institutional agents, specifically academic counselors, draw on these policies to shape their practice and persuade Latinx STEM students to change majors or leave the university.

Time-to-Degree Policies

Time-to-degree policies generally mean that students are only given a certain amount of time to complete their undergraduate degree. Most universities/colleges, as well as each department or school within the university, in the United States have their own time-to-degree policies. Concerns over student debt and educational performance have forced colleges and university to create strict time-to-degree policies. UCP believes that making timely progress is a sign of intellectual development, competence, and commitment. It is typical for STEM department time-to-degree policies at UCP to allow students only 12 quarters, or 4 academic years, to complete their major requirements and graduate. It is important for students and institutional agents to take the time-to-degree policy into consideration when making decisions or recommendations about class schedules and class options. This is because students who

struggle academically and do not pass, or have poor academic performance, in a certain STEM course and want to retake the course will have to wait for that class to become available, which may be the following quarter/semester, or they may have to wait a year. Waiting a quarter/semester or a year poses a serious challenge for students because many lower-division STEM classes are sequential or they serve as a prerequisite for other classes, and therefore failing a course throws students off of their academic plan and puts them at risk for not meeting the time-to-degree policy.

Challenges in meeting time-to-degree policies are further exacerbated for STEM students because they are also required to take multiple, difficult STEM classes simultaneously and they are not allowed to spread out their course load because that would require more time. If STEM adjusted their time-to-degree policy and extended it by a year, then that will allow students to spread out their STEM classes so that they can focus more attention on a few STEM classes at a time. Instead, students who struggle academically during the year will often enroll in summer, or take classes at a different university or community college just to get back on track. When students do not finish their degree within the allocated time that they are allowed then their record and enrollment privileges are often placed on a hold. When this happens students are not allowed to enroll at the university again until they file a petition and get approved to re-enroll by college administrators.

Though time-to-degree policies were created to ensure that universities are being held accountable to rising student debt and the quality of their education, the drawback is that students at UCP who are not on track to meeting the time-to-degree policy are often pushed out of STEM. The price of maintaining or improving UCP's college rankings, prestige, and accountability in STEM results in strict time-to-degree policies that punishes students who fall behind because of

academic struggles. Unfortunately, it is students from racial and low-income backgrounds, as well as students who come from poor high schools that academically underprepared them, that struggle the most academically in STEM (Chen, 2013; Griffith, 2010; Huang, Taddese, Walter, 2000), and thus are more likely to be weeded out of their majors or the university all together if they fail to keep up and/or meet the time-to-degree policy (Chen, 2013).

Academic Standing and Probation Policies

In the U.S., there is an increase in demand for colleges to produce skilled workers in science, technology, engineering, and math. This is closely linked to both global demands and competition for STEM innovations. Universities and colleges across the country actively try to provide students with a quality education in order to prepare them for the STEM workforce. At UCP, STEM classes and majors are designed to be rigorous and demanding. To persist and graduate in all majors, including STEM majors, all students must maintain a 2.0 cumulative GPA and 2.0 GPA in their respective major. Attrition rates, or also known as drop-out rates, are a big concern for colleges and universities because they impact both the prestige and rankings of the university. Concerns over students dropping out, as well maintaining college prestige and rankings, have led UCP to create policies and practices that both claim help students and also protect themselves. One such policy is the academic probation policy.

Academic probation is generally a warning for students who performed poorly academically during a quarter/semester, or who are not on track to meet the major requirements or making timely progress. For example, at UCP when a student's cumulative or quarterly GPA falls below a 2.0 they are automatically placed on academic probation. Students who struggled academically and are placed on academic probation are often required to increase their GPA

above 2.0 in order to get back on good academic standing. If a student continues to struggle academically, or make little progress towards graduation, then they risk being disqualified from the university. Being placed on academic probation can sometimes serve as a wake-up call for students to perform better academically. However, being placed on academic probation can also discourage some students from returning to the major or from the university altogether (Lindo, Sanders, & Oreopoulos, 2010). For example, one study found that students in engineering who were placed on academic probation their first year are substantially more likely to leave engineering before graduation than students who were not placed on academic probation their first year (Scalise, Besterfield-Sacre, Shuman, & Wolfe 2000). It is unclear if being placed on academic probation, or struggling academically, or perhaps both are reasons for why some students choose to leave STEM or leave college. Nevertheless, there should be a concern over academic probation policies and their intentions because unfortunately it is racial minorities, low-income, first-generation college students, and academically underprepared students who are more likely to struggle academically in college (Anderson & Kim, 2006; Herrera & Hurtado, 2011; Kokkelenberg & Sinha 2010), and thus more likely to leave STEM or college (Kokkelenberg & Sinha 2010). Instead, most universities create these policies without fully understanding what unintended consequences may arise. I argue that these policies are created to protect themselves. This is evident in the contract students sign when they are on academic probation.

When students are academically struggling and are placed on academic probation, they are often asked to sign a contract that requires them to fulfill certain requirements in order to get out of academic probation. Contracts are recommendations and actions that are crafted by counselors for students that are on academic probation. Counselors create individualized

contracts for each student, which are tailored to their needs. There are, however, common requirements that many students on academic probation must fulfill, such as passing a previous failed course with a C or above, and/or maintain an overall GPA of 2.0. In many ways, the contract serves as a written warning, indicating both the requirements needed to move forward and the consequences of failing to meet those requirements. Jennifer, a young, white female academic advisor, described this as a "do or die" option, stating:

> "Spring quarter is the 'make or break' quarter. So fall quarter if you get above a 1.5 but below a 2.0 you are placed on probation...Winter quarter, if you fall below a 1.5 you are immediately subject to disqualification, and winter could potentially be your last quarter. For students who had two quarters in a row that they did really bad, this is it. If they don't do well they are gone."

The academic contract, I argue, works more to protect the university. It shifts the accountability and responsibility from the university to the student. By having students sign the contract they are agreeing to the university terms, and consenting to understanding what requirements are needed to get back on track and what the repercussions are if they do not meet those requirements. It is a written agreement that justifies university practices of disqualifying students who continue to struggle academically. It also protects the university if a student decides to take legal matters for any reason.

Overall, accountability demands, particularly those tied to student debt and academic standards, have forced universities and colleges to implement strict policies, such as time-to-degree and academic probation, to ensure that they are meeting those demands. These policies reinforce the culture of science by rewarding students who are better equipped to compete in STEM because of their access to various resources, academic support, and academic preparation, and punish those who do not have those resources, support, or solid foundation in STEM.

Unfortunately, little is known on the impacts of university policies on student persistence and success. Only a few studies have considered how institutional policies affect student persistence and success in STEM. One recent study by Cromley, Perze, and Kaplan (2016), who examined the relationship between undergraduate STEM achievement and cognitive, motivational, and institutional policies and practices, found that institutional policies and practices, such as placement test, time-to-degree policies, and grading practices create challenges for students, especially first-generation students who are less likely to understand how to navigate the complexity of college. Take for example English Language Learners (ELL) who are simultaneously trying to develop their English proficiency while also learning their college class material. These demands pose a challenge for ELL students who may need more time in college, yet may not have the financial resources to do so, nor are able to extend their time due to strict time-to-degree policies found across higher education institutions (Bergey, Movit, Baird, & Faria, 2018; Kanno & Grosik, 2012). While universities and colleges across the country offer students who are not meeting the academic progress or academic standing requirements information and services to help them get back on track, persist, and graduate from college, there is little known as to how higher education these academic policies influence student success (Brawner, Frillman, & Ohland, 2010). Brawner, Frillman, and Ohland (2010) argue that:

> "perhaps it is because academic rules and regulations are so ubiquitous that they have relatively little recent attention in the literature as potential contributing factors in students' ability to succeed. While there have been multitudes of studies concerning climate and teaching techniques during the past two decades, relatively few have investigated what impact, if any, can ultimately be the result of institutional policies (p. 3)"

It is important for higher education institutions to be transparent with their policies and their intentions in order to ensure that they are meeting the needs of their students and that they take responsibility for the impact their policies have on student success, or the lack thereof.

Currently, institutional agents must adhere to these policies without understanding fully how they affect students, nor understand how these one-size-fits-all policies do not necessarily work for all students. Furthermore, I argue that these policies are often used by institutional agents to weed-out students from STEM, which I will describe in the next section.

Facilitating the Weeding-out Process Through Academic Counselor Practices

When STEM students struggle academically most STEM departments will send them an email, informing them about their academic status and will ask them, or require them, to meet with an academic counselor. According to academic counselors, a large majority of students placed on academic probation do speak with them after receiving the email. however, there are a few number of students that don't. When students do meet with academic counselors, most counselors approach the conversation holistically and try to figure out why a particular student is struggling, and then advise them on their options and what resources are available. Unfortunately, from the discussions I had with both Latinx students and academic counselors, when students do struggle academically one of the first topic of conversations they have with a counselor is the discussions of whether or not STEM is the right major for them, and if perhaps they would be better suited in a different major. Most academic counselors often do not directly ask academically struggling students to change majors. Instead, conversations about changing majors are often carefully and thoughtfully crafted by counselors. They use different strategies to persuade students to change majors, with the more experienced and effective counselors being able to convince students that changing their major was their idea.

So how do academic counselors convince students to change majors? At UCP, when STEM academic counselors meet with students who are struggling academically they will often

begin by talking about the student's motives for pursuing a STEM career. In my conversations with Latinx students and counselors, most Latinx students, especially those from low-income backgrounds and/or who first-generation college students, are often motivated to succeed in college and in their STEM major in order to help their community, obtain economic security, and obtain social mobility. Most academic counselors gather this information and often use it to persuade students to change majors by informing them that their career goals could be accomplished in a different major.

After discussing the student's career goals, the academic counselor would typically examine the student's classes and grades. One common strategy among academic counselors is to show students their GPA by turning around their monitor and letting students see their grades for themselves. Then, academic counselors compare the student's general education G.PA with their STEM GPA. At this point, counselors would ask students where they are doing academically well. Generally, students who struggle in STEM typically do better in non-STEM classes. Academic counselors know this and again will use this information to persuade them to change majors, usually a non-STEM related field. The strategy of showing students their grades and persuading them to change majors is a very common practice among academic counselors. If a student still wants to major in STEM after being advised to change majors, then the academic counselors will typically suggest an alternative major that is related to STEM, one that is less rigorous. For example, it is common for academically struggling students majoring in Biology to change majors to Public Health. George, a former STEM student who graduated and now is an academic counselor for a STEM department, describes his process of advising students who struggle academically to change majors in detail, stating:

> "A lot of the time we will review their courses, well I will review their course work, and we will see that 'these are the courses and this is how you are doing. So what's going on?' I will compare them with the other courses that they are doing well in. So if there is a correlation were, I mean if the comparison, if between the comparison there is a big difference between let's say their general education courses and [STEM] courses, the student actually most of the time see's and says, 'ok, yeah I'm not doing well in [STEM major], but you know the other classes I'm doing really well in because I really like reading, or I really like writing.' And I kind of help them with that because it's never is a good idea, I've noticed, to tell them that [this STEM major] isn't for you. I kind of just provide the examples and use the evidence and, you know, let them see that whether or not they think it's working... So I kind of put it on them so that it's coming from them, the decision is coming from them as oppose to me forcing them on it. Cause they are adults at the end of the day. So I always feel more comfortable when they understand that they have to learn how to read the signs of whether or not it's the major for them and when is the ideal time for them to switch to a different career path."

Academic counselors varied in their approach when discussing changing majors, with some having a more welcoming and sympathetic approach, and others being more assertive and less sympathetic. Take Jennifer, for example, who is a young, White, female academic counselor who graduate with a STEM degree. She's been working for the STEM department now for 3 years, and prior to that she served as a peer advisor for STEM majors while she was an undergraduate. When I asked her how she usually discusses changing majors with students, her method was more direct and to the point, as she described, stating:

> "So usually what I do is sort their GPA by school, because I have the ability to do that, and I turn my screen around and I show them and I say, 'if you're a counselor and you were sitting in my position and you were meeting with me as a student and you see these grades, what would you recommend?' And always their face drops and they go, 'oh, I would recommend that they go to social sciences,' and I say, 'yeah, because that's what you're strong in, that's what you can do well in.'

Academic counselors have dual responsibilities in serving both students and the institution. While many academic counselors claim that they are acting on the best interest of students, their recommendations are influenced by institutional pressure to adhere to university

and department policies, policies which are design to protect the university. Perhaps one of the most unsettling advice that academic counselors give to students who are struggling academically is to advice them to go to community college and finish their lower-division STEM classes, and then reapply to the university. For transfer students who consistently struggle academically, academic counselors advise them to attend UC extension[21] and enroll in the Concurrent Readmissions Program[22] for UCP. Students in the concurrent readmissions program must meet certain GPA and class requirements before applying for readmissions. While this may seem like a good suggestion, academic counselors are not critically taking into account the challenges and barriers students face at both community college and UC extension. Furthermore, they simplify the process of taking classes at community college and transferring, giving students limited information and a sense of false hope that returning to UCP will be easy. Rather, academic counselors are advising students to leave UCP and attend community college and/or UC Extension with no regard for the challenges they will face.

The literature on challenges and barriers students face at community college is robust. For example, research suggest that community colleges face financial and structural challenges that impact their ability to help students (Calcagno et al., 2008; Dowd, 2007; Goldrick-Rab, 2010; Goldrick-Rab, Broton, & Gates, 2013; Jenkins, 2007). There are lack of local, state, and federal funding for higher education, and unfortunately community colleges often absorb a disproportionate share of the higher education budget cuts (Boggs, 2004; Goldrick-Rab, 2010).

[21] Every University of California has an Extension program that offers students various programs dedicated to continuing their education. They offer programs such as post-baccalaureate programs, certificate programs, and programs that offer students prerequisite classes needed for graduate school. UC Extension also offers students who have been disqualified, or students who withdrew from the university, a readmissions program so that they can appeal for readmission. If enrolled, students are granted access to the institutions resources, such as library privileges, student services, email, etc.

[22] This program, offered through UC Extension, provides students with an opportunity to take classes, earn a high GPA, and then reapply for admissions to the university.

As a result, budget cuts impact the quality and availability of student services and programs (Boggs, 2004; Goldrick-Rab, 2010). Furthermore, persistence rates are a growing concern at community colleges. Many students are failing to complete a program, obtain a credential or transfer to a four-year college (Goldrick-Rab, 2010). It is surprising that an academic counselor would advice students to leave an institution with greater resources for an institution with fewer resources and more challenges, despite knowing what the research says about the challenges students in attending these institutions.

The concurrent enrollment program for readmissions at UC extension also has their share of challenges. For one, students enrolled in the program at UC Extension are only allowed to enroll in a max of 8 units per quarter, which is part-time. Attending college part-time can prolong their time in college, which can cost more money in the long run. Another challenge students face deals with GPA policies for readmissions, which require students to obtain a minimum 3.0 GPA in classes taken at UCP extension in order to apply for readmissions. Students who do not obtain the minimum GPA requirements cannot apply for readmissions, and thus run the risk of wasting time and money trying to achieve this goal. Finally, one of the biggest challenge students face at UC extension is that they do not qualify for government grants or loans. Students who wish to enroll must pay with cash, credit, or private loans—all of which can deter students from enrolling and persisting in college, especially students from low-income and racial/ethnic backgrounds who typically face more challenges with college affordability (Goldrick-Rab, 2016; Heller, 2008; Price, 2008).

Overall, advising students to attend community college or UC extension may not serve their best interests as they are likely to run into further academic and institutional challenges that can create obstacles in their path towards obtaining a STEM degree at a four-year college. While

in some ways, asking Latinx students to leave to community college or UC Extension can serve as an opportunity to get back on academic track, in other ways it limits opportunities and exacerbates inequality by forcing students to attend institutions that have fewer resources and greater challenges.

It is easy to vilify academic counselors for suggesting to students to change majors, go to community college, or go to UC Extension, as some of the Latinx students I spoke who had negative perceptions about academic counselors and viewed them as gatekeepers. However, it is important to understand the academic counselors perspective for why they make those suggestions. Most academic counselors I spoke with were genuinely good people, dedicated to helping students persist and succeed in college in any way that they could. When students struggle academically, academic counselors do ask holistic questions and try to understand why students struggled, whether it be personal, financial, or academic. Still, most academic counselors advice all students, including Latinx students, who are academic struggling to change majors or leave the university, regardless of what's going in their personal life, and it's not because they believe that they are gatekeepers, but because for them the alternative of having students continue to struggle academically in STEM can have detrimental academic, social, and financial repercussions. For example, one academic counselor who was concerned over a student's career and educational future indicated that if students "just did social sciences [they] would have a 3.4. You know, that Bio is at a 2.0. If [they] are a social science major then [they] would probably have a lot more options once [they] graduate than a 2.0 Bio major." She went on to discuss medical school and their requirements, suggesting that if students wanted to become doctors then those doors might be difficult to open with a 2.0 GPA, given that most medical

schools in the United States are extremely competitive, selecting applicants with high GPA's that usually range between 3.5-4.0.

Another academic counselor discussed with me the financial and college completion repercussions of consistent academic struggle, stating that "students who are low-income, we are keeping them here and we are keeping them in debt. I mean, our tuition is going up and up and up, and the longer they have to stay here, for those students who have to stay a 5th year because they didn't do well, that's a lot of money, that's a lot of money." She continued on the topic of college affordability and began talking about how the financial burden is exacerbated when students realize that they may not graduate, even after 5 years. I asked which students are likely to experience this, and if are they informed that they may not graduate? She responded:

> We make sure that they know, we make sure that they know. So most of the students that we do have who struggle with GPA's in their last couple of years are Hispanic. Um, but they are well aware. So you know, it's their choice... [But] we do let them sign up graduation and we do let them attend the ceremony and stuff, but they are well aware that they are probably not getting their diploma."

Academic counselors, from their perspective, are trying to serve the best interest of the student. If students are having personal problems, financial problems, or academic problems, the advice is the same, sign a contract, change majors, or go to community college. Academic counselors understand how difficult STEM majors are, and how much time must be allocated to studying for that major. That's why they believe that if students are working, or have things going on at home, or are having a difficult time with STEM that they should make a change because they believe that non-STEM majors, especially those in social sciences, are less academically demanding, or simply put "easier," and more flexible so that students can have more time to allocate to their personal needs while also managing their academic responsibilities.

Determining what type of social capital, if any, will be produced depends on the relationship between the academic counselors and the student themselves. Noguera (2001) argues that if the relationship is "weak, or characterized by fear and distrust, it is more likely that school will serve as a source of negative social capital" (Pg. 193). Negative social capital is defined as being unresponsive to the needs of a certain individual or group, and/or undermining social cohesion which further marginalizes and reproduces social inequality (Noguera, 2001; Wacquant, 1998). For many Latinx students who seek support from academic counselors and are instead greeted by being asked to switch majors or go to community college, their relationship with these counselors begin weak, with some Latinx becoming distrustful of academic counselors and their advice. Academic counselors who limit information, resources, and support services, and instead advise academic struggling Latinx students to change majors or leave the institution for community college or UC extension, are serving as agents of negative social capital. Through their actions they are exacerbation inequality and further marginalizing students from obtaining the resources and support they need to be successful in STEM.

At UCP, there are many students who struggle in STEM, but more frequently, and unfortunately, Latinx students seem to struggle more than other racial groups, according to the academic counselors I spoke with who stated, "a good percentage of the students who we see in academic probation are going to be first-gen[eration] students and, um, and a lot of students who we require to change out of our major unfortunately is our first-gen[eration] and it happens to be a lot of our Hispanic students." While UCP may not overtly exclude and weed-out Latinx students from persisting and succeeding in STEM, they do so indirectly by creating policies that make it difficult for Latinx students who may not have the cultural capital and social capital to understand and navigate such policies, and by sustaining practices that validate and reinforce

policies that force Latinx students out of STEM. More so, rather than institutions and their agents questioning these practice and policies and how they exacerbate educational inequality, they often blame students for not meeting institutional requirements. In fact, as I will describe in the next section, institutional agents continue to draw on student centered personality trait rhetoric, as well as deficit discourses, to described why Latinx students struggle or succeed in STEM.

Institutional Agent Perspectives on Why Latinx STEM Students Succeed or Struggle

Exploring how institutional agents understand why Latinx students succeed or struggle in STEM was a central question in this dissertation. In my research, I asked institutional agents what they thought were key factors that contributed to the success or struggle of Latinx students majoring in STEM. In analyzing the data on perceptions of institutional agents, the data revealed several complicated institutional perceptions of how and why Latinx students succeed or struggle in STEM. There were three common themes that were apparent in the data, which revealed that institutional agents believe that Latinx success and/or struggle in STEM was related to student centered personality traits, deficit cultural and family factors, and college readiness factors. Only a very few institutional agents focused on how institutions played a role in contributing to the success or struggle Latinx students in STEM. In this chapter, I will highlight how 1) student centered characteristics/personality traits, 2) cultural deficit rhetoric, and 3) college readiness rhetoric are pervasive in the perspectives among institutional agents, who place the blame of academic struggle solely on students by using deficit discourses, yet fail to recognize how institutional policies and practices contribute to the problem of students who struggle in STEM. I will then 4) describe institutional agent practices of how they weed-out Latinx students in STEM who do not fit their mold of a successful student by drawing on their policies.

Student Centered Characteristics/Personality Traits

"For all student's it's drive, initiative... If you're lazy you're not going to do well in [my class]. I don't say you're lazy, I don't use that word cause that's a label. Um, marginally motivated," explained Dr. Johnson, a white female faculty member in the physical sciences who has been with the department for more than 20 years, when I asked why students succeed or struggle in STEM. During this topic of conversation, Dr. Johnson seemed frustrated and flustered with her perception about some of her students and their lack of effort and motivation to learn and succeed in her class. The more we talked about factors relating to success and or struggle the more she focused on student centered traits. For example, she believes that students

> "rather play video games, they rather drink with their friends, they rather; they're not super motivated, or maybe they don't want to be here... I mean, I am the 'hard' teacher, and it surprises me when somebody will sign up. I mean, 'why are you signing up for my class, why are you taking my class if you're not even going to be here? You're not going to try, you're going to whatever,' I don't know. Um, I think you just need a strong work ethic. I think success in my class, or in any class, is work ethic, it's 80% work ethic and 20% ability.

Dr. Johnson wasn't the only faculty or institutional agent who felt that academic success or struggle was primarily dependent on student personality traits. Many others shared her feelings, believing that success or struggle was related to students inability to be motivated and work hard, or have strong work ethic, initiative, study skills, or time management skills. Drawing on student personality traits to help explain academic success or struggle is not surprising, given that attribution theorist, social psychologist, and past research suggest that when people make inferences about their own or other people's behaviors and actions, in this case making sense of academic success or struggle, people's judgments commonly attribute responsibility to factors within the individual (Duckitt, 1992; 2001; Guimond, Begin, Palmer, 1989; Weiner, 2010; Shaver, 2016).

Attributing STEM success or struggle to students and their personality traits is also very common in research. For example, MacPhee, Farro, and Canetto (2013) examined the relationships between academic self-efficacy (defined as one's ability to complete a task) and academic performance among underrepresented minorities (gender, social class, and race) in STEM, and they found that low self-efficacy was related to poor academic performance. Furthermore, they found that students who had a double minority status (e.g. women and being low-income) in STEM were more likely to have lower academic self-efficacy and lower academic performance than students with a single STEM minority status. Other scholars have suggested that academic and social integration, which means being academically prepared and building social networks and feeling like you belong to the college/university are important factors for both college and STEM success in college (Strayhorn, 2018; Tinto, 1993; Zumbrunn, McKim, Buhs, & Hawley, 2014), especially for racial minorities (Foltz, Gannon, & Kirschmann, 2014; Jackson & Laanan, 2015).

A more recent study conducted by Bazelis, Lemay, and Doleck (2016) examined the how grit and prior academic performance are related to college academic achievement in science. Grit is defined as persevering and having passion for achieving goals, despite facing failure and adversity (Duckworth, Peterson, Matthews, & Kelly, 2007). Bazelis, Lemay, and Doleck (2016) found that grit was not a significant predictor of academic success, but that prior academic performance was. Though grit was not a significant factor, the fact remains that studies continue to look at personality traits to help explain student success while simultaneously dismissing institutional practices and policies and their affect on student achievement. This is also true among institutional agents in this study, who continue draw grit, motivation, work ethic, and other student personality trait rhetoric to explain student struggle and/or success. For example,

when I asked institutional agents what they believed are the reasons for why Latinx STEM students succeed or struggle academically, many attributed motivation, grit, study skills, time management, self-discipline, and other student centered personality traits when explaining why Latinx students succeed and struggle in STEM.

Attributing student-centered, personality traits as a reason for success was shared among many institutional agents, including those who identified as Latinx themselves. Take for example Dr. Ramirez, a director of a student service program for STEM, who earned her Ph.D. in a related STEM field during the 70's. When describing her background and educational journey, she often spoke about fighting and persevering in education, despite facing numerous obstacles as both a woman and Latina in a time when women and racial minorities where very underrepresented in the field of STEM. She had tremendous grit, and her personal journey became the foundation for understanding why students succeed or struggle/fail. When I asked her what she thought were some of the factors for why students succeed or struggle, she responded:

> "Bring me any Latin[x] student, anyone one of them. If they don't have *ganas*, if they don't work hard then they are not going to do well here. I spoke to a young man and his mother the other day and I looked at him and told both of them 'you have to be really dedicated, really motivated to be an Engineer or a Doctor here.' I told him, 'si tienes ganas you can be whatever you want, but if you don't then this isn't the place for you.'"

It was clear for Dr. Ramirez that factors relating to meritocracy, such as working hard, were key factor for success in STEM. She was also very aware that some Latinx struggle academically in STEM, stating that she was ok if students leave because she believes that in STEM "only the best succeed and the rest are weeded out." Perhaps one of the biggest concerns in using student centered factors to explain struggle or success is that these perceptions

reinforces meritocracy, which fails to recognize the external factors that create social inequality and makes it difficult for individuals to succeed, especially those from working class and racial/ethnic minority backgrounds who often come from high schools that academically underprepared them. Unfortunately, there is little awareness, or recognition, among institutional agents on how institutional policies and practices contributes to how Latinx STEM experience and navigate the STEM field. This is not to say that student-centered personality traits are not important. As stated before, there has been numerous research indicating that personality traits, like motivation, hard work, study skills, or other student centered personality traits are very important for student success, and negative student personality traits, such as low motivation, can negatively affect student's ability to do well across all their classes, including their STEM classes (Kitsantas, Winsler, & Huie, 2008; Spitzer, 2000). However, concerns arise when student personality traits become the central and only factor used to explain student success or struggle in STEM. There are multiple factors, including institutional factors, that equally contribute to the success or struggle in STEM, and dismissing or omitting these institutional or other external factors creates a situation whereby blame is often placed on the student and their behavior.

Furthermore, motivation, drive, initiative, and other similar personality traits are not static, rather they are subject to change based on experiences and time (Nowell, 2017). For example, research has shown that motivation can slowly diminished if there is a discrepancy between the amount of work put into something and the outcome they received (Nowell, 2017; Rainey, 2000; Van Etten, Pressley, McInerney, & Liem, 2008). With regards to this study, some Latinx STEM students lost motivation after experiencing a discrepancy between the amount of time that they studied and the grades they earned, and feeling as though all their hard work was not paying off. Therefore, the question may not be why Latinx students are not motivated, but

rather why is their motivation diminishing? Perhaps Latinx student motivation is low or diminishing not because of their personality traits, but because they are constantly battling a system that is pinned against them, which can be exhausting and debilitating.

Cultural Deficit Rhetoric - Blaming The Culture and The Family

Another common, yet troubling, perception among institutional agents for why Latinx students struggle academically is because of their cultural and family values. Some institutional agents believed that Latinx families and their culture do not value education, and that when the students went home, or when they lived at home, they were expected to set aside their academic responsibilities and perform house chores or work to support their family. This deficit discourse is more commonly known in the literature as the culturally deprivation discourse, which suggest that Latinxs are *culturally deprived* and come from families and environments that do not value education, nor have the resources to support their children's cognitive and linguistic development or educational endeavors (Black, 1965; Clark & Plotkin, 1972; Lewis, 1971; McDermott & Varenne, 1995; Shaw, 1963).

According to culturally deprivation theorists, academic failure can be traced to the inability of families to transmit the values and cultural patterns that are essential for academic success (Black, 1965; Clark & Plotkin, 1972; Kaplan, 1963). Lewis (1971) argued that "the lack of effective participation and integration of the poor in the major institutions of the larger society is one the crucial characteristics of the culture of poverty" (p. 46). Given the overwhelming impoverished conditions many Latinx families have faced, there have been stereotypes and myths suggesting that Latinx families prioritize financial security and stability over education (Valencia & Black, 2002). While these stereotypes and myths are not true, culturally deprived

theorist have argued that children from poor families do poorly in school because their families do not place a high value on education (Lewis, 1971; Marans & Lourie, 1967; Shaw, 1963).

When I spoke to faculty and other institutional agents about factors relating to Latinx success or struggle/failure in STEM, their responses revolved around this same culturally deprived rhetoric. For example, when I asked a Math professor what he believed were some reasons for why Latinx students succeed or struggle, he responded by saying that they struggle because they lack motivation from their families, stating:

> "Some students don't have motivation, which comes from their families... I mean, his or her parents are not highly educated, so perhaps that student is the first one in their entire whole family was starting the college, or entered college. And, they don't feel that sense of urgency that 'I need to finish, I need to be successful,' cause they think the worst case I'm going to be like my parents. And, um, that kind of takes away their motivation... Like I said, they kind of compare themselves with them and say, 'um, they did, they didn't do that bad, they did fine, so the worst case if I don't to go college or if I don't finish it I'm going to end up being like them.'"

According to the Math professor I interviewed, Latinx students who come from working class backgrounds and have parents with little formal education have no motivation to succeed and surpass their parent's educational and career attainment, nor are their parents motivating them to do so. This is not true at all, and in fact what Latinx students shared with me was the exact opposite, which I will describe in more detail in the next chapter. What is known is that there has been a large number of studies that indicate that Latinx families value education, and that they encourage and support their children's academic aspirations (Auerbach, 2006; Gloria & Castellanos, 2003; 2007; Gloria, Castellanos, Lopez, & Rosales, 2005; Gloria & Segura-Herrera, 2004; Hurtado, 1994; Ojeda, Navarro, & Morales, 2011).

Family, or *familismo* as described in chapter 3, is very important to Latinxs. According to Castellanos and Gloria (2007), "*Familia* is a central component to Latina/o students' experiences from which they gain cultural affirmation and specific navigational strategies to negotiate the host culture of academia. By building family-like systems, Latina/o students can garner and maintain their academic momentum" (pg.10). Family is such an important source of support that there have been tremendous efforts made by Latinx students and Latinx faculty to create an *academic family*. An academic family can best be described as fostering and developing family like networks of individuals that serve to academically support Latinx students (Castellanos & Gloria, 2007; Comas-Diaz, 2010; Delgado-Guerrero & Gloria, 2013; Delgado-Guerrero, Cherniack, & Gloria, 2014; Gloria, Castellanos, Dueñas, & Franco, 2019; Luedke, 2018). Overall, Latinx families play an important role in supporting their children, as they often encourage and morally support their children's educational aspirations, contrary to what some faculty believe.

A very few faculty were a bit more aware that some of the cultural deprivation rhetoric used to explain Latinx academic struggles might be false or be simply stereotypes, yet they rarely challenged them. Instead, those few faculty members referenced the stereotypes as a possibility for why Latinx students struggle in STEM. For example, one chemistry professor said:

> "I've heard that culturally, I think it's changing now but, there's not a push in that in the Mexican-American community to get an education. It was kind of almost looked down on some ways. I don't know if this is true or not, but somebody told me this. And so, um, I would imagine that having role models would be a difficult thing... I would imagine that being told that culturally it's not really looked highly upon to go and get a higher education, that I could imagine that there would be role models lacking for those students, you know."

A few other institutional agents, such as academic advisors, also drew on deficit rhetoric to explain Latinx academic struggle. Take Nancy, for example, an academic counselor is STEM who said:

> "In large part it's their family because; ok, they are this great, supportive family system, and they are all nearby, but they have to take care of them. So, I mean if we are going to go off stereotypes, in this cause it tends to holds true... They are dealing with situations where 'I have to go home and take care of my grandma,' and living with your grandpa and taking take of your grandpa with Alzheimer's, you know... And it's like, they have all of these extra responsibilities, and that support system of the Hispanic family is a double edge sword system, and I think that that's the problem... You know, 'you have to take care of your little brother and sister and you're not studying.' And, I think that that is a tremendous challenge for Latino students."

Not all institutional agents believed that academic struggle is tied to deficit cultural and family values. A few institutional agents, specifically Latinxs worked in academic programs, didn't believe that it had to with the culture or family. Rather, most believed that UCP was not doing enough to support Latinx students, arguing that more needed to be done. However, a large majority of institutional agents have a misconception about Latinx families and their value for education, with some believing that Latinx families do not value or encourage their children to obtain an education. This is simply not true. A large number of studies have indicated that Latinx families highly encourage their children to learn and to get educated (Arellano & Padilla, 1996; Castellanos & Gloria, 2007; Gándara, 1995; Gloria & Rodriguez, 2000; Hernandez, 2000; Hurtado, Carter, & Spuler, 1996; Torres & Solberg, 2001). One challenge that Latinx parents do face, especially those that had little formal education, is that they are limited in their social and cultural capital, and therefore they may not have the ability or resources to help their children navigate and academically succeed in college (Auerbach, 2004; Chrispeels & Rivero, 2001; Holcomb-McCoy, 2010; Zarate & Burciaga, 2010). Still, many Latinx families have different

forms of cultural capital, which Yosso (2005) described as community cultural wealth, that they pass down to their children, which helps them navigate college. In addition, Latin parents also provide an abundant amount social and moral support, and continuously encouraging their children to strive in college (Auerbach, 2006).

While there were Latinx students who did go home and did spend time or help their families in some way, most Latinx students indicated that this was not a huge or inconvenient problem. Yet, institutional agents see this as a concern or a problem, believing that it will affect their motivation and impact their academic performance. This is not unique, as other scholars have found that this perspective is common among institutional agents. For example, Castellanos and Gloria (2007) argue that "within the educational context, Latina/o students are often 'pulled home' to attend to family needs and as a result are frequently subjected to stereotypes and competency questioning by faculty or peers as to whether they are really motivated to earn a higher education" (Pg. 6). This is troubling because, again, institutional agents are looking at the student and their behaviors (e.g. going home) to explain why they succeed or struggle in STEM, assuming negative stereotypes as the culprit for lack of motivation or lack of engagement, yet dismiss institutional factors altogether.

Overall, many Latinx families do encourage and motivate their children to obtain a high level of education. Families understand that studying and doing homework requires time, and that work and family responsibilities will be limited or completely set aside while their children attend to their academic responsibilities. While many Latinx parents are limited in their ability to support them academically, they give their children tremendous amount of encouragement, and provide whatever form of tangible or social support they can that is within their means. Unfortunately, there are some institutional agents who continue to draw on deficit cultural

discourses to explain why Latinx students struggle academically in STEM. As Yosso (2005) argued, social institutions continue to view communities of color, in this case Latinx families, as having deficit forms of cultural capital. Describing culture and family values through the lens of culturally deficit discourses not only places blame solely on the student for having a lack in values and lack in dominant cultural capital to succeed in college, it also reinforces the stereotype that Latinx students are inadequate and deficit (Carter, 2005; Smit, 2012; Yosso, 2005).

Challenges With Being College Readiness

"A lot of high school these days don't really prepare them very well. Like, more and more the pre-calculus part is the hardest part of calculus. If they don't understand it it's because they didn't learning good back then," said Dr. Moore, a young, male faculty member in Math who has been teaching for 5 years, when responding to the question regarding why students struggle in STEM. Perhaps the most common factor shared by students and institutional agents in explaining why Latinx students succeed or struggle in STEM has to do with their academic background, specifically their academic preparation. Latinx students and institutional agents alike agree that being academically prepared is important for both STEM and college success. In the literature review, academic preparation often falls under the concept of college readiness. College readiness is defined as a students' ability to enroll and succeed—without remediation—in a college course at a postsecondary institution that offers a baccalaureate degree or transfer to a baccalaureate program (Conley, 2007). According to Conley (2007), the common approach to defining college readiness is through enrollment in rigorous courses (AP and honors classes), GPA, and college admission exams (ACT or SAT). There has been a large number of studies that suggest college readiness is an important factor for college persistence and success, both

generally speaking and in STEM majors (Peralta, Caspary, & Boothe, 2013; Reid & Moore III, 2008; Roderick, Nagaoka, & Coca, 2009; Tai, Sadler, & Mintzes, 2006; Warburton, Bugarin, & Nunez, 2001). However, studies have shown that there are racial/ethnic disparities in level of college readiness, with more minority students being underprepared (Roderick, Nagaoka, & Coca, 2009). Deil-Amen (2011) argues that being underprepared for college puts students at risk of non-completion.

At UCP, many faculty feel that there are a lot of students, including Latinx students, who are coming to college academically underprepared for STEM majors. According to faculty, many students were not taught how to apply their knowledge, rather, they were taught to simply memorize the material. Dr. Miller, a faculty member who has been with the physical science department for five years, perfectly captured the challenge students are facing when studying for Chemistry and other STEM classes, stating:

> "It's not how much they study, but the way that they study. The students who are trying to treat [chemistry] like a math class where they are doing problems, they seem to do pretty well. The students who are trying to treat [chemistry] like a biology class where they can just sit down and read the book and watch the lectures, they do very poorly. Um, almost universally when people come to me after the end of the first midterm and say:
>
> [Student] 'I'm studying a lot and I'm not doing that well,'
> [Professor] 'How are you studying?'
> [Student] 'I watched your video lectures three times.'
> [Professor] 'Well that is really pointless, but I appreciate that you're willing to listen to me for that amount of time, but that's not what you should be doing.'
> [Student] 'I read the book and then I watched your videos, and then I went back to read the book.'
> [Professor] 'Well how many problems did you do?'
> [Student] 'Five.'
> [Professor] 'Ok, well there's your problem.'
>
> And so, I think that, that understanding of learning is by doing and not by listening. The thing I see over and over again is that they just don't listen. I think

> that they were trained to outline chapters when they were in high school, and you know, and that's how they learned, and that doesn't translate well in college."

While some high schools provide students with resources and support, research suggest that a large majority of high schools attended by racial/ethnic and low-income minority students are under-resourced and have undertrained staff that limit racial/ethnic minorities from pertinent information, adequate resources and academic preparation—factors needed to help students obtain college access and succeed in college (Brown, Brown, & Jayakumar, 2009; Hallett & Venegas, 2011; McDonough, 2005; Oakes, 2005). Even among high schools with resources, many racial/ethnic and low-income minority students face systematic challenges and barriers, such as tracking, that exclude them from obtaining resources and adequate preparation and support that can help them be academically prepared for college (Oakes, 2005; McDonough, 2005a; 2005b). Thus, high schools, through their lack of financial, educational and tangible resources, and along with systematic discriminatory practices, serve more as institutions that reinforce social reproduction. Furthermore, racial/ethnic and low-income minorities face overwhelming challenges in not only obtaining adequate academic preparation and college information (cultural capital) in schools, but also challenges in developing useful and reliable networks (social capital) that may provide guidance and support that may be vital for college success (Bourdieu & Passeron, 1990; Bourdieu, 1986; Bowles & Gintis, 1976; Giroux, 1983; Hurtado, Inkelas, Briggs, & Rhee, 1997; Karen, 1991; McDonough, 2005a; 2005b; Mullen, 2010; Oakes, 2005; Yosso, Parker, Solorzano, & Lynn, 2004).

Universities and colleges assume, based on entrance exams, high school GPA, and high school classes taken by students, that students are coming to college academically prepared. Yet, this is based on the premise that most high school classes and curriculum are the same. In reality not all high schools are equal in their resources and ability to prepare their students for STEM in

college. As a result, faculty in colleges and universities are creating curriculum based on the assumption that all students are ready for the STEM classes, when in fact many are not. As Dr. Chang, a faculty member in Physics, explained, "we're teaching the mechanics of how to solve the problem, but we're not teaching, you know, how to develop a strategy of how to learn. And I think that's probably one of the biggest factors that is letting people to fail." Dr. Chang was referring to mastering fundamentals and understanding how to problem solve, which are skills and knowledge that should've been taught during high school, and are essential and necessary to be successful in introductory and advance STEM classes. Though Dr. Chang and other faculty understood that some high schools academically underprepared students for college level STEM courses, many didn't feel responsible for bringing them up to date on their knowledge and skills.

The unfortunately reality is that students who come poor high schools are more likely to be under resourced and have under qualified teachers (Lankford, Loeb, & Wyckoff, 2002; Peske & Haycock, 2006). Latinxs who attend poor high schools, or who are tracked into subpar classes, are denied the opportunity to learn the STEM fundamentals, which serves as a disadvantage because without fully understanding those fundamentals Latinxs are more likely to academically struggle and leave STEM (Ejiwale, 2013). This is because STEM education is multilayered, and if the fundamentals are poorly taught to students then they are likely to struggle learning more advance STEM material. The inability to effectively teach youth STEM fundamentals has an accumulation effect that can follow students throughout high school and into college (Ejiwale, 2013). As a result, college students who come from poor high schools and want to major in STEM begin their college journey academically underprepared. Students who are underprepared are simultaneously trying catch up and learn the STEM fundamentals that were poorly taught to

them while also being caught up on their college STEM classes, which can be very overwhelming and stressful.

Chapter Conclusion

Demands in accountability has partially shaped institutional policies, such as time-to-degree policies, which serve the interest of the university, at the cost of neglecting their core values of helping students persist and succeed in college. These policies are then upheld by academic counselors, many whom would like to help students succeed in STEM, but are required by their institution to adhere to policies and weed-out students who are academically underperforming. As a result, these policies and practices are further exacerbating inequality for low-income, racial/ethnic minorities, and first-generation college students who are less likely to be academically prepared and less likely to have the cultural and social capital to successfully navigate college.

What is equally troubling is that institutional agents overwhelming place the onus on students when explaining success or struggle, yet they fail to recognize how they contribute to the problem of students struggling in STEM. In this study, personality traits and deficit rhetoric where dominant factors used to explain academic struggle among institutional agents. Focusing on the individual, in this case Latinx students, creates a perception that Latinx students are lacking the required skills and knowledge (cultural capital) necessary for STEM success, and consequently forces students to catch up on their own, or struggle and possibly be forced out of STEM through the policies and practices created under the university. Institutional agents believe that students who come from "deficit" cultures, or who lack valuable personal traits, must conform to the institutional habitus of meritocracy—working hard and constantly motivated—

and therefore are responsible for themselves to obtain the skills and knowledge necessary to succeed in college. According to O'Shea, Lysaght, Roberts, & Harwood, (2016) these demands for conformity creates and reinforces deficit discourses that suggest students don't have what it takes to succeed.

Fortunately, the experiences and perspectives Latinx students shared with me provide a counter narrative that debunks the deficit rhetoric perspective held by institutional agents. As will I explain in the next chapter, family support is very well present in the lives of Latinx students, however, many continue to struggle academically. The next chapter focuses on a counter narrative, spoken by Latinx in STEM, that describes who the Latinx STEM students are, what their educational and career aspirations are, the struggles they face as STEM students, how they respond to those struggles, and what they believe are the causes for their struggle in STEM.

Chapter 5

Latinx STEM Students - Habitus, Navigating College, and Making Sense of University Policies and Practices

Latinx students' habitus influences the way they navigate college and make sense of the University and their policies and practices. As I described earlier in chapter 1, habitus can best be described as someone's habits, disposition (inherent character qualities), and tastes (Bourdieu, 2013). It's the way people make sense of the world around and how they react to it. Habitus is shaped by values, beliefs, and lived experiences. An understanding of Latinx students' habitus will help readers not only better understand how Latinx students navigate and make sense of college, but also understand the choices they make during college and how difficult some of those choices can be. Furthermore, drawing on Yosso's (2005) community cultural wealth will illustrate how Latinx develop forms of cultural capital that though may not be viewed as dominant cultural capital, they are used to help them navigate college.

This chapter will be organized into two different sections. In the first section, I will describe who Latinx students are. More specifically, I will describe how Latinx student habitus is shaped by 1) cultural values and beliefs, 2) class background, and 3) lived experiences. I argue that Latinxs habitus and development of community cultural wealth has instilled in them the value of education, fueling them to obtain the highest possible degree in order to escape poverty, obtain social mobility, and to give thanks to their families for sacrificing their needs and supporting them during their educational journey.

Drawing on Latinx students habitus, the second section will focus on how Latinx students 4) navigate college, 5) understand struggle and success, and 6) make sense of university policies

and practices. I argue that Latinx student's habitus—shaped through cultural and family values and beliefs, and lived experiences—influences the way they navigate college, and how they respond to university policies and practices. I also argue that while their habitus, specifically the notion of *ganas*, can empower some Latinx students to succeed, for academically struggling Latinx students in STEM who have to make decisions about staying or leaving STEM, the cultural value of having *ganas* influences their decision to and persist, regardless of what challenges and obstacles they face. This is concerning because having *ganas* may not be enough to overcome years of educational inequality, as well as institutional practices and policies that weed-out students. Instead, the notion of having *ganas* may force to students to make poor decisions and force them to dig a deeper hole that they may not be able to get out of. More concerning is that when Latinxs are struggling academically some may feel *verguenza* (shame or embarrassment), and thus are likely to withhold sharing their struggle with friends, family, and even institutional agents and attempt to overcome their academic and institutional challenges alone.

Who Are They? Shaping Habitus Through Cultural Values and Beliefs, Class Background, and Lived Experiences

Cultural Values and Beliefs

"I'm here because of my family. They've always supported and encouraged me, and so I want to do well in life so that I can watch out for them and take care of them," said Jasmine, a freshman biology student. Like Jasmine, many Latinx students I spoke with shared with me how family is very important to them, and that family has played an important role in shaping their values, beliefs, attitudes, and behaviors. Among one of the most important cultural values

embraced by Latinxs is their value of education. Past studies have that indicated that Latinx families tend to prioritize family needs over individual needs, and that both men and women are expected fulfill gender specific contributions (Marin & Marin, 1991; Saenz & Ponjuan, 2009; Suarez-Orozco & Suarez-Orozco, 1995). This included setting aside school and having men work and provide for the family, and women fulfilling the role of care giving and staying-at-home (Raffaelli & Ontai, 2004; Saenz & Ponjuan, 2009; Suarez-Orozco & Suarez-Orozco, 1995). However, this was not the case for Latinx students in this study. While most students expressed the value and importance of *familismo*, they stated that their family's needs and responsibilities were not a priority; rather, obtaining an education and focusing on schooling was more important to them and their family. This was consistent with Valencia and Black's (2002) findings in that Latinx families do value education, arguing that the idea of Latinxs not valuing education is simply a myth and stereotype.

While some readers may suggest that the findings of this study may be biased since I interviewed students already in college and who possibly had the support of their families, from the interview data I gathered there appears to be a shift in family expectations in that Latinx families have developed a heighten awareness of how important education is, not only for social mobility, but as a necessary investment for their family's future economic well-being. In essence, Latinx families believe that higher education is an investment in both the individual and their family, which is more important than short term and/or immediate needs. As Lupe stated, for her and her family getting a college education is "really important," stating that "as long as I do what’s best for me and I do well in college, and make sure that my life is way better than it was while I was growing up, then that’s all [my family] ask[s] for. To see that I’m better off after college than I was before." This finding suggests that perhaps there has been a shift in the way

Latinxs make sense of family responsibilities. In the past, it may have been common to work and attend to the immediate needs of the family. However, in time Latinx students and their families have come to understand that Latinx can have a greater impact for their families in the long run by getting education and delaying gratification until they finish college and obtain a well paying career, for which they can use their earned income to help their families and communities (Carey, 2016). Perhaps this is one reason why Latinx parents encourage their children to get an education because they know that their children will be better off.

As stated earlier in chapter 3, Latinx families encourage their children to succeed in school, and they are constantly motivating and supporting their educational endeavors and aspirations (Castellanos & Gloria, 2007). The value of *familismo* can therefore be used as asset whereby strong social and family networks can utilized as form of support for their academic achievement, as described by Yosso's (2005) understanding in familial capital, an important form of cultural capital in her concept of community cultural wealth. Family encouragement and support was a common theme expressed by Latinx students. Thus, it should be no surprise that achieving educational and career goals is a form of demonstrating gratitude and appreciation to Latinx fathers, mothers, grandparents, and/or other family members who have sacrificed their own needs and goals, and encouraged and supported Latinx youth during their educational journey.

Latinx families, especially those from low-income backgrounds, understand that the path to success is not going to be easy, and many families often instill in their children the ethics of working hard, staying focused, and being determined. When it comes to their education, many Latinx families often encourage their children by providing moral support (Auerbach, 2006) and by drawing on life lessons or *modismos*. Modismos are the equivalent of idioms in the English

language, which are essentially phrases, words, or expressions that have figurative meaning. Yosso (2005) would describe these lessons as linguistic capital, a form of cultural capital that is part of her concept of community cultural wealth. Perhaps one of the most common *modismos* used, especially among Mexican and/or Mexican-Americans, when discussing factors that are important for school success is having *ganas*, which generally refers to putting forward great effort, working hard, and/or giving it your best (Easley, Bianco, and Leech, 2012; Gutierrez, 2001; Rodriguez, Castillo, & Gandara, 2013). According to Easley, Bianco, and Leech (2012), the idiom *ganas* constitutes multiple components that are connected to students will and desire to succeed in education. Those components are: "(a) acknowledgement of parental struggle and sacrifice, (b) strong value of family and family's history, (c) parental admiration and respect, (d) a desire to repay and pay forward, and (e) resilience and willingness to persevere" (Pg. 169).

Working hard and having a strong will, or having *ganas*, was very evident among many Latinx students who expressed what they believe are important factors for academic success. The ethics of working hard and being determined, aspects of having *ganas*, are strongly ingrained in the Latinx culture (Easley, Bianco, & Leech, 2012; Rodriguez, Castillo, & Gandara, 2013), and it permeates into the habitus of an individual. For many Latinxs, understanding the social world and making sense of how to survive it and succeed in it takes *ganas*. This personality trait was evident among many Latinx students participants, like Francisco, whom I spoke about earlier and had parents with very little college experience. His motivation for success is to make his parents proud, and to take advantage of the opportunity that his parents never had have. As Francisco says, "I think for success, I would definitely say the push of being determined and like if your parents did not have a background in education then it kind of gives you more of a drive to want to complete it for them and for yourself." Similarly, Jose, a Mexican-American student who is a

senior in Mechanical/Aerospace Engineering, said "I learned, particularly from my mother, that if I want something I have to work hard for it. That it wasn't just going to be easy... [and] I'm motivated to keep doing my work even if the work becomes overwhelming. And I try to remind myself that in the end it's going to be worth it." Drawing on Easley et al. (2012) components of *ganas*, both Francisco and Jose are clearly stating that their passion and will for college success is in part due to honoring their parents, and acknowledging their sacrifice and struggle by ensuring their parents that their hard work and support is what is fueling their desire to succeed.

Latinx families also instill a variety of cultural values that pertain to educational achievement. According to Hill and Torres (2010), some of the more dominant cultural values relating to education include *empenos,* which is defined as having dedication and being committed to a task, *estudios*, which is studying with effort, and *verguenza*, which is having interpersonal humility, self-respect, honor, and shame. Collectively, these cultural values shape the Latinx habitus by instilling in them self-centered, empowerment traits that can motivate them to succeed and accomplish their goals.

Idioms, like *echale ganas*, as well cultural values such as *empenos* and *estudios*, can definitely serves a source of motivation and familial support. However, examining it critically does raise concerns. While on one hand these are wonderful and powerful cultural values that that serve as strong motivational factors. On the other hand, these cultural values suggests that it is only through hard work and effort that people succeed, and if one fails it suggest that it is due to their lack of effort and not because of external factors, such as social inequality and/or discrimination. These cultural values, such as having *ganas*, are self-centered personality traits which are often used to describe why Latinx succeed or struggle, yet they fail to acknowledge the how past and present institutional challenges influence success or struggle. As I will discuss

in more details later in this chapter, for Latinx who are struggling academically, the rhetoric of having *ganas* impacts the decisions they make whereby some students may not seek help when they are struggling academically, and stay in STEM despite facing severe challenges, obstacles, and risks such as being disqualified from STEM or the risk of not graduating at all.

Class Background - Shaping Attitudes, Beliefs, and Behaviors

The experiences in life are shaped by various cultural, social, and personal factors. With regards to class background, there have been numerous studies indicating that families and individuals from working class backgrounds face numerous challenges in obtaining equality, resources, access, and opportunities, which in turn can affect the educational resources and opportunities their children have (Ball, 2010; Jackman & Jackman, 2003; Lareau, 2011; Reay, 2005; Rothman, 2015). Class background also has a profound way of influencing the way you see the world, the way you react to it, and the goals you have (Sayer, 2005). Here, I describe how class background has shaped the experiences and habitus of Latinxs. Many Latinx students I interviewed are from a working class background. Their families have, and continue to, struggle to make ends meet. Growing-up working class means that they lived with financial restrictions. For example, Lupe, a Mexican-American college freshman who is majoring in Biology said, "anytime that I'm spending money, I have to remember that I don't have the money to be spending recklessly so I have to watch out for that and help my family out in a way. So that's how this whole situation has been for me growing up." Other students used their working class background to empower themselves, believing that working hard and being determined will help them get out of poverty. Yvette is one of those students. Growing up her family faced economic hardship. After continuously struggling to make ends, her father eventually saved up enough money and invested it in property. Her father is now a landlord and her family is more

financially secure. During our conversations she often reflected on her family's hard work, the times they struggled, and how hard her father managed to get their family financially secured. Yvette stated,

> "My dad came here 30 years ago with absolutely nothing. He worked at a dairy, making less than $20,000 a year and he had to support a family of 5... So it was really tough, it was really tough, but luckily, I mean with hard work you get to where you want to be and that's the case with my parents."

Growing up, Yvette's father instilled in her a strong work ethic and an attitude of having *ganas* in order to obtain your life goals and become financially secured. For Yvette, choosing a STEM career has been partially fueled by her and her parents desire for her to stay out of poverty and become financially secured.

Perhaps one of the biggest challenges that many working class families face with regards to their children's education is their limited ability to provide adequate academic sources or academic opportunities (Lareau, 2011; Reardon, 2011). For many Latinx working class students and their families, having financial limitations meant not having certain personal or academic resources, or not being able to participate in academic and social opportunities (Lareau, 2011). Take for example Javier, a Mexican-American who grew up working class in San Diego, California. Growing up, his father worked in construction while his mother stayed at home and took care of him and his siblings. During our conversation he often reflected back on how he was different than other students. One of his first encounter and recognition of class differences was in elementary school when he noticed different forms of apparel worn by different students. Javier stated,

> "I remember going to school and all my friends had some cool Nike's or Jordan's, or like really nice GAP sweaters, and I always wanted that stuff, but I almost

> never got it. My parents used to take me to Payless shoes, or take me to cheap stores to buy knockoffs. I would wear them cause I had nothing else, you know. But man I was so embarrassed back then, you know, wearing that stuff... but that's all my dad and mom could afford at the time, you know."

Material culture can work as symbols in society that not only reflect class and cultural identity, but also shape behavior and attitudes (Crane, 2012). According to Crane (2012), clothing and fashion are visible markers of social status, gender, and culture that are used to maintain or control symbolic boundaries, and serve as an indication of people's own position is social structures and how they negotiate those boundaries. Javier understood class differences at a young age, and knew how consumption behaviors served as indicators of class differences. Though, in time, clothing became less important to Javier, however, there were other symbols of consumption that not only reflected Javier's class background, but also reinforced his class struggle and the obstacles he faced while in school. One example was his inability to buy an expensive calculator that could've been beneficial to his academic development. Javier said,

> "In high school, when I was in Math I remember that everyone had the TI-83 or the TI-84 calculators that could do graphs and a lot of more, like, advance math stuff. Man, you know, I remember that I really wanted that calculator, but all I had was this piece of shit from the 99 cent store. It was really cheap, you know what I'm saying. Like, all it had was the numbers and the basic math stuff, like division and addition... So every time we had to, like, do graphs or hard math problems I would have to work with someone in class, or ask the teacher to borrow his... It sucked, especially when I had homework and I didn't have it... The good thing is that it forced me to stay after school and go to homework club where they had the calculator."

Javier's inability to afford the expensive graphing calculator was only one example of how being poor affected his ability to obtain academic resources and opportunities. During my conversation with Javier he also mentioned how in high school he couldn't enroll in ACT prep classes like some other students, but fortunately his parents bought him some ACT prep books

that helped him. Still, he felt that due to his family's financial limitations he could not have the resources, or could participate in ways that could have maybe better prepare him for college. Now, as a college student he feels that his high school experience, in combination with the lack of resources and opportunities he had, partially explains why he struggled as a Bio major and had to change majors to Public Health. His plan was to become a doctor so that he can help his community and become financially well-off, as he put it. He hasn't given up on that dream and he is still working towards his goal of becoming a doctor by taking all his pre-med classes. Yet, he is concerned that he may not have the GPA needed to compete with other Med School applicants. His backup plan if he is not admitted to med-school is to enroll in a post-baccalaureate program to strengthen his academic background.

Being from a working class can limit the social and academic resources one has, as well as the opportunities one is exposed to. While being low-income can be very devastating and have severe impacts, many Latinx students, like Lupe, Yvette, and Javier, often reflected on their class background and use it to empower themselves to strive for a better life and achieve social mobility. Being working class has had a profound influencing on Latinx students' attitudes and behaviors, which has motivated them to work hard in order to obtain the things that they want most in life. In fact, many of the Latinx students I spoke with stated that one of the main reasons why they chose STEM is because of the financial and career opportunities that come with it.

Latinx Experiences and Aspirations - Obtaining Social Mobility Though Education

When I asked Yvette why she wanted to major in STEM, her response was clear, she wanted a career that was fulfilling and financially rewarding. Yvette's exact response was:

> "I'm determined to stay in [STEM], no matter how hard it gets because, well not only because STEM careers have really good paying careers, but because my parents say 'get a career that is going to pay you well and be financially stable, so that you don't have to go through what we went through,' type of thing."

For Yvette and many Latinxs like her who grew up in a working class background, her and her families experience with poverty served as a source of motivation to obtain a secure and well paying career. Yosso (2005) would describe this as aspirational capital, which is again the ability to maintain hopes and dreams, have resiliency over perceived barriers, and persist in order to be in a better educational and economic position.

Living in an economically diverse world heightens the awareness of class consciousness, as well as the differences among and between different class groups, positive or negative. Class and economic background can impact the types of artifacts possessed, the social activities one engages in, the type of property (if any) one can acquire, and the type access to resources and opportunities one has (Jackman & Jackman, 2003; Reay, 2005; Rothman, 2015). It is well known that those from working class background often struggle to obtain not only essential needs, such as quality food or healthcare needs, but also struggle to obtain the things they desire in life, like owning property (Rothman, 2015). It should be no surprise then that some people who grew up in, or are living in, poverty are trying to find ways to obtain social mobility so that they can obtain the things that they want in life. For many individuals from working class backgrounds, education is the pathway out of poverty.

Obtaining social mobility through education is very much a possibility. Social mobility is generally defined as a way individuals or groups move between different social class statuses within a social hierarchy (Neelsen, 1975; Sorokin, 1998). Many scholars have long argued that education is a great equalizer in society and can be used as an important tool for obtaining social

mobility (Brown, Reay, & Vincent, 2013; Neelsen, 1975; Sorokin, 1998). Employment or occupational status, income, and level of education are the most often used metrics to define an individual's social status (Hauser, Warren, Huang, & Carter, 2000). More specifically, research on occupational status, income and education have consistently found a positive correlation between the level of education and income earnings (Hauser, Warren, Huang, & Carter, 2000; Hout, 2012). For example, the median income for individuals holding a professional degree is roughly $102,000/yr, which is higher compared to individuals who hold a bachelors degree ($56,000/yr) and for those with only a high school degree ($35,000/yr) (College Board, 2013) (see figure 4). In addition to greater income, research also suggests that people who have higher levels of education have healthier lives, have greater access to resources and networks, and are more civically engaged—all of which are indicators of a middle or higher social class status (Brown, Reay, & Vincent, 2013; Hout, 2012).

It is not uncommon for Latinx parents to want their children to do better than them, and many believe that education is one of the major factors that can help their children achieve social mobility. This was true for many Latinx students I spoke with who believed that education is a vehicle that can get them out of poverty and into middle class. As Sandra stated, education

> "was my escape, and I knew it since I was born. Because back home, I already knew that college was a thing because I didn't want to work a minimum wage job for the rest of my life, cause I see my family and like my friends doing it [and] it's not a good idea and you are going to be poor forever. Um, and I don't want to be poor."

Similarly, Lupe said, "I wanted to better my life and not have to struggle as much as my parents did, but also to be able to give back to them. Also because my parents pushed me a lot toward education. They made it really important a lot while I was growing up."

Latinx families understand that education is an important tool for social mobility. This is why many Latinx families instill the value of education to their children at a very young age. There are various ways parents can support their children's education, which include providing tangible (i.e. providing resources), moral, social, informational, and academic (i.e. helping with homework) support, which may differ to the traditional parental involvement expectations and perceptions that institutional agents believe (Lopez, 2001; Zarate, 2007). Throughout elementary school, middle school and high school, many Latinx parents draw on their community cultural wealth to reinforce the value of education on their children, and demand that they pay attention in school and work so that they can go to college, obtain the career that they want, and to get out of poverty. Zarate (2007) argues that Latinx parents believe that by providing moral and social support their children will develop good classroom behaviors that will allow for greater academic opportunities and success. "My mom was always big on making sure I went to school so that I get what I wanted. She said, 'you are going to be the one who gets us out of here.' She was always big on the sense of schooling. A little bit too much, but it got me here," said Mario. There is a growing awareness among Latinx families that in order to live a comfortable life and obtain the things that they want in life that they need to have a good paying career, and that many of these careers require higher education credentials.

Overall, the habitus of Latinxs is shaped by their cultural, social, and lived experiences. Latinxs come from a culture that values family and community, and one that is very supportive of their children's educational and career aspirations. Latinx also have a strong work ethic and believe that achieving their goals can be accomplished simply by working hard, or having *ganas*. Many Latinx participants I interviewed are from working class backgrounds. Their class experiences, particularly the struggles, obstacles and challenges of living in poverty, motivates

them to obtain the highest level of education so that they can not only obtain social mobility and economic stability, but also have means to help their family as well. Collectively, these experiences and values motivate Latinx youth, especially those from working class backgrounds and first-generation college students, to attend, persists, and succeed in college with the intention of obtaining social mobility and achieve what some call the American dream (Banks-Santilli, 2014).

For many Latinx youth, drawing on *ganas* and *familismo,* as well as reflecting on their class experience, can serve as a form of empowerment and motivation to succeed in college (Yosso, 2005). However, for some, these values and experiences fail to recognize the institutional challenges and obstacles that can hinder their success. As I will describe in more detail in the next section, when Latinx students do struggle academically, their values and lived experiences can sometimes work against them in that struggling students will often isolate themselves and do not share with their family their academic struggle because they do not want to cause concern, fear disappointing them, fear being blamed for not working hard or not having *ganas*, or simply because their family won't understand their struggle. As a result, many struggling students do not share their struggle with anyone and often are left along to figure out things for themselves.

In the next section, I will highlight how student's habitus, shaped by their cultural values and lived experiences, shapes student behaviors. In particular, I will describe how Latinx students draw on *familismo* and *comunidad* to help them develop a supportive network in college that can provide support, information, and resources to help them navigate college. Furthermore, I will also highlight the challenges and limitations of their habitus. More specifically, I will highlight how the cultural values of *ganas* and *verguenza* not only forces some Latinx students to

both isolate themselves and not share their struggle with anyone, including their family, but how it also affects the decisions they make with regards to staying or leaving STEM.

Latinx STEM College Students - *Navigating College*

Seeking Academic Support

College is sometimes described as a rollercoaster of emotions and experiences (Christie, Tett, Cree, Hounsell, & McCune, 2008). Students, regardless of race, gender, and class are likely to experience academic, social, and personal hardship. However, the amount of negative experiences, and the consequences or impact of those experiences, can be somewhat controlled or alleviated, depending on types of resources, information, support, and preparation a student has for college. Wealthy students, for example, are more likely to have parents who are educated and can transmit important information (cultural capital) and provide resources to successfully navigate college as well connect them to individuals (social capital) who can help them along their journey (Wells, 2008). Students from working class background, on the other hand, may not have the same access to information or resources, and thus are more likely to struggle overcoming the challenges and obstacles the face during college (Walpole, 2003).

In this study, most participants were from working class families, many of whom were also were first-generation college students, meaning they are the first in their family to go to college. Since many of the participants parents never went to college, their ability to help their children navigate college was limited. Zarate (2007) similarly found that as Latinx youth progressed through school their parents found the content and course material more difficult to understand, and therefore could not provide academic support in the form of homework assistance or tutoring. In this study, this also meant that many Latinx parents who had little

formal education could not guide or help their children obtain access to college, nor help them persist or succeed in college. As Mario describes, "I had to figure it out on my own. Ever since high school and applying to college and all that and being here." This was not the case for all Latinx students. A few students had older siblings who attended college and were able to provide guidance with the college application process, yet for most students their siblings were unable to provide academic assistance since most were busy with their our academic responsibilities.

A few other Latinx students did have parents who attended college, with a few earning Bachelor's and Associate's degrees. However, again only a few of them were able to provide information and academic support for their children both before and during college. Take for example Yolanda, a Honduran-American who is a junior in Chemistry and Environmental Science at UCP. Her mother graduated from a California State university with a liberal arts degree. Since her mother had experience with successfully navigating high school and also graduation from college, she was able to help Yolanda with her school work during high school and college. For Yolanda, her mother was very instrumental to her past and current success, stating that "I wouldn't be here without her. She's the one that has helped me the most, and she keeps telling me to keep going, to just keep going." In contrast, Kathy, a Mexican-American who is an undeclared/undecided student trying to get into the Chemistry program, had a different experience. Though Kathy's mother attended community college, she did not do well academically in high school, nor did she understand how to apply for 4-year colleges. Thus, Kathy's mother was limited in her ability to academically help Kathy during high school and in college, as she explains:

> "[My mom] went to community college, but she dropped out. She didn't like it... She used to help me with homework, but not so much in high school... and now

> she really can't now. It goes over her head, you know, stuff with calculus and chemistry. She doesn't get it, so I can't ask her for help."

Yolanda and Kathy were among a few who had parents that attended college, yet differed in the types of support their parents could give them. Most students, however, had parents that didn't have the education and/or knowledge to help them with their high school and college classes. Their parents inability to help them during college only exacerbates the challenges they face during college, especially in STEM as they competed with students who had parents who could inform, advice, and were better able to support their academic needs.

Given that many Latinx parents were limited in their capacity to help their children, some Latinx students I spoke with either turned to campus programs and/or other student services, student organizations, and/or friends for academic support, while others isolated themselves and tried to navigate college on their own. Some Latinx STEM students did managed to develop networks and obtain academic support. Others, including those that sought and found networks and academic resources, were not so lucky.

As I stated earlier in chapter 3, *familismo* and *comunidad* are important aspects in the Latinx culture. While in college, it is important for some Latinx students to try and establish meaningful and supportive relationships with other Latinx students. This is why some Latinx try and develop friendships and obtain guidance and support from Latinx faculty. These networks of students and faculty would often develop into an academic family, which is a network of Latinx students and faculty that played familial roles (providing support and care, and sharing resources) (Delgado-Guerrero & Gloria, 2013). To create an academic family, some participants sought out Latinx student led organizations or racial/ethnic minority campus programs or services, while others tried to make friends to study with.

"I met most of my friends in LS. We study together, and like we help each other out. If I don't know something I can just ask my friend, 'hey, do you know this? Can you help me?' and like they help me," explained Nancy when describing how the Latinx student led organization has been very helpful for her in developing friendships and finding academic support. Nancy's friendships, brought together through the LS organization, has developed into something meaningful, as Nancy described, stating that they do everything together, from studying to simply just "hanging out," "staying at each other's dorms and eat each other's food (laughs)." Nancy describes the value of her relationship with her friends, by stating, "it's like we are sisters," suggesting that building family like relationships in college was important to her. These friendships are very beneficial in that Nancy and other Latinxs like her can share information and resources, and support one another, which can be helpful in successfully navigating college.

Attending and participating in a Latinx student organization was one way that Latinx students were able to obtain the social and cultural capital they needed to navigate college. Other Latinx students developed friendships with other Latinxs in their dorm, or through other social means. "I met a couple of Latina girls that were in my same bio class, and after that we said 'let's study together, let's sit together, let's do homework together,'" said Patricia. When I asked why she enjoyed working with her Latinx classmates, she stated "because we are the same, like Latinas, and we help each other." Again, the value of *familismo* and *comunidad* draws Latinx to one another because they get a sense of authenticity, and because they believe that Latinxs are genuinely interested in helping each other.

Finally, another form of support that Latinx students sought to help them navigate college was seeking out institutional forms of support. There were a few programs on campus specifically dedicated to helping racial/ethnic, first-generation, and/or low-income students

obtain the resources and support they needed to navigate college and beyond. These programs offered all students opportunities to be involved in research and internships, often connecting them with faculty or professionals who were similar to them and had a shared interest. They also provided students with resources, such as free peer tutoring services, and information on how to navigate college. Yolanda was grateful for the services provided by these institutional programs, claiming that they helped her "become part of UCP," and that she "was able to learn about professors, make friends with a lot of people, and make mentors." Many of these programs were run by women of color, all of whom were aware of the challenges that racial/ethnic minorities, low-income, and first-generation college students face in college. These Latina administrators put a lot of effort in helping these students thrive and succeed.

Despite having institutional programs and Latinx student led organizations that have resources and provided support to Latinx students, there were many students in my study who were not aware of these programs or organizations. Administrators of these programs, as well the leaders of student led organizations, bring awareness of their existence by attending student orientation and by posting posters and flyers around campus. The most common, and consistent form, of advertisement for these organizations and programs is through emails. Yet, these forms of advertising are not reaching all students. When I asked students if they have ever seen any ads or received any emails about campus programs or Latinx student organizations, most Latinx students said they had not. Students are exposed to so many emails, posters, and ads on campus that they pay little attention to them and often skim or ignore them. Some students do manage become aware of them only after being informed by academic advisors of their existence. Even then, not all students seek those organizations or campus programs.

While having student led organizations and programs on campus that provide resources and support can be very beneficial in helping Latinx students build a supportive network that can provide academic resources, this doesn't suggest that they are effective in helping students. In this study there were some students who sought out services and support from student organizations and campus programs, yet they were unable to obtain the social and cultural capital needed to overcome their academic struggle. For example, both institutional agents and students themselves have indicated that study groups are helpful for students who are struggling with their class material. This is one reason for why student led organizations have created spaces for students to study together. Yet, some Latinx students I spoke with indicated that they had a hard time making friends in the Latinx organization, even though many shared a similar cultural background. Melissa said, "when I was a freshman I went to LEAPS, but I felt like the girls there, like, they already had their cliques... so it was hard to make friends. That's why I stopped going." Other Latinx students felt that the Latinx student organization study sessions were not a useful space. For example, Juan said, "I tried going to the [study jams] in LS, but it was too loud for me, so like, it was hard to concentrate... Oh yeah, and also, like, I felt like people kept asking me for help, and I helped them, but when I needed help, like, no one could ever help me because a lot of people just didn't know the material. So, it just wasn't for me." A few other Latinx students stated that the organization couldn't fully help them overcome their academic struggles, even after attending study jam sessions and getting tutoring from other members. In fact, in my informal conversations with the leaders of the Latinx student organizations, many of shared with me that there are a lot of Latinx students in their organization who are struggling academically, and that many reach out to them for help, but there is very little they could other than provide study spaces and inform them of campus programs and resources that are available. Furthermore,

these leaders also stated that many students who come to the organization seeking academic help and find no help end up leaving or never coming back to the organization.

Much like student led organizations, STEM campus programs that serve racial minorities are not fully equipped to help students overcome their academic struggles. For example, the Center for Academic Sciences and Advancement (CASA) that serves racial/ethnic, low-income students, and first-generation college students provides free tutoring for their students. However, tutors hired for these positions are often students themselves who have recently finished the class. The requirement to become a tutor is that a student must have both taken and performed academically well in the classes that they plan on tutoring. Most tutors focus on a few STEM classes to tutor students on. The more common the class the more tutors the program has to tutor those classes, and the less common the class (typically advanced and upper division classes) the fewer tutors they have for those classes. Tutors typically work one to two days a week, for one or two hours a day. Therefore, students who need academic tutoring must come during a specific hour that a tutor is there in order to get help. Even when students do arrive, the tutoring sessions are not usually structured, and most tutors expect students to come with questions. Furthermore, most tutoring sessions are held in or near the campus program offices themselves, which have limited space for tutoring. Students typically sit on a few couches available in the office, or sit on chairs outside the program office during the tutor sessions. However, when these spaces get crowed it can limit both teaching and learning.

Overall, Latinx students draw on their habitus, specifically their values in *familismo* and *comunidad*, to seek social support from other Latinx students, Latinx organizations, and minority serving campus programs. While these organizations and programs provide academic help, oftentimes their services, such tutoring and study group sessions, are often subpar and cannot

help students with all their academic needs. This is not to say that these campus programs, or student led organizations, are not effective in helping Latinx students. In fact, for students who are not struggling academically, these programs and organizations provide students with a number of great resources and opportunities, such as internships, research opportunities, mentor/mentee networking, and leadership experiences. However, providing students with academic specific resources and support, such as tutoring, is often limited and subpar due to these organizations and campus programs financial constraints.

Having little institutional academic support from organizations and campus programs, along with not being aware of such resources, partially explains why Latinx sometimes navigate college by themselves. The cultural value of having *ganas*, as well as concerns of how their family would respond to their academic struggle, are another two major reasons for why Latinx students who are struggling academically keep their struggle to themselves and try to overcome their academic challenges alone.

¡Echale Ganas! - The Pressure of Family and Cultural Values

At a young age, many Latinx parents tell their children that they have to work hard to earn the things that they want. As stated earlier, *ganas* means to have put forward great effort. Many Latinx families instill in their children the value of having *ganas*. Over time, this idiom becomes woven into their habitus and becomes part of what they believe and how they make sense of success and failure. *Echale ganas* is much like the idiom "pull yourself up by your own bootstraps," which means to succeed or elevate yourself without any help. Both idioms are rooted in the discourse of meritocracy. Even when the playing field is not leveled, Latinxs are expected to work hard to accomplish their goals, despite the challenges and obstacles in their

path. Having *ganas* is closely related to grit, which is the ability to persevere regardless of any challenges and/or obstacles. Grit and *echale ganas* are intertwined and rooted in the discourse of meritocracy. They individually and collectively place the onus on the individual to succeed, regardless of how difficult the path may be. If Latinxs STEM students struggle or fail in their education, they are concerned that members of their community, and their family, may perceive it as a flaw in their character, suggesting that they didn't have *ganas,* rather than questioning institutional practices and policies that create challenges, inequalities, or other forms of oppression that keep Latinx students form succeeding.

Perhaps what is the most troubling aspect about *ganas*, or the expression of *echale ganas*, is that the components highlighted by Easley, Biacno, and Leech (2012) become a reason for why some Latinx students do not seek academic support services in college, or inform their parents of their academic struggle when they are faced with academic challenges in college. Typically, when Latinx youth inform their parents that they will pursuing a college degree, especially one in STEM, it is very common for their family members, particularly their parents, to express their joy and pride by telling their extended family and close friends that their child is attending college and that they are on their way to becoming a doctor, engineer, nurse, or any other prestigious STEM career. "Mom my is bien chismosa, she tells everyone that I'm gonna be a doctor," said Yvette. "My tia called me the other day and out of nowhere she told me she was proud that I was going to be a doctor... I was like, 'who told you?' It was my mom, of course," said Nancy, a sophomore Biology major. The desire to make their families proud increases the pressure to not only succeed, but makes it more difficult to reveal their struggle, especially when their extended family and close friends become aware of their goals.

Unfortunately for many Latinx STEM students, their families are not fully aware of the obstacles and challenges in their pursuit of both being admitted to, and succeeding in, STEM at college. Many Latinx parents are under the impression that succeeding in college is transparent in that all it takes is *ganas*, or hard work and motivation. However, as I have, and continue to describe, there are a number of institutional challenges and obstacles that create barriers in obtaining a STEM degree. As a result, many of the Latinx students I spoke with do not inform their family about their academic struggle for many reasons, One main reason is because students feel their family simply may not understand their struggle. When I asked Sandra if she has shared with her family that she was struggling in STEM, she responded:

> "I don't feel like I need to tell my family or friends that I am not doing good. Like, I don't want to seem like I am struggling. Like, I tell whoever I have to tell, but I am not going to. Like, with my tias and stuff, they ask 'oh, how is school?' and I say 'it's fine.' We don't need to talk about it, like that's it. Cause, I don't know, I want to seem like, like I got here and I am able to do it, and they don't need to know the little details because for the same reason that they don't know what it is like. To them it is just higher education."

I asked her, "what do you mean that they don't understand?" and she said:

> "My family, like, I haven't spoken to them about school work because they won't understand what I am going through. Like my dad he has a good mindset, like he would say 'anything is possible.' But like he is not as realistic as I would want him to be because I am the only one who has gone to college, so I always tell him 'you haven't been in my shoes and you don't know how hard it is and how much work you need to put into it.' And you can tell someone over and over, but they will never know until they actually do it."

From the interview, I gathered that Sandra doesn't share her struggle with her family because on one hand she is prideful and wants her family to believe that she can succeed. She wants to maintain an image of resilience and perseverance to succeed. On the other hand, she doesn't share that information with her family because they simply won't understand her struggle. The unfortunately reality is that Latinx parents who have little experience with schooling in the

U.S. are less likely understand how complex the system is, and how policies and practices hinder the ability of their children to both persist and succeed in college (Auerbach, 2004; Chrispeels & Rivero, 2001; Zarate & Burciaga, 2010). Latinx parents may not understand what their children are experiencing, nor do they have the resources to help them. Most of what parents can do is morally and socially encourage and support them, but that may not be enough.

An overwhelming number of Latinx students also said that they don't share their struggle because they are prideful, and feel ashamed because is some ways struggle may be viewed as a sign of weakness. The cultural value of having *verguenza* (embarrassment or shame) and *ganas* shapes the behaviors, forcing some students to not seek help when they need it, or they seek help when it's too late. Take for example Jose, a first-generation Mexican-American grew up in Los Angeles. Growing-up he attended a charter schools because his parents believed the school would help him develop intellectually and help him become better prepared for college. At a young age, his family instilled in him the value of education, working hard, and having *ganas* to succeed. While these cultural values have been in empowering in many ways, they also pose learning challenges for Jose. When I asked Jose who he asks for help when he needs it, his response was:

> "I'm kind of hesitant to ask for help... I mean the standard that I hold myself to I feel like it's a pretty high standard... I could go to [my friends] and ask for help but I mean it's not a matter if they could help me cause I know they could help me, it's a matter that if I'm struggling and I fall behind on work it's just a matter of I guess loosing that recognition or like I want to be able to succeed but I don't want them to look at me differently."

Jose response highlights the challenges associated with his cultural values in that asking for help stirs up feelings of inadequacy and *verguenza* (shame), and that asking for help contradicts his own efforts and hard work (*ganas)*.

Another common reason for my Latinx students keep their struggle to themselves is because they do not want to burden their family with more stress. Many of the Latinx students I spoke with have parents who have tremendous financial and family responsibilities, and they are concerned that informing them about their struggle will only add more stress to their lives. Take Olivia, for example, a junior in Chemistry who said, "I try not to tell my parents, or family, because I think that they're going to be worried too." Latinx students are acknowledging their parental sacrifice and struggle, and they believe that informing them of their academic struggle will burden them with concern.

While there were many students who withheld sharing their struggle with their friends and family, there were some Latinx students did share that information. Those who shared their experience stated that their family were sympathetic and encouraging, and that most believed that that it didn't matter that they weren't in STEM, as long as they were studying something that they liked and were happy, then their parents were happy as well. Contrary to what Latinx STEM students believe, most parents will be sympathetic to their children' academic struggle, and will continue to encourage and support them and not pass any negative judgment, or be concern so much that it will affect their lives.

Unfortunately, many Latinx students continue to believe that they are solely responsible for their success and/or failure. The next section highlights how the cultural values of working hard and earning what you get is very evident, especially among academically successful Latinx who often blame Latinx students for not succeeding in college.

Student Perceptions of Success and Struggle in STEM

Exploring how Latinx students understand success or struggle in STEM was a central question in this dissertation. Among Latinx students, there were differences in perception, particularly between students who were academically successful and those who weren't. Students who were more successful attributed *ganas* to success. For example, one student said to me, "I think one of things that my parents and grandparents have told me is to keep on going, no matter what... So when [students] fail it's cause they stop trying. It gets too hard and they give up. They stop focusing, and they stop caring, so they go to Chicano studies where it's easier." Even among students who were struggling, they often reflected inward when discussing their struggle, saying things like "I didn't study enough" or "I didn't try hard enough." One key difference between students who succeeding and students who were struggling is that those who struggled believed that there struggle had more to do with their lack academic preparation and the lack of institutional support.

A less common, yet important to mention, explanation for why Latinxs struggle in STEM was due to family expectations and gender roles. This perception was particularly popular among a few men who were more successful in STEM. For example, Vicente, an exceptional transfer student, shared his belief for academic struggle, particularly when it comes to female Latinx students. Vicente stated:

> "More so on the Latino side, Latinas in STEM that are female and Mexican American, they have this, I guess parents have a view of their daughters of being the big care takers of the house, so if they go off to college and live in the dorms they expect them to come home of the weekend and take care of siblings or do other responsibilities at home, when that can be a lot to bear... So, I think it just comes from the different background your parents grew up in and their ideals for you."

For Vicente and a few other male Latinos like himself, it is difficult to set aside the cultural gender norms, especially for women. They believe that women who participate in care-taking activities risk negatively influencing their academic success. However, from the conversations I had with female students, this was not the case. Many didn't have any family responsibilities, and for those that did they were not overwhelmed with those responsibilities, nor did they take time away from their studying. Furthermore, the gender stereotype was held only by a few, successful male students. Most male students, and all of the female students, had little to no family responsibilities, and if they did, it did not distract them from studying.

The most common explanation used by Latinxs when describing why they struggled in STEM is because of their lack of high school preparation. UCP has demanding and competitive admissions requirements. Most Latinx students admitted to STEM programs at UCP were selected based on the same measures used to measure college readiness. The average, self-reported, GPA among the participants, with the exception of transfer students, was 3.47. I didn't ask students for their college entrance exam scores, but examining the average GPA's and exam scores for each department revealed that the students selected for each STEM major at UCP had high entrance exam scores and high GPA's. Despite having great college entrance requirements, some Latinx students struggled academically in STEM.

When I interviewed Latinx student participants, many describe the shortcomings of their high schools and their inability to help them. They believed that their high schools failed to prepare them for college because they lacked resources and quality teachers. For example, when I asked Olivia if her high school had prepared her academically for college, she responded "no, definitely not! I feel like; first of all, I mean we didn’t even have chemistry or physics. Even a general background [in chemistry or physics] would have been helpful. I found out that like a lot

of the [college] students who are in my classes for them it was review, like 'oh yeah, I remember this from high school' but for me it was all new."

Like my conversation with Olivia, most students felt that they were not as academically prepared as other students in their STEM classes. For example, when I asked Sandra if she believed her high school prepared her for college she responded:

> "No, not at all...I felt like a really big difference from high school to college. And I think that's a regular thing, but it was just like really extreme. Like, I didn't find my high school classes hard at all. Um, I only took one AP class, but even with that I didn't stress about high school. So it was really weird when I started struggling here, because I was like getting really good grades in high school and then you come here and you're not getting good grades, and then it messes with the person you thought you were. Cause I've heard of people who graduated as a valedictorian and then they come here and it is the opposite."

When I asked Carlos, he said:

> "No (laughs)! High school didn't prepare me at all. You know, the high school itself didn't even have a football field. We were really, really underfunded. Um, some of the classes were actually portables. The classes were packed. You know, it really wasn't about education. The way I saw my high school was more about 'okay, let's make sure we hold these students together until 3 o'clock or 3:30 and once 3:30 hits who cares, let the them go.' It was more like keeping us busy; it wasn't about teaching us."

Eva, a freshmen Mexican-American Latinx who was pre-medical student studying public health said "it's a straight up no... Our science department wasn't great. Our teachers weren't the best." When I asked if that affected her in her STEM classes and she said "yes, I'm definitely behind. I'm always trying to catch up." Olivia, Sandra, Carlos, and Eva were among the many Latinx students who felt that their high schools were subpar and they could academically underprepared them due to lack of funding and adequate teachers. Their high schools failed to help them develop the valuable cultural capital they needed to thrive in STEM. Their high schools inability to prepare them academically created a ripple effect in that as college students

they are constantly trying to catch up with each class they take, trying to learn both the fundamental material they should've learned in high school and the current material presented in their college classes, which for many is overwhelming and very stressful.

Despite attending poor high schools that academically underprepared them, their habitus—the value of working hard, having pride, being determine, and having grit or *ganas*—motivates many Latinx students to press on and try to achieve academic success, regardless of the limited educational resources, opportunities, and preparation they had in high school. The value and work ethic of working hard, as well as being very prideful, is very ingrained in the Latinx culture. However, these cultural values may work against Latinx college students who believe that having *ganas* is all that it takes, when in reality it is not, and for many Latinx students who guide their behaviors and decisions based on *ganas* may find themselves facing more struggles and challenges, as I will describe in the next section.

Academically Struggling Latinx Students

Making Sense, and Responding to, University Policies and Practices

In college, it is very common for some students to change majors (Montmarquette, Cannings, & Mahseredjian, 2002; Riegle-Crumb, King, & Moore, 2016). As undergraduates, students take a variety of different classes that they need to fulfill certain requirements, and in that process they may find a topic or major that is of interest to them. It is enjoyable, perhaps, to find a major that you value and find interest in. However, struggling academically and being in an academic situation where you are given the option of being disqualified from the university or the option of changing majors, most students take the option of changing majors. For some Latinx students, struggling in STEM can be an indication that this major is not for them, and

being advised to switch majors is viewed as good advice and a good opportunity. However, most Latinx students who I spoke with who were asked to changed majors by academic counselors struggled in coming to terms with this decision, contemplating what went wrong and what their future holds for them in a major that they have no interest in.

As discussed earlier, working class Latinx view STEM careers as viable pathways out of poverty. Their habitus, shaped by lived experiences, as well as their cultural and family values, led them to want to escape poverty and obtain a prestigious STEM career, which to them can be achieved through hard work, perseverance, and motivation. When Latinx college students who are majoring in STEM are struggling academically and are advised by counselors to change majors it not only threatens their opportunity to escape poverty, but it challenges their habitus by questioning their *ganas* and their commitment to succeed in STEM.

When a student majoring in STEM struggles academically and fails a course, or obtains a low cumulative or low quarter GPA, they are placed on academic probation and are asked to speak with an academic counselor. Conversations about why a student struggled are examined holistically, with academic counselors asking questions relating to why students struggled, be it personal and/or academic reasons. Regardless of what may have caused students to struggle academically in the first place, one of the first recommendations given by academic counselors for students who are struggling is to change majors. Some Latinx students do switch majors, while others were more resistant and perceived the recommendation to switch majors as a malicious attempt by the institution to push them out of STEM. These responses were the most common experiences that many Latinx students shared with me when they were academically struggling and were presented with the recommendation to change majors.

Melissa was one student who viewed changing majors as something positive. Her story captures what a few other Latinx students like her felt when they struggled academically and decided to change majors. Melissa is a first-generation college Mexican-American student who grew up in San Diego. Growing up, all Melissa wanted to do is to become a doctor because she really "wanted to help people," and doctors were among the few people she knew who helped others with their healthcare needs. She wasn't aware of the various careers involved in helping people obtain adequate and affordable healthcare. That all changed when she began having academic difficulty. Melissa stated, "I really didn't like math, or chemistry. Like, I really hated chemistry. I did bad on both my calculus class and my chemistry class, but that's because I just didn't like what I was studying. Like, it just wasn't for me." After struggling with math and chemistry she was placed on academic probation. Soon after she decided to speak with an academic counselor who shared with her the various different career pathways she could take. Melissa shared with me the conversation she had with her academic counselor, stating:

> "I talked with my counselor and I told her what I wanted to do in my life, which is like to help people get good healthcare, you know. So we talked, and she was the one who told me about Public Health. I didn't know anything about that... We talked more, and then I decided to take a few classes and I fell in love with it. Oh my god, like it was night and day! I really liked the classes and teachers, and I felt like I was really learning something... So after that I decided to change majors to Public Health and so... honestly, it was the best decision I made, for real."

Melissa was one a few students who I spoke with who had a positive experience with counselors and believed that changing majors was a positive decision. This was not the case for most Latinx students, many who perceived the advice and recommendation provided by academic counselors as negative. Patricia was one of those students.

When I met Patricia she was a junior at UCP, majoring in Public Health. Patricia began her college journey as a Math major. Despite doing really well in high school, earning an overall G.P.A. of 3.7, she struggled academically her first quarter in college. When Patricia arrived to UCP she underestimated how rigorous the STEM classes were and how fast the quarter system was. She not only had poor planning, but she felt that she didn't understand the material. She became very overwhelmed academically, and felt that she was always trying to catch up on old material and being on top of the new material in class. Unfortunately, Patricia struggled during her first quarter and performed very poorly. At the end of the first quarter she received an email stating that she was placed on academic probation and that she was required to speak to an academic counselor regarding her academic progress. She met with an academic counselor who discussed her options and insisted that Math wasn't for her, suggesting that she should pursue a different major. Patricia perceived the advice and recommendation by the academic counselor as being unsupportive and unhelpful. She was upset that her academic counselor suggested that she change majors rather than work on plan to get her back in good academic standing. In Patricia's own words, she described her frustration with the academic counselor, stating "I was mad because first of all, 'did I ask for your opinion? I didn't ask for that, I asked you to help guide me for some resources,' you know. 'I don't need you to tell me to change majors. Like you already don't have faith in me." Though Patricia had no interest in changing majors, she was in tough situation and needed to do something to get back on academic track. "I was about to get kicked out, so I switched to undeclared and undecided," said Patricia. When she went to speak to an academic counselor in the undecided and undeclared office they advised her to not take any more STEM classes the rest of the year, which made her feel like the institution did not "believe in [her] or support[ed] [her]."

The decision to change majors did not come easy for Patricia, who believed that a STEM career would get her and her family out of poverty. However, this was not the end of STEM for Patricia. She eventually declared a major in Public Health and, despite the counselors advice to not take any further classes in STEM, she continued to take STEM classes in order to fulfill the prerequisites needed to pursue a graduate degree in Chiropractics, stating "I took science classes because it's my money and I am going to study what I want to study." Fortunately, Patricia did managed to pass her STEM classes with what she told me was a "B average." The last time I spoke with her I was happy to hear that she was en route to graduating and was applying for graduate school.

For Latinxs like Patricia, who are working class and first generation college students, the decision to switch majors is not easy because they want a STEM career and they want the economic rewards associated with a STEM degree. This was the case for Sandra, one of the students I wrote about in the first chapter, who shared the same experience as Patricia. Like Patricia, Sandra struggled her first academic quarter. She placed on academic probation and was asked by her counselor to change majors. In my conversation with her, she informed me that her counselor was trying very hard to convince her to change her major. She stated, "my counselor said 'there are 84 majors so there is something you're bound to like.'" I asked her why she didn't change majors, and she responded by saying "I want something that is going to secure me after graduation, and Bio is that for me." I then asked what she did after the academic counselor asked her to change majors. Sandra replied, "so when they told me that stuff I was like 'ok, thanks,' but like in my head I was like 'this is what I want to do.'" Sandra wanted to continue in STEM, but she felt that she had no other option but to change majors to undecided and undeclared and work her way back into the Biology major.

The idea of giving up on their career goals, coupled with the thought that the new career you choose may not be as economically rewarding as STEM careers, can come with a lot of emotional strain. Many Latinx students who changed majors as a result of their perceived failure had expressed disappointment, anger, and/or sadness. It is common for people to express these emotions when failing to meet expectations (Stets & Turner, 2014). This was the case for both Patricia and Sandra who did not want to change majors and had a difficult time accepting the change and leaving the STEM field. From the experiences counselors shared with me, most students do change majors after being placed on academic probation. There are, however, a few Latinx students who did not change majors, despite the information and advice presented to them by academic counselors. For those that decided to stay in STEM, only a few managed to overcome their academic struggles. The majority of Latinx students who stayed in STEM after being advised to change majors continued to struggle and end up either forced out of the major or forced out of the university entirely. Carlos, Miguel, and Jorge are three students who refused to change majors, and all three had different experiences.

Carlos is Math major who transferred from a community college. The transition to UCP was difficult for Carlos. He excelled academically at community college, graduating with a 3.7 GPA, yet at UCP he faced many academic challenges and often struggled to understand his class material. After his first quarter at UCP his GPA was a 1.7, and therefore he was subject to academic probation. Like many students in his situation, he received an emailed by the Math department which asked him to make an appointment to speak with an academic counselor and discuss his academic standing. He thought he would be meeting with them to discuss resources, opportunities, or support services, but was surprised and became upset when the academic counselor suggested that he change majors. Carlos stated:

> "This counselor told me, 'technically, because you already failed this class they could really dismiss you, they could really disqualify you, but this is kind of like a warning. This is us helping you.' Then they started saying like, 'oh, were not here to stop you from pursuing your dreams, were here to help you, but maybe your dream isn't to be a math teacher. Maybe it's to be a counselor you know? You're involved with the community, so why don't you be this, or why don't you go into this other department here, or this school, or look into this major. Look, you did good in the Chicano/Latino history course. You got an A- there. Maybe that's your calling?' It's like, 'what basis are you going from that?... I mean, I speak really good Spanish so I should just be a Spanish major?'... It doesn't work that way."

For Carlos and others in a similar academic situation, changing majors is simply not an option. Choosing to stay in STEM is often fueled by personal and financial reasons, with most Latinx students believing that STEM can help them make a difference in the world, and that a STEM career creates greater financial security. When I asked he if he has ever thought about changing majors he smiled and then slightly laughed, saying "no." He then described why he wouldn't change majors, saying:

> "I mean I have my days where I'm just like 'maybe I should change my major,' but then the way I look at it is um, if I change my major then I'm not only letting myself down, but I'm also letting down these students that I would be able to influence to pursue something amazing in their lives as a college professor. So that's the thing that keeps me going to be honest with you. It's the thought of letting those students down. Those students that I don't know yet, but I know that I'll be able to impact them in such a way that they'll be able to do great things in life."

Fortunately for Carlos, he managed to find/form a study group that consisted of a network of students from different racial/ethnic backgrounds. He felt that studying in group was beneficial to in him in that he learned new studying techniques that helped him solve more complicated Math problems. He eventually passed the Math class he had failed and eventually got out of academic probation. Miguel and Jorge, however, had less success, which resulted in a different, more negative experiences. Miguel is a Mexican-American, first-generation college

student who was born in Victorville, California. When I met him he was a senior at UCP studying Sociology. Growing up he loved everything about computers, from creating and assembling computers, to finding out ways to "hack" games and programs, or use software for programming—most of which I was vaguely familiar with. It was only natural for him to want to pursue a major in computer science in college. He believed that computer science is the way of the future and of economic prosperity, stating that "it's where the money's at." He applied to UCP and was admitted as a Computer Science major.

When Miguel first arrived at UCP he became overwhelmed by how much Math was involved in his Computer Science major. He struggled with his Calculus class during the fall quarter, but managed to pass with a C. However, he obtain a C- on one of his Computer Science classes, which dropped his overall GPA, and thus was placed on academic probation. He shared with me the disappointment he had with himself, reflecting on the ways he could have worked harder or studied more. He didn't share his struggle with anyone close to him, and only spoke to an academic counselor because he was required to. He was a prideful, young man, and he didn't like asking for help. When he spoke to an academic counselors they informed him of the different resources he could use to get back on track. However, they highly recommended that he change his major. Miguel was upset about the recommendation, and believed that with hard work and with *ganas* he can get back on good academic standing. Miguel refused to change majors and instead discussed a plan with his academic counselor who made Miguel signed a contract that reflected that plan.

Unfortunately for Miguel, he continued to struggle academically and failed to meet the contract requirements during the winter quarter of his first year. His records and registration privileges were placed on hold, and he had to meet with the academic counselor to discuss the

next steps. When he met with the counselors he was informed that he was disqualified from the major and that he should go to the undecided and undeclared office and search for a new major. He shared me the entire experience, saying:

> "So I failed the midterm exam for my class, my [second] calculus class, and I knew that it wasn't looking good for me, but I still had hope, you know. But then I got like a low C, a really low C, in my calculus final and I knew that my grade in the class was probably going to be an F or a D... The grades came out pretty fast cause spring quarter was the week after, so the school needed to get the grades out. I saw that I got a D and, like, probably a day or two after I got an email saying I had to talk with my counselor... So I went in and talked with them, and then they basically kicked me out of the major, you know. That was it... I kind of expected it though. So after that I went to the undeclared office and there I took some gen[eral] ed[ucation] classes and then I eventually enrolled as a sociology major. I really like the major and the classes that I've taken... [but] I don't know what I'm going to do with my degree."

Miguel's decision to stay in Computer Science was fueled by his admiration for the field, the economic benefits associated with computer science careers, and his cultural value of having *ganas* to persevere. Miguel had *ganas* and studied very hard, as he explained. The drawback was that he didn't seek help, nor did he understand the degree to which his lack of academic preparation had on his ability to succeed in college STEM classes. This is not to say that Latinx students from poor high schools are destined to fail in STEM, however, they are likely to face overwhelming academic challenges and obstacles, and if they do not seek or receive adequate support then they may fall through the cracks and be weeded-out of STEM, or weeded-out of the university altogether. This brings me to Jorge's experience, a transfer student who I met at a Latinx student social gathering during the winter quarter.

Jorge grew up in Bakersfield, California, a large city that is part of the Kern County, which is known for its oil and agricultural production. Both his parents were from a working class background, with one parent working in the hospitality service industry and the other in the

agricultural industry. He grew up working class, and like other working class Latinx students I met, he wanted to obtain a good career and get out of poverty. For Jorge, Math was his vehicle for social mobility. As a young adult, Jorge moved to Los Angeles where he worked while attending community college for four years before transferring to UCP and majoring in Math. Like Carlos, Jorge excelled in community college, but at UCP he struggled academically, averaging below a 1.0 GPA after his first quarter. When I met him, he was on academic probation and, like other students in his situation, was asked by academic counselors to change his major. He informed me that he refused that advise and wanted to continue with Math. "I want to do Math. There's nothing else that I want to study, and no one can change my mind," said Jorge when I asked how he responded to his academic counselor. Jorge was on the verge of being academically disqualified, so he was asked to sign a contract and was informed of the consequences if he didn't meet his contract requirements.

After my initial conversation with Jorge it was difficult to get a hold of him. I reached out to him through emails, text messages, and phone calls, and every time I managed to communicate with him he told me that he was really busy and couldn't get together. We didn't get together again until early summer, where he informed me that he had failed to meet his contract requirements during the winter and spring quarter. He withdrew from UCP, but was attending UC extension in order to get back on academic track. I asked Jorge if he could share with me what happened, and he stated:

> "I just couldn't get the classes. Two classes to be specific; abstract algebra and the other in math theory. I failed both classes the first time, and then the second time I got a D and C-... Then they gave me one more shot during the spring, but I already had done bad on my first exam... So then I went in to talk with [the academic counselor] and they said I should go to UC extension if I wanted stay in STEM... [They said] I can go there, take classes, and then come back to UCP.

> That all I will have to do is just apply. So, um, I just decided to take their advice and do UC extension cause I want to stay in Math."

Jorge had experience intense academic struggles, obtaining a low GPA his first year at UCP, and eventually becoming disqualified from the university. I couldn't help but think how he could've benefited from on-campus resources and/or social/academic support groups. Yet, I wonder how much attention was placed on those services and support networks when he met with the academic counselors, and if they did inform him, did Jorge both seek those services and find those services helpful? I wish I could've asked him, but unfortunately Jorge continued to rarely respond to my communication attempts. When he did respond to me we did manage to make plans to meet or talk a few times, but he never followed through. After a few more communication attempts I emailed him one last time and asked that he contact me when he felt comfortable and was ready to share his experience. Unfortunately, we never spoke again.

For many Latinx students in my study, majoring and earning a degree in STEM means a having a prestigious career, obtaining financial security, helping family, and/or obtaining social mobility. Latinxs from working class backgrounds are expected to demonstrate grit and have *ganas* in order to overcome the challenges and obstacles they face in their pursuit of a career in STEM. For a few that struggle, like Melissa, they might be contempt with changing majors from STEM to something else that they find value in, or when they feel that STEM is not for them. For many others students who struggle academically, changing majors is not an option because of future career and financial opportunities associated with a STEM degree, as well as the opportunity to help themselves and their families escape poverty and obtain social mobility. Yet, the cultural value of having *ganas* and grit, coupled with the lack of resources, support, and an unwillingness to seek help clouds their judgment and their perceived ability to overcome their

lack of academic preparation, as well as academic challenges and obstacles they face as STEM college students. While some students, like Carlos, do manage to overcome those challenges, other students like Sandra, Patricia, Miguel, and Jorge end up being forced out of STEM and either struggle to get back on track or never return at all.

Chapter Conclusion

Working hard or having *ganas* are a centerpiece of the Latinx work ethic. While many studies have indicated that these cultural values are empowering, which they are (Auerbach, 2006; Easley et al., 2012; Gutierrez, 2001; Hill & Torres, 2010; Padilla, et. al., 2005; Rodriguez, Castillo, & Gandara, 2013), many failed to recognize their limitations and disadvantages. What is often not discussed is how *ganas* and other similar *modismos* are rooted in the discourse of meritocracy, which forces Latinx students to work hard despite overwhelming challenges and obstacles. These cultural and family values place a lot of pressure on Latinx students to succeed, and if they struggle academically they often hide their struggle from their family because they fear disappointing their family, fear being labeled as not having *ganas,* and/or fear that they might create more stress and unnecessary concern among their family.

Struggle in STEM, however, is partially the result of decades of educational inequality. There are many Latinx college students who attended poor high schools that had few resources and systems of support. Their high schools failed to help them develop their STEM fundamentals, a valuable form of cultural capital that is essential for STEM success in college. In turn, when Latinx students attend college they begin their journey academically overwhelmed with the rigor in their college STEM classes. Given these challenges, some Latinx students are driven by their cultural values of *familismo* and *comunidad* to seek support from student led

organizations, campus programs, and friends on campus. While these networks can provide some valuable social capital, many do have the adequate resources or support to help build on student's cultural capital, in this case their STEM fundamentals and knowledge, and as result many struggling Latinx STEM students continue to struggle and face challenges in STEM.

Those who struggle academically are strongly encouraged to leave their STEM major by their academic counselors. If they refused and continue to struggle they are forced out by the departments due to their strict academic policies. The recommendation to switch majors weighs heavily on Latinx students because many come from working class backgrounds and rely on a STEM careers to help them and their family get out of poverty and obtain social mobility. Many Latinx students and their parents believe that STEM careers are more economically beneficial, and therefore some Latinx students are reluctant to settle for anything else but a STEM degree because they face family and personal pressure to succeed. Yolanda, for example, shared the family pressure she receives from her mother, stating that "because she majored in liberal arts, and she doesn't have a good enough job, she encourages me to pursue STEM because there are more opportunities."

When Latinx students did struggle in STEM there were some who did change majors and perceived it as a positive opportunity. However, most Latinx students perceived the recommendation to change majors as a gate keeping strategy that prevents them from reaching their personal, career, and financial goals, as well a practice that challenges their cultural values—the value of having *ganas* and persevering. Though some Latinx students did find adequate resources and supportive networks that helped them persist in STEM, there many others do not find the support and resources they needed, and thus were weeded-out of STEM. What's even more unfortunate is that some successful Latinx students draw on meritocracy and

ganas and blame academically struggling Latinx students for their own academic struggles, suggesting that they didn't have the motivation, *ganas,* or grit to persist and succeed in STEM, all while paying little attention as to how institutional challenges contributed to the academic struggle Latinx students face in STEM.

Chapter 6

Conclusion

The purpose of the study was to develop a greater understanding of the educational experiences of Latinx STEM students at a large public university in Southern California. Through ethnographic research, I sought to explore the ways in which Latinx students draw on community cultural wealth to navigate both higher education and their STEM field. Furthermore, this paper explored the ways in which individual and institutional factors promote or hinder the persistence and success of Latinxs in STEM. In examining the STEM environment at UCP, which is what Bourdieu (2013) would describe as the "field," my research revealed that there is a presence of hegemonic power in the culture of science (discussed in chapter 3) at UCP. The culture of science is one that reflects an ideology that values meritocracy and competition, as well as values certain skills, knowledge, and ways of thinking—which can be viewed as dominant forms of cultural capital (Bourdieu, 1986)—that presents barriers for Latinx students who may not possess this type of cultural capital (Carter, 2005). The culture of science is a dominant force that asserts their power by enforcing policies and practices that caters to their ideology, marginalizing Latinx students different forms of knowledge and/or cultural capital and labeling them as deficient if they fail to prescribe to their ideology. Latinx students who do not possess the cultural capital that is reflective of the university hegemonic ideology often face obstacles and challenges that make it difficult for them to succeed in an already unwelcoming and isolating environment.

The culture of science exists across multiple layers within the institution and among the students majoring in STEM. STEM departments at UCP, and the agents and students within, give way to a complex system that supports and validates a culture of science and meritocracy.

Pedagogical practices, such as traditional lectures with little to no room for discussion or questions, and grading policies, such as grading on a curve and/or grade distribution, give way to an environment whereby students focus more on grades and very little on mastering the knowledge. This was most common in lower-division STEM classes which typically have large classes, ranging from 100-400 students per class. From the voices of Latinx students, many have indicated that they feel isolated and under supported in traditional lectures, and feel troubled that students are forced to compete with one another rather than help each other. Latinx students described lower-division STEM classes as hostile environment whereby other students exclude or withhold information, resources, and support from other students with the hopes of increasing their chances of obtaining higher grade at a cost of limiting other students' success.

My second major finding suggest that higher education institutions and STEM departments, as well as the agents within them, fail to understand how the culture of science, along with the practices and policies that reinforce it, marginalize students who may either do not adhere or simply are not aware of the rules in the culture of science or the institutions hegemonic discourse. Instead, these practices and policies disadvantage some Latinx students who enter college academically underprepared, or in *educational debt*. According to Ladson-Billings (2006), educational debt refers to the cumulative historical, educational, economic, social-political, and moral decisions and policies which have led to severe inequalities that have restricted or limited opportunities for racial minorities, including Latinxs. These cumulative inequalities trickle down to historical marginalized students who have limited opportunities, resources, and educational preparation that they need to succeed in schooling. It is a debt that follows them through K-12 and into college. What this means is that Latinxs students who come from poor high schools are entering college with weak educational skills and knowledge, skills

and knowledge that are both necessary and highly valued in STEM, but has been withheld from them due to social inequality. Like any other form of debt, being in educational debt is difficult to get out of as many Latinx students are simultaneously trying to both master the fundamentals of science that were poorly taught to them and master the current knowledge that they are receiving from their college STEM classes. Rather than questioning the accumulation of social and educational inequality, institutional policies and practices sustain a weeding-out process that is prominent across STEM departments whereby some Latinx students with educational debt are struggling academically and are forced out of STEM majors (see chapter 4). To justify institutional policies and practices, institutional agents often attribute Latinx academic struggles to personality traits, academic background, and culture and family values when discussing reasons for why Latinx students struggle in STEM, further reinforcing the deficit discourse (see chapter 4).

Another major finding revealed that demands in accountability, along with university prestige maintenance, has led to creating and sustaining policies and practices that, perhaps unintentionally, serve more as gatekeepers of STEM degrees rather than facilitators of STEM success. Policies, such as time-to-degree policies, at UCP are very stringent, and institutional agents are required to enforce these policies as well as the consequences when students fail to meet their academic responsibilities in order to meet their accountability demands. When Latinx students struggle academically, they are often advised by institutional agents to change majors and/or attend community college to get back in good academic standing. Bourdieu (1986) would describe the gatekeeping practices performed by institutional agents as a form of symbolic violence. Symbolic violence can be described as actions taken by social agents that explicitly or implicitly reinforce a social hierarchy, assuming that it is natural and legitimate. In this situation,

the gatekeeping practices performed by institutional agents are indirectly reinforcing social reproduction and social hierarchy in that they are keeping underrepresented minorities from majoring in STEM and from obtaining STEM degrees by weeding them out. In this case, it is Latinx who have historically been underrepresented in higher education, in STEM majors, and in the STEM workforce. The underlying assumption is that Latinxs do not belong in STEM. These findings support what social theorist have long argued in that education institutions serve to reproduce social classes and limit opportunities for social mobility (Bourdieu, 1973; Bowles & Gintis, 1976).

A fourth finding suggest Latinx students are not passive, but active and reactive when it comes to navigating both higher education and the challenges and obstacles embedded in the system (see chapter 5). By drawing on community cultural wealth (Yosso, 2005) and LatCrit, the voices of Latinx students are captured in this study, which highlights who they are, their cultural values, their motivation for seeking a STEM education—all of which shapes their habitus. What we learn from the narratives of Latinx students is that both they and their families place a high value on education, which contradicts both institutional agent perspectives and past research that suggested that they do not value education. Latinx students' cultural background has instilled in them the value of hard work, determination, family, and community, which they draw on as a form of empowerment and community cultural wealth to pursue, and succeed in, higher education. In addition, many of the Latinx students I interviewed come from a working class background, and their experience with financial hardship, along with their cultural value of *ganas* motivates them to succeed in school and obtain social mobility.

Though many of them come to higher education with rich cultural capital, or community cultural wealth, it is viewed as non-dominant and therefore not valued in higher education.

Having dominant forms of cultural capital, in this case having strong K-12 education, and information and knowledge on how to navigate college, provides students with not only greater access to opportunities and resources, but also provides them a strong foundation needed to succeed in STEM. Latinx students, particularly those who come from working class backgrounds, often have limited access to opportunities and resources that would help them obtain the dominant forms of cultural capital needed to navigate and succeed in college. Latinx often face challenges in getting recognition for their cultural capital, and as I described in chapter 3, their cultural capital and community cultural wealth is often rejected and viewed as culturally and academically deficient by faculty and other institutional agents, which again contributes and reinforces cultural deficit rhetoric which has been plaguing the Latinx culture for generations. Furthermore, Latinx student's value in family and community creates a culture clash with the values of meritocracy and individualism, which are dominant in the culture of science. As a result, many Latinx often experience hostility and isolation, and feel under supported.

A final finding suggest that Latinx draw on their community cultural wealth to help them navigate college. For example, some Latinx students who value *familismo* and *comunidad* often sought out other Latinx students, Latinx student organizations, and campus programs to help them navigate college and help overcome institutional challenges and obstacles. While both students and programs offer some Latinx students academic support and resources to help them persist and succeed in STEM, for other Latinx students these programs and student organizations did not have the adequate resources and networks to help them. As a result, some Latinx students often tried to navigate college on their own. Despite the difficulty of navigating college, many Latinxs do not easily give up on their goals of obtaining a STEM degree. They draw on their cultural values of *ganas* and believe that through hard work anything is possible. However, the

idiom of *ganas* is a double edge sword in that on one edge it is an empowering cultural value that motivates Latinxs to strive for success, but on the other edge it also resembles the ideology of meritocracy and individualism in that it places the responsibility solely in the hands of Latinxs and dismisses institutional factors that can hinder success. As a result, many Latinx students try and navigate college on their own, and for those who continue to struggle, their cultural values of *verguenza* and *ganas* forces them to keep their struggles to themselves and not share their struggles with family and friends. Part of the reason why Latinx students keep their struggle to themselves is because they believe that it can create stress among their family. Their families are working hard to make ends meet, and they are often dealing with their own life struggles and challenges, and by informing their families about their educational challenges some Latinx students believe that this will only create more unnecessary stress in their already complicated lives. However, for Latinx students who did share their struggles with their families, most families understood their struggle and continued to encourage their educational goals, even if Latinx students decided to change their majors. Still, many academically struggling Latinx students stay in STEM, regardless if they were advised to change majors. While a few students did manage to overcome their academic challenges, a large number of Latinx students were unable to do so. This suggest that having *ganas* is not enough, and that sometimes this cultural value can work against Latinxs who overlook the overwhelming institutional challenges and obstacles they face in trying to get back on track.

Recommendations

Concerns about Latinx STEM persistence and success, along with pressure to both diversify and increase the STEM workforce prompted this study. This study, along with previous studies, suggest that Latinx students continue to struggle in STEM. The following suggestions

made to help alleviate the issue with attrition in STEM among Latinxs are informed by Latinx students experiences as both STEM majors and as college students in general.

Higher Education Policy Recommendations

Institutions should critically examine their institutional policies and (re)design them help students overcome common challenges and obstacles that students of color face. If the goal of institutions is to increase student retention and graduation rates, they should examine their policies to see if they serve more as gatekeepers or pathways to success. Changing policies can have an influence on the way academic counselors provide resources and advice in that they will no longer feel pressure to push students out of STEM for struggling academically. One policy, for example, that colleges should consider changing is the time-to-degree policy. As it stands, many STEM departments at UCP, as well as across the country, have strict 4-year time-to-degree policies. Any student who struggles academically and needs to repeat a class are still expected to complete their degree within 4 years. Thus, many who struggle academically might choose to take summer classes or take additional classes at a community college in order to catch up. For students who fail multiple classes it is extremely difficult to get back on track, especially since many STEM classes are sequential or serve as prerequisites for other lower and upper division STEM classes. Extending the time to complete lower division STEM requirements from two years to three will allow students who come from poor high schools to transition into college and help disperse their STEM workload, giving them more time to adjust and focus on a few STEM classes per semesters/quarter as they develop an understanding on how to navigate college.

Creating policies that facilitate academic support should also be considered. Research has demonstrated the value of having supportive faculty who can serve as mentors Latinx students,

especially if those faculty members are Latinxs themselves (Bensimon, Dowd, Stanton-Salazar, & Dávila, 2019). One recommendation for higher education institutions is to create policies that incentivize and provide resources for faculty to help mentor racial minority students. For example, junior faculty who are up for tenure should be given credit or be rewarded for mentoring undergraduates, particularly undergraduates from minoritized backgrounds. As of now, faculty, especially non-tenured junior faculty, are under a lot of pressure to produce research, obtain grants, teach, and participate on various committees. Some have no time to devote to mentorship, and even among those that do, mentoring is not acknowledged when it comes to institutional decisions on salary, tenure evaluation, and/or faculty evaluations. Recognizing mentorship as a positive value would encourage faculty who want to mentor to do so.

Government Recommendations

Like most colleges and universities, concerns over funding for programs, student aid and scholarships, and campus resources are always a concern. If the U.S. is interested in increasing their STEM workforce then they should provide colleges and universities the necessary funding so that they can increase resources and support, such as funding for student led organizations, campus programs, and institutional forms of tutoring for students who come for poor high schools. Doing so will help students obtain the necessary cultural and social capital to persist and succeed in STEM. For example, access to institutional tutoring services at UCP can be both expensive for Latinx low-income students, as well as scarce. Tutoring services, much like classes, fill up at UCP, and therefore increasing both funding and institutional tutoring services can be helpful in both increasing Latinx student success and reducing attrition rates in STEM.

In addition, there should be more financial assistance for universities that are minority serving institutions. UCP is a Hispanic Serving Institution (HSI), which like other minority serving institutions they produce a large number of STEM graduates that identify as a racial minorities (Palmer, Maramba, Gasman, 2013). Yet, according to De Los Santos and Cuamea (2010), many HSI's stated that one of their biggest challenge is the lack of funding, which is needed to help create programs and services to help Latinx students. Palmer, Maramba, Gasman, and Lloyd (2013) argue that financial deficiencies for programs and resources for minority students are related to issues with attrition in STEM, and that increasing resources will help facilitate access, persistence, and success among racial minority STEM students.

Pedagogical Recommendations

In 1997, Seymour and Hewitt wrote a book on a study that had a similar focus to this study, which was to explore the reasons for why students leave the sciences. In their interviews with students, they found that many students left sciences because of the competitive and unsupportive culture, the heavy workload and the fast pace of STEM programs, and issues with teaching styles. More than two decades after Seymour and Hewitt (1997) reported their findings in their book, we see that these same issues persist, as demonstrated in the findings of this study. It is clear that work in creating a welcoming, non-hostile, and learning environment is crucial in not only helping Latinx students, but all students, persist and succeed in STEM.

With that being said, universities and colleges should consider adding more STEM classes that are taught in innovative and interactive styles, which have more room for engaging and allowing students to participate in their learning rather than just being passive sponges in traditional lecture classes. In addition, faculty should also be trained to understand their students

and the challenges and obstacles they face. As of now, some faculty feel disconnected from their students in their lower-division classes. They do not understand where they are coming from, who they are, and what challenges they face as STEM students. This lack of awareness of who their students are is a cause for concern, given that the findings in this study revealed that this disconnection can lead to deficit ways of thinking when describing why certain students struggle academically, attributing student academic struggles to personal and cultural factors. Creating an awareness and understanding of who students are will help faculty better serve their needs.

Another recommendation is to develop transitional programs. Though some programs are still being perfected, and initial studies have found mixed findings (Barnett, Fay, Pheatt, & Trimble, 2016; Trimble, Pheatt, Papikyan, & Barnett, 2017), universities and colleges, practitioners, policy makers, and scholars should continue to work together to improve existing transition programs, or create programs following models that work. At UCP, one of the STEM departments has taken initiative and has created a cohort model that provides students extra support and resources. The program is still in its initial phase and is continuously being developed to meet the needs of the students. With that being said, there is little known about their effectiveness given that it has changed over the course of its introduction. Still, the program has faced challenges, which is why it continues to be a work in progress. For example, one resource that students are provided in the cohort is supplemental instruction, which is created and administered by the program. The intention was to have faculty or graduate students help undergraduate students with questions regarding their coursework for any STEM class. This supplemental instruction is a move in the right direction, however, it is far from perfect. As it stands, the supplemental instruction serves more as an informational session to help students find resources on campus. Administrators who work on the program are aware of the issue that

students are not receiving the supplemental academic support that they need, and thus they are continually working on improving that service. Nevertheless, the intention to help students is there, and once they have solid model then that can open the door for researchers to examine the program and see if it has any effect on student persistence and success in STEM.

Transparency in Higher Education

Finally, institutions should be transparent about the challenges and obstacles that Latinx students have encountered in the pass and inform current and incoming students and their families. Providing this information will help Latinx students understand that academic struggle is common, and that there are resources and forms of support to help them overcome those challenges. In addition, educational institutions (K-12 and higher education) should work on creating sources of information that can help inform Latinx students and their families about common challenges and obstacles in higher education and in STEM. By doing so, it will allow students and their families to create a dialogue about the institutional challenges and obstacles that Latinx students face as STEM students. This way, if Latinx students do academically struggle then parents and Latinx students will understand that it is partially due to the institutional challenges, as well as the obstacles associated with the culture of science. One way of delivering this information to students and parents is by having an informed, possibly STEM graduate or faculty or administrator, Latinx deliver this information in way that is culturally relevant and understands the Latinx culture.

Limitations

This study was conducted at an institution that is both an Asian American and Native American Pacific Islander Serving Institution (AANAPISI) and a Hispanic Serving Institution

(HSI). It an institution that not only has a racially diverse student population, but many administrators (excluding faculty) identified as racial minorities as well. Therefore, access to same Latinx support groups were more accessible to Latinx students than other institutions that may not be as racially diverse, such as Predominantly White Institutions (PWI). Furthermore, there are large Latinx communities surrounding UCP which can be accessible to Latinx students seeking communities that represent their culture. With that being said, UCP is not a representation of many institutions across the country. However, this is not to say that Latinx students attending different universities do not share very similar experiences in STEM as Latinx at UCP (i.e. challenges with navigating the culture of science), however, their challenges and obstacles may be exacerbated by the lack of available supportive networks (e.g. Latinx organizations or Latinx institutional agents).

One surprising finding was that all students, regardless of their gender, had similar experiences with regards to experiences as STEM students and the challenges they faced. Though there were a couple of men who did hold negative stereotypes about Latinas, most students did not have any unique gender experiences with regards to their experiences as STEM students. Past research suggests that women, especially women of color, have a harder time as STEM majors because the field is male dominated, and women's intelligence and belongingness are often questioned by male students and faculty (Espinosa, 2011; Johnson, 2012). However, this was not the case in this study. One reason perhaps is because UCP has a large number of Latina students enrolled as STEM majors, and therefore they may feel like they belong and feel that they are valued. Another reason may be that Latinas may have withheld sharing that information with me because I identify as a Latino. Future research can examine the experiences

of women majoring in STEM who have a large presence in the class to see if women continue to face similar, or new, challenges.

Another limitation is that this study only recruited participants who were enrolled at the university. Students who were not enrolled the university were not interviewed, mainly because I had no access to them (e.g. contact information). It would be very insightful to interview Latinx STEM students who left, or where pushed out of, the university to further explore and add more depth as to why they are no longer enrolled in college.

Finally, this study drew on Critical Ethnography, which revealed the rich and complex process by which Latinx STEM students struggle and succeed in higher education, and how Latinx students make sense and navigate a system that promotes competition, limits support and access to resources, and in some ways facilitates the exit of Latinx students from STEM, which is difficult to capture using quantitative methods. With that being said, this is a unique case, which can be complemented and strengthened through further qualitative research at other institutions that examine and explore this student population and the practices and policies at those institutions. Finally, the use of large scale data and quantitative methods would help increase the scale of the study and increase the external validity of the findings from this study.

Research Implications

An area for further developing the understanding the challenges Latinx face while in college and as STEM students is understanding the communication they have with parents about their academic success and/struggle, as well as exploring how Latinx families perceive and respond to their children succeeding or struggling. Exploring what Latinx parents understand and how involved they are with their children's higher education experience, particularly among

STEM students, will help highlight the ways in which parents can, or are limited to, helping their children with their academics as STEM students.

Creating and implementing programs that can help Latinx STEM majors in college can not only be very helpful, but it can also help create awareness among practitioners, institutions, policymakers, and researchers understand what works and what doesn't. Future research can use quantitative methods to examine the impact of such programs on a larger scale in order to see what programs, or areas of a program, are more effective in helping racial and low-income minority students persists and succeed in STEM.

Finally, scholars, practitioners, and policy makers should examine the level of rigor and access to resources and support across primary schools (K-12) attended by racial and low income minorities in order to examine if these institutions have enough, and are doing enough, to help prepare students for college level STEM classes. From the data gathered in this study, many Latinx students stated that their K-12 schools academically underprepared, despite earning high grades in their STEM classes in school. There is a clear discrepancy between the rigor and quality of STEM classes being taught in K-12 and the level that is expected in college. Racial minority and low-income students who take, and master, poor quality and poorly taught STEM classes in high school are given false hope that they are ready for college level STEM classes, which from the research provided in this study suggest that they are not. If we are to have an educated and strong workforce in STEM in this country we need to begin by providing resources and support to all K-12 schools in order to better prepare them to succeed in college level STEM courses.

Tables and Figures

Table 3: Student Demographic - Family SES Detail

Table 3: Student Demographic Family SES Detail

				Family Socio-Economic Status (SES)					
		Self-Identified	Self-Identified	Mother's			Father's		
n	Pseudonym	Gender	Class	*Highest Education*	*Income*	*Occupation*	*Highest Education*	*Income*	*Occupation*
Latinx Students Who Entered UCP as Freshmen									
Ethnography Participants									
1	Ana	F	Working Class	H.S. Diploma or GED	Under $25,000	Other Working Class	N/A - Single Parent	N/A - Single Parent	N/A - Single Parent
2	Lupe	F	Working Class	Some H.S or Less	Under $25,000	Blue Collar	Some H.S or Less	Under $25,000	Other Working Class
3	Yvette	F	Middle Class	H.S. Diploma or GED	Under $25,000	Other Working Class	H.S. Diploma or GED	$100,000-$124,999	Blue Collar
4	Patricia	F	Working Class	Associates Degree	Under $25,000	Small Business Owner	N/A - Single Parent	N/A - Single Parent	N/A - Single Parent
5	Sandra	F	Working Class	Some H.S or Less	Under $25,000	Other Working Class	Some H.S or Less	$75,000-$99,999	Clerical
6	Enrique	M	Middle Class	Bachelors	$50,000-$74,999	Clerical	Associates Degree	$50,000-$74,999	Small Business Owner
7	Francisco	M	Middle Class	Some College	$25,000-$49,999	Blue Collar	Some College	$100,000-$124,999	Managerial
Supplemental Interview Participants									
8	Jose	M	Middle Class	Some H.S or Less	$25,000-$49,999	Blue Collar	Associates Degree	$75,000-$99,999	Professional
9	Olivia	F	Working Class	Some H.S or Less	Under $25,000	Blue Collar	Some H.S or Less	Under $25,000	Blue Collar
10	Eva	F	Working Class	Some H.S or Less	$25,000-$49,999	Other Working Class	Some H.S or Less	$25,000-$49,999	Other Working Class
11	Mario	M	Working Class	H.S. Diploma or GED	$25,000-$49,999	Blue Collar	Some H.S or Less	$25,000-$49,999	Blue Collar
12	Kathy	F	Middle Class	Some College	$25,000-$49,999	Other Working Class	Some H.S or Less	$50,000-$74,999	Blue Collar
13	Yolanda	F	Middle Class	Bachelors Degree	$50,000-$74,999	Academic	Some H.S or Less	$25,000-$49,999	Other Working Class
14	Juan	M	Working Class	Some H.S or Less	Under $25,000	Other Working Class	N/A - Single Parent	N/A - Single Parent	N/A - Single Parent
15	Nancy	F	Working Class	H.S. Diploma or GED	$25,000-$49,999	Blue Collar	Some H.S or Less	$25,000-$49,999	Other Working Class
16	Diana	F	Working Class	H.S. Diploma or GED	$25,000-$49,999	Managerial	Some H.S or Less	$25,000-$49,999	Blue Collar
17	Javier	M	Working Class	Some H.S or Less	Under $25,000	Blue Collar	H.S. Diploma or GED	$25,000-$49,999	Blue Collar
18	Melissa	F	Working Class	H.S. Diploma or GED	$25,000-$49,999	Other Working Class	N/A - Single Parent	N/A - Single Parent	N/A - Single Parent
19	Jasmin	F	Working Class	Some H.S or Less	Under $25,000	Other Working Class	H.S. Diploma or GED	Under $25,000	Other Working Class
20	Miguel	M	Working Class	Associates	$25,000-$49,999	Managerial	H.S. Diploma or GED	$25,000-$49,999	Managerial
Latinx Students Who Entered UCP as Transfer Student									
Ethnography Participants									
21	Carlos	M	Working Class	Some H.S or Less	Under $25,000	Other Working Class	Some H.S or Less	$50,000-$74,999	Blue Collar
22	Vicente	M	Middle Class	Some H.S or Less	$25,000-$49,999	Blue Collar	H.S. Diploma or GED	$50,000-$74,999	Managerial
Supplemental Interview Participants									
23	Jorge	M	Working Class	Some H.S or Less	Under $25,000	Other Working Class	N/A - Single Parent	N/A - Single Parent	N/A - Single Parent
24	Claudia	F	Working Class	Some H.S or Less	$25,000-$49,999	Blue Collar	H.S. Diploma or GED	Under $25,000	Blue Collar

Figure 1: Academic Profile of Freshmen Entering UC's, 2008-2017 (UC Accountability Report, 2018)

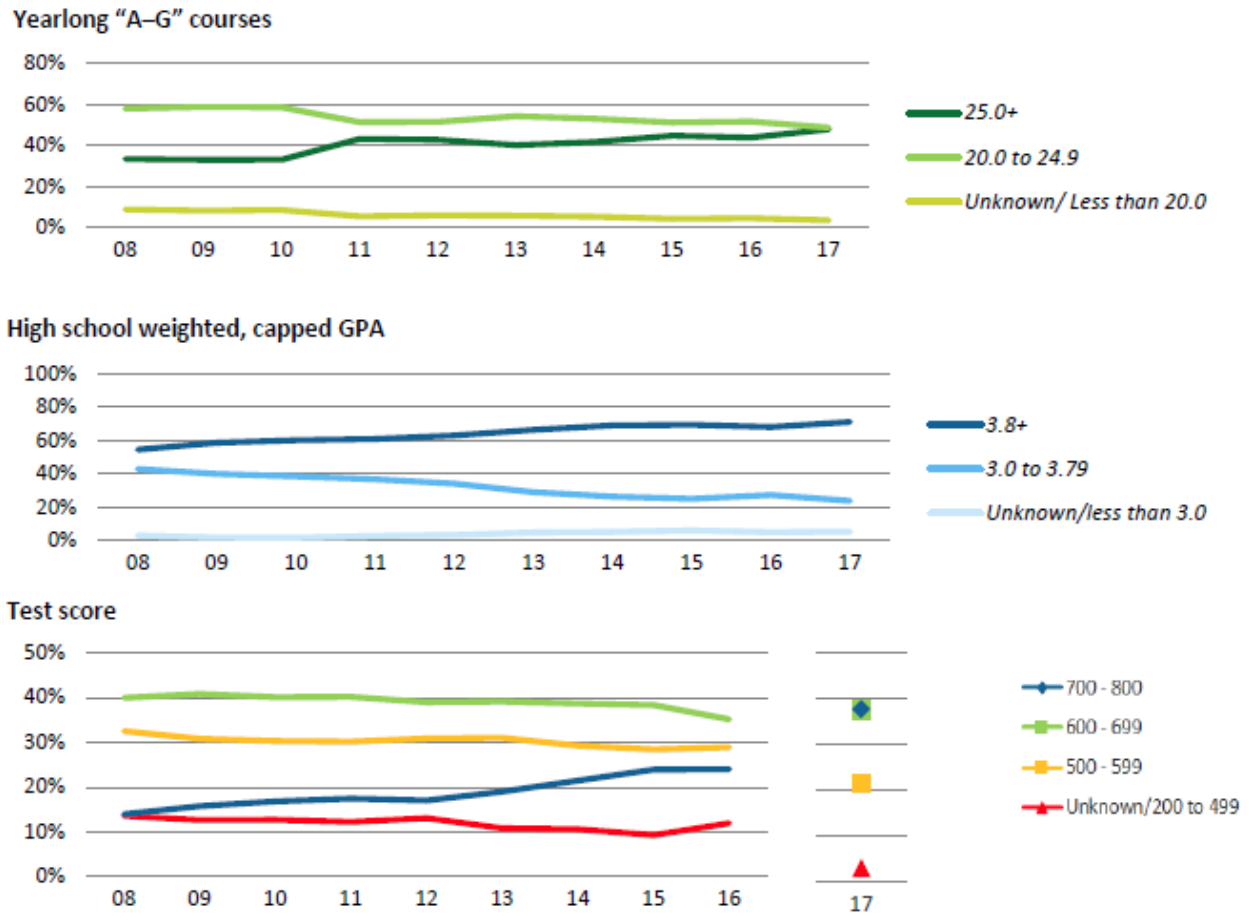


Figure 2: Entering students by first-generation status, race/ethnicity, first language spoken at home, Pell Grant receipt and entering level, University wide, Fall 2017 (UC Accountability Report, 2018)

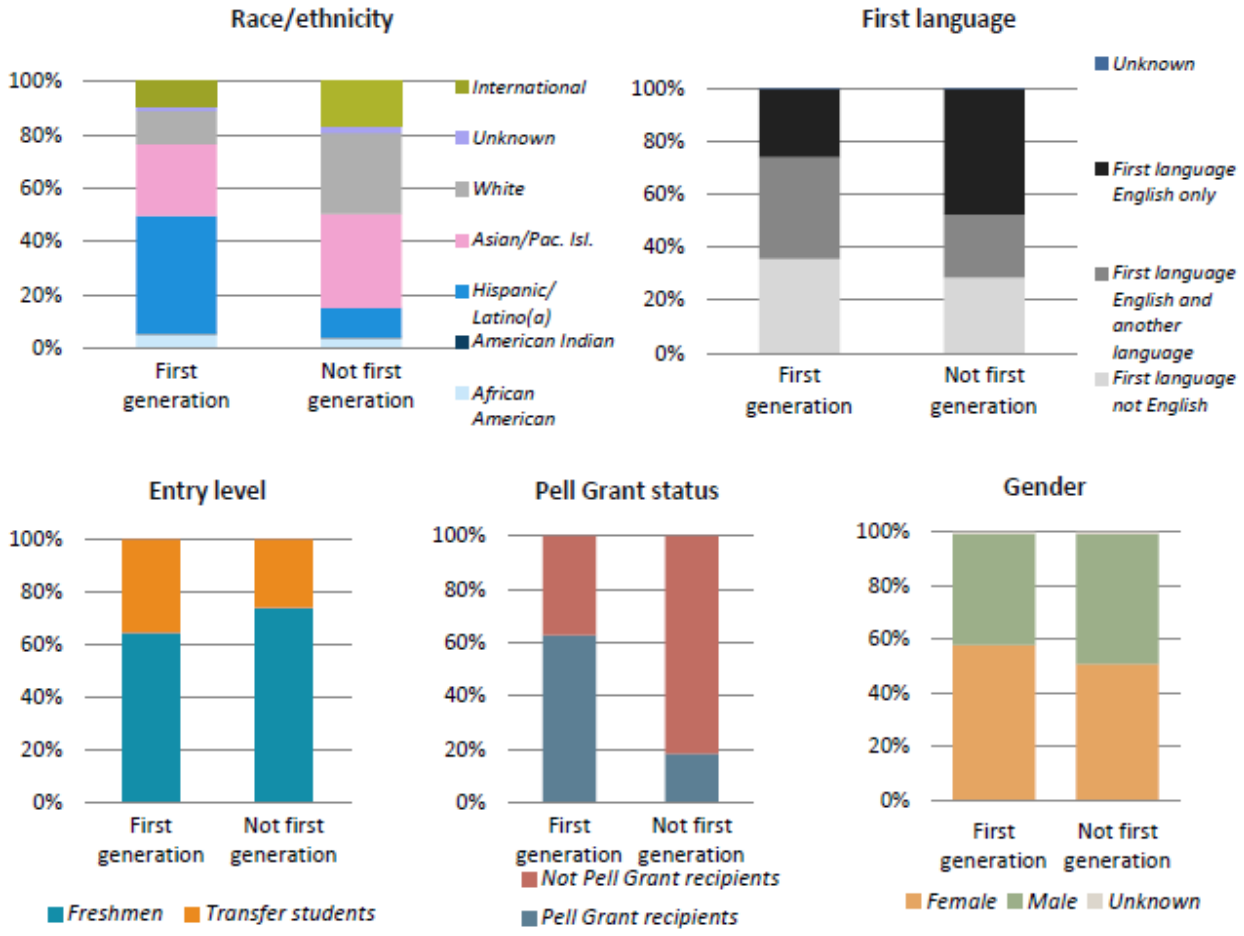


Figure 3: Student Demographic Questionnaire

Demographic Questionnaire

Age: _____ **Gender:** _____ **High School GPA:** _____ **Current College GPA:** _____

Current Major: _____

Undergraduate class standing: ☐ Freshman ☐ Sophomore ☐ Junior ☐ Senior ☐ 5th Year

Mothers Highest Educational Attainment

- ☐ Doctorate
- ☐ Professional Degree
- ☐ Master's Degree
- ☐ Bachelor's Degree
- ☐ Associates Degree
- ☐ Vocational or Technical Certificate
- ☐ Some College (No Degree or Certificate)
- ☐ High School Diploma or GED
- ☐ Some High School or Less

Fathers Highest Educational Attainment

- ☐ Doctorate
- ☐ Professional Degree
- ☐ Master's Degree
- ☐ Bachelor's Degree
- ☐ Associates Degree
- ☐ Vocational or Technical Certificate
- ☐ Some College (No Degree or Certificate)
- ☐ High School Diploma or GED
- ☐ Some High School or Less

Mothers Yearly Income (Current)

- ☐ Over $200,000
- ☐ $175,000 - $200,000
- ☐ $150,000 - $174,999
- ☐ $125,000 - $149,999
- ☐ $100,000 - $124,999
- ☐ $75,000 - $99,999
- ☐ $50,000 - $74,999
- ☐ $25,000 - $49,999
- ☐ Under $25,000

Fathers Yearly Income (Current)

- ☐ Over $200,000
- ☐ $175,000 - $200,000
- ☐ $150,000 - $174,999
- ☐ $125,000 - $149,999
- ☐ $100,000 - $124,999
- ☐ $75,000 - $99,999
- ☐ $50,000 - $74,999
- ☐ $25,000 - $49,999
- ☐ Under $25,000

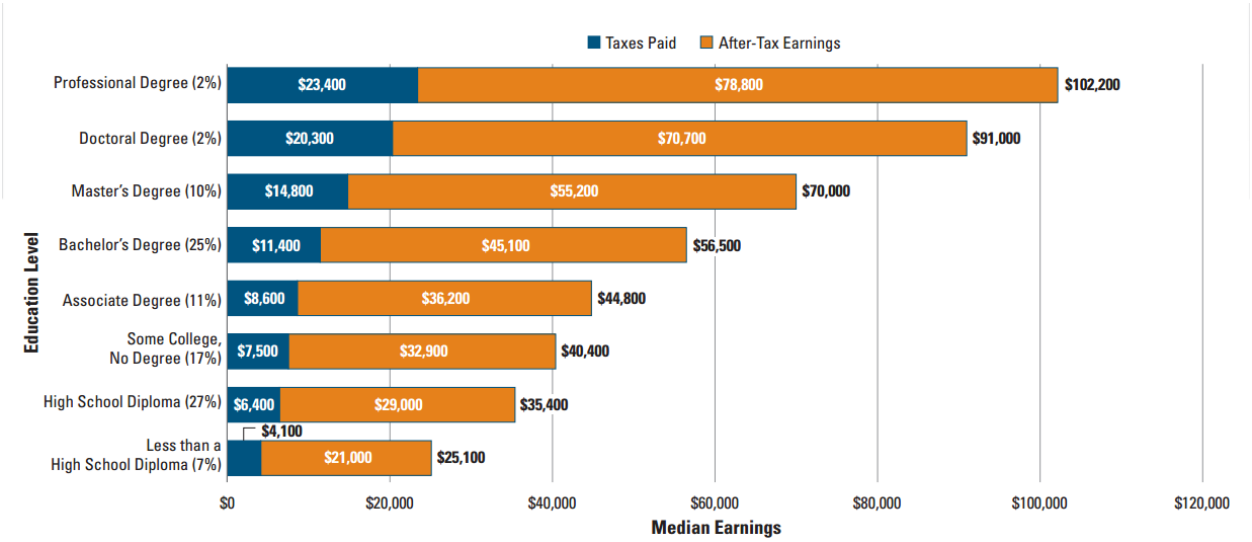
Mothers Occupation

- ☐ Academic
- ☐ Professional
- ☐ Managerial
- ☐ Clerical
- ☐ Blue Collar
- ☐ Small Business Owner
- ☐ Other Working Class Occupation

Fathers Occupation

- ☐ Academic
- ☐ Professional
- ☐ Managerial
- ☐ Clerical
- ☐ Blue Collar
- ☐ Small Business Owner
- ☐ Other Working Class Occupation

Figure 4: Median Earnings and Tax Payments of Full-Time Year-Round Workers Ages 25 and Older, by Education Level, 2011 (Source: College Board, 2013)



The bars in this graph show median earnings at each education level. The blue segments represent the estimated average federal, state, and local taxes paid at these income levels. The orange segments show after-tax earnings.

NOTE: The numbers in parentheses on the y-axis indicate the percentage of all full-time year-round workers with each education level in 2011. Taxes paid include federal income, Social Security, Medicare, state and local income, sales, and property taxes. Percentages may not sum to 100 because of rounding.

SOURCES: U.S. Census Bureau, 2012, Table PINC-03; Internal Revenue Service, 2010; Davis et al., 2013; calculations by the authors.

References

Anderson, E. L., & Kim, D. (2006). *Increasing the success of minority students in science and technology* (No. 4). American Council on Education.

Apple, M. W. (1982). Reproduction and contradiction in education: An introduction. *Cultural and economic reproduction in education. Boston: Routledge and Kegan Paul*.

Apple, M. W. (2004). *Ideology and curriculum*. Routledge.

Apple, M. W. (2007). Ideological success, educational failure? On the politics of No Child Left Behind. *Journal of Teacher Education*, 58(2), 108-116.

Arellano, A. R., & Padilla, A. M. (1996). Academic invulnerability among a select group of Latina/o university students. *Hispanic Journal of Behavioral Sciences*, 18, 485-507.

Aryee, M. (2017). *College students' persistence and degree completion in science, technology, engineering, and mathematics (STEM): The role of non-cognitive attributes of self-efficacy, outcome expectations, and interest (Doctoral dissertation).* Seton Hall University Dissertations and Theses (ETDs). 2246. Retrieved from http://scholarship.shu.edu/dissertations/2246

Atkinson, R. D., & Mayo, M. J. (2010). Refueling the US innovation economy: Fresh approaches to science, technology, engineering and mathematics (STEM) education. *The Information Technology & Innovation Foundation, Forthcoming.*

Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *Journal of Higher Education*, 886-924.

Auerbach, S. (2004). Engaging Latino parents in supporting college pathways: Lessons from a college access program. *Journal of Hispanic Higher Education*, 3(2), 125-145.

Auerbach, S. (2006). " If the student is good, let him fly": Moral support for college among Latino immigrant parents. *Journal of Latinos and Education*, *5*(4), 275-292.

Bailey, M. J. & Dynarski, S. M. (2011). Gains and gaps: Changing inequality in U.S. college entry and completion. In G.J. Duncan & R.J. Murnane, (Eds.) Whither opportunity? Rising inequality and the uncertain life chances of low-income children. New York: Russell Sage.

Baker, C. N., & Robnett, B. (2012). Race, social support and college student retention: A case study. *Journal of College Student Development*, 53(2), 325-335.

Ball, S. J. (2010). New class inequalities in education: Why education policy may be looking in the wrong place! Education policy, civil society and social class. International Journal of *Sociology and Social Policy*, 30(3/4), 155-166.

Banks-Santilli, L. (2014). First-Generation college students and their pursuit of the American dream. *Journal of Case Studies in Education*, 5.

Barnett, E., Fay, M., Pheatt, L. E., & Trimble, M. J. (2016). What We Know About Transition Courses. Columbia University. Retrieved from: https://academiccommons.columbia.edu/doi/10.7916/D82V2G35

Bazelais, P., Lemay, D. J., & Doleck, T. (2016). How Does Grit Impact College Students' Academic Achievement in Science?. *European Journal of Science and Mathematics Education*, 4(1), 33-43.

Bensimon, E. M., Dowd, A. C., Stanton-Salazar, R., & Dávila, B. A. (2019). The role of institutional agents in providing institutional support to Latinx students in STEM. *The Review of Higher Education*, 42(4), 1689-1721.

Bergey, R., Movit, M., Baird, A. S., & Faria, A. M. (2018). Serving English Language Learners in Higher Education: Unlocking the Potential. *American Institutes for Research*.

Bernal, D. D. (2002). Critical race theory, Latino critical theory, and critical raced-gendered epistemologies: Recognizing students of color as holders and creators of knowledge. *Qualitative inquiry*, *8*(1), 105-126.

Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches.* Rowman & Littlefield.

Black, M. H. (1965). Characteristics of the culturally disadvantaged child. *The reading teacher*, *18*(6), 465-470.

Boggs, G. R. (2004). Community colleges in a perfect storm. *Change: The Magazine of Higher Learning*, 36(6), 6-11.

Bogle, K. A. (2008). *Hooking up: Sex, dating, and relationships on campus*. NYU Press.

Bonous-Hammarth, M. (2000). Pathways to success: Affirming opportunities for science, mathematics, and engineering majors. *Journal of Negro Education*, 92-111.

Bourdieu, P. (1973). Cultural reproduction and social reproduction.

Bourdieu, P. (1986). The forms of capital. In *Cultural theory: An anthology*, 81-93.

Bourdieu, P. (1990). *The logic of practice*. Stanford University Press.

Bourdieu, P. (2013). *Distinction: A social critique of the judgement of taste*. Routledge.

Bourdieu, P., & Passeron, J. C. (1990). *Reproduction in education, society and culture* (Vol. 4). Sage.

Bourdieu, P., & Wacquant, L.J.D. (1992). *An invitation to reflexive sociology*. Cambridge: Polity Press.

Bowles, S., & Gintis, H. (1976). *Schooling in capitalist America* (Vol. 57). New York: Basic Books.

Brawner, C. E., Frillman, S., & Ohland, M. W. (2010). A comparison of nine universities' academic policies from 1988 to 2005. *Online* Submission. Retrieved from http://files.eric.ed.gov/fulltext/ED508293.pdf

Brown, R. (2011). *Prejudice: Its social psychology*. John Wiley & Sons.

Brown, B. A., Brown, C. A., & Jayakumar, U. M. (2009). When cultures clash: Transposing a college-going culture in an urban high school. In *Towards a brighter tomorrow: College barriers, hopes and plans of Black, Latino/a and Asian American students in California*, 277-297.

Brown, P., Reay, D., & Vincent, C. (2013). Education and social mobility. *British Journal of Sociology of Education*, 34(5-6), 637-643

Burtner, J. (2005). The Use of Discriminant Analysis to Investigate the Influence of Non-Cognitive Factors on Engineering School Persistence. *Journal of Engineering Education*, *94*(3): 335−338.

Calcagno, J. C., Bailey, T., Jenkins, D., Kienzl, G., & Leinbach, T. (2008). Community college student success: What institutional characteristics make a difference?. *Economics of Education review*, 27(6), 632-645.

Calcagno, J. C., & Long, B. T. (2008). The impact of postsecondary remediation using a regression discontinuity approach: Addressing endogenous sorting and noncompliance (No. w14194). National Bureau of Economic Research.

Carey, R. L. (2016). "Keep that in mind… You're gonna go to college": Family influence on the college going processes of Black and Latino high school boys. *The Urban Review*, *48*(5), 718-742.

Carnevale, A.P., Smith, N., and Melton, M. (2011). *STEM: Science, Technology, Engineering, and Mathematics*. Washington, DC: Center on Education and the Workforce, Georgetown University.

Carpi, A., Ronan, D. M., Falconer, H. M., & Lents, N. H. (2017). Cultivating minority scientists: Undergraduate research increases self-efficacy and career ambitions for underrepresented students in STEM. *Journal of Research in Science Teaching*, *54*(2), 169-194.

Carspecken, P. F. (1996). *Critical ethnography in educational research: A theoretical and practical guide*. Psychology Press.

Carter, P. L. (2005). Keepin'it real: School success beyond Black and White. Oxford University Press.

Castellanos, J & Gloria, A.M. (2007). Research considerations and theoretical application for best practices in higher education: Latina/os achieving success. *Journal of Hispanic Higher Education* 6, no. 4. Pg. 378-396.

Castillo, L. G., Conoley, C. W., Choi-Pearson, C., Archuleta, D. J., Phoummarath, M. J., & Van Landingham, A. (2006). University environment as a mediator of Latino ethnic identity and persistence attitudes. *Journal of Counseling Psychology*, *53*(2), 267.

Cates, J. T. & Schaefle, S. E. (2011). The relationship between a college preparation program and at-risk students' college readiness. *Journal of Latinos and Education*, 10(4), 320-334.

Chang, M. J., Cerna, O., Han, J., & Saenz, V. (2008). The contradictory roles of institutional status in retaining underrepresented minorities in biomedical and behavioral science majors. *The Review of Higher Education*, 31(4), 433-464.

Chen, X. (2013). STEM Attrition: College Students' Paths into and out of STEM Fields. Statistical Analysis Report. NCES 2014-001. *National Center for Education Statistics*.

Chen, R., & DesJardins, S. L. (2010). Investigating the impact of financial aid on student dropout risks: Racial and ethnic differences. *Journal of Higher Education*, 81, 179–208.

Chrispeels, J. H., & Rivero, E. (2001). Engaging Latino families for student success: How parent education can reshape parents' sense of place in the education of their children. *Peabody Journal of Education*, 76(2), 119-169.

Christie, H., Tett, L., Cree, V. E., Hounsell, J., & McCune, V. (2008). 'A real rollercoaster of confidence and emotions': Learning to be a university student. *Studies in Higher Education*, 33(5), 567-581.

Clark, K. B., & Plotkin, L. (1972). A review of the issues and literature of cultural deprivation theory. *The educationally deprived. New York: Metropolitan Applied Research Center*.

Cole, D. & Espinoza, A. (2008). Examining the academic success of Latino students in science technology engineering and mathematics (STEM) majors. *Journal of College Student Development*, 49(4), 285-300.

College Board (2013). *Education Pays Full Report*. Retrieved from: https://trends.collegeboard.org/sites/default/files/education-pays-2013-full-report.pdf

Collins, J. (2009). Social reproduction in classrooms and schools. *Annual Review of Anthropology*, *38*, 33-48.

Comas-Diaz, L. (2010). Madrinas, comadres, and luminarias: Latina mentors in action. *A Handbook for Women Mentors: Transcending Barriers of Stereotype, Race, and Ethnicity*, 161.

Condron, D. J., & Roscigno, V. J. (2003). Disparities within: Unequal spending and achievement in an urban school district. *Sociology of Education*, 18-36.

Conley, D. T. (2007). *Redefining college readiness*. Eugene, OR: Educational Policy

Conley, D. T. (2007). The challenge of college readiness. *Educational Leadership*, 64(7), 23.

Conley, D. T. (2008). Rethinking college readiness. *New directions for higher education*, 2008(144), 3-13.

Contreras, F. E., Malcom, L. E., & Bensimon, E. M. (2008). Hispanic serving institutions. In *Understanding minority serving institutions*, 71-90.

Covington, M. V. (1992). *Making the grade: A self-worth perspective on motivation and school reform*. Cambridge University Press.

Cowan, G. (2005). Interracial interactions at racially diverse university campuses. *The Journal of social psychology*, 145(1), 49-64.

Crane, D. (2012). *Fashion and its social agendas: Class, gender, and identity in clothing*. University of Chicago Press.

Creswell, J. W., & Creswell, J. D. (2017*). Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Crisp, G., & Nora, A. (2010). Hispanic student success: Factors influencing the persistence and transfer decisions of Latino community college students enrolled in developmental education. *Research in Higher Education*, 51, 175–194. doi:10.1007/ s11162-009-9151-x

Crisp, G., & Nora, A. (2012). Overview of Hispanics in science, mathematics, engineering and technology (STEM): K-16 representation, preparation and participation.

Crisp, G., Taggart, A., & Nora, A. (2015). Undergraduate Latina/o students: A systematic review of research identifying factors contributing to academic success outcomes. *Review of Educational Research*, 85(2), 249-274.

Cromley, J. G., Perez, T., & Kaplan, A. (2016). Undergraduate STEM achievement and retention: Cognitive, motivational, and institutional factors and solutions. *Policy Insights from the Behavioral and Brain Sciences*, 3(1), 4-11.

Darling-Hammond, L. (1998). Unequal opportunity: Race and education. *The Brookings Review*, 16(2), 28.

Darling-Hammond, L. (2007). Race, inequality and educational accountability: The irony of 'No Child Left Behind'. *Race Ethnicity and Education*, 10(3), 245-260.

Darling-Hammond, L., Noguera, P., Cobb, V. L., & Meier, D. (2007). Evaluating" no child left behind". *NATION-NEW YORK-*, 284(20), 11.

Davila, E. R., & de Bradley, A. A. (2010). Examining Education for Latinas/os in Chicago: A CRT/LatCrit Approach. *Educational Foundations, 24*, 39-58.

De los Santos Jr, A. G., & Cuamea, K. M. (2010). Challenges facing Hispanic-serving institutions in the first decade of the 21st century. *Journal of Latinos and Education*, 9(2), 90-107.

Delgado-Guerrero, M., & Gloria, A. M. (2013). La importancia de la hermandad Latina: Examining the psychosociocultural influences of Latina-based sororities on academic persistence decisions. *Journal of College Student Development*, 54(4), 361-378.

Delgado-Guerrero, M., Cherniack, M. A., & Gloria, A. M. (2014). Family away from home: Factors influencing undergraduate women of color's decisions to join a cultural-specific sorority. *Journal of Diversity in Higher Education*, 7(1), 45.

DeLozier, S. J., & Rhodes, M. G. (2017). Flipped classrooms: a review of key ideas and recommendations for practice. Educational Psychology Review, 29(1), 141-151.

Dika, S. L., & D'Amico, M. M. (2016). Early experiences and integration in the persistence of first-generation college students in STEM and non-STEM majors. *Journal of Research in Science Teaching*, 53(3), 368-383.

Dovidio, J. F., Gaertner, S. E., Kawakami, K., & Hodson, G. (2002). Why can't we just get along? Interpersonal biases and interracial distrust. *Cultural Diversity and Ethnic Minority Psychology*, 8(2), 88.

Dovidio, J. F., Kawakami, K., & Gaertner, S. L. (2002). Implicit and explicit prejudice and interracial interaction. *Journal of personality and social psychology*, 82(1), 62.

Dowd, A. (2007). Community colleges as gateways and gatekeepers: Moving beyond the access "saga" toward outcome equity. *Harvard Educational Review*, 77(4), 407-419.

Duckitt, J. (1992). *The social psychology of prejudice*. New York: Praeger.

Duckitt, J. (2001). A dual-process cognitive-motivational theory of ideology and prejudice. *In Advances in experimental social psychology* (Vol. 33, pp. 41-113). Academic Press.

Duggan, M. B. (2002). *The Effect of Social Capital on the First-year Persistence of First Generation College Students: A Dissertation*. University of Massachusetts Boston.

Dumais, S. A., & Ward, A. (2010). Cultural capital and first-generation college success. *Poetics*, 38(3), 245-265.

Easley Jr, N., Bianco, M., & Leech, N. (2012). Ganas: A qualitative study examining Mexican heritage students' motivation to succeed in higher education. *Journal of Hispanic Higher Education*, *11*(2), 164-178.

Ejiwale, J. A. (2013). Barriers to successful implementation of STEM education. *Journal of Education and Learning*, 7(2), 63-74.

Espinosa, L. L. (2008). The academic self-concept of African American and Latina (o) men and women in STEM majors. *Journal of Women and Minorities in Science and Engineering*, 14(2).

Espinosa, L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review*, 81(2), 209-241.

Frederick, P. J. (2002). Student involvement: Active learning in large classes. In C. A. Stanley & M. E. Porter (Eds.), *Engaging large classes : strategies and techniques for college faculty. Bolton, MA* . Anker Publishing Company.

Freeman, L., & Greenacre, L. (2011). An examination of socially destructive behaviors in group work. *Journal of Marketing Education*, 33(1), 5-17.

Foltz, L. G., Gannon, S., & Kirschmann, S. L. (2014). Factors that contribute to the persistence of minority students in STEM fields. *Planning for Higher Education*, 42(4), 1-13.

Ford, C. S. (2010). Impact of the advancement via individual determination (AVID) program on closing the academic achievement gap.

Fry, R. (2004). Latino Youth Finishing College: The Role of Selective Pathways. *Pew Hispanic Center*.

Fryer, L. K., Ginns, P., Howarth, M., Anderson, C., & Ozono, S. (2018). Individual differences and course attendance: why do students skip class?. *Educational Psychology*, 38(4), 470-486.

Gaertner, S. L., & Dovidio, J. F. (1986). *The aversive form of racism.* San Diego, CA, US: Academic Press.

Gaertner, S. L., & Dovidio, J. F. (2005). Understanding and addressing contemporary racism: From aversive racism to the common ingroup identity model. *Journal of Social issues*, 61(3), 615-639.

Gaertner, S. L., & Dovidio, J. F. (2014). *Reducing intergroup bias: The common ingroup identity model*. Psychology Press.

Gandara, P., Larson, K., Rumberger, R., & Mehan, H. (1998). Capturing Latino students in the academic pipeline. Berkeley: University of California Office of the President, The California Policy Research Center. Retrieved October 23, 2004, from http://www.ucop.edu/cprc/pipeline.html

Gandara, P. C., & Contreras, F. (2009). The Latino education crisis: The consequences of failed social policies. Harvard University Press.

Garcia, G. A. & Hurtado, S. (2011). Predicting Latina/o STEM persistence at HSIs and non-HSIs. *University of California, Los Angeles*.

Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in higher education*, 53(2), 229-261.

Geske, J. (1992). Overcoming the drawbacks of large lecture class. *College Teaching*, 40(4), 151-154.

Gibbons, S. (2004). The costs of urban property crime. *The Economic Journal*, 114(499), F441-F463.

Giroux, H. (1983). Theories of reproduction and resistance in the new sociology of education: A critical analysis. *Harvard educational review*, *53*(3), 257-293.

Gloria, A. M. (1997). Chicana academic persistence: Creating a university based community. *Education and Urban Society*, 30, 107–121.

Gloria, A. M., & Robinson-Kurpius, S. E. (1996). The validation of the cultural congruity scale and the university environment scale with Chicano/a students. *Hispanic Journal of Behavioral Sciences*, 18, 533-549.

Gloria, A. M., & Pope-Davis, D. B. (1997). Cultural ambience: The importance of a culturally aware environment in the training and education of counselors. In D. B. Pope-Davis & H. L. K. Coleman (Eds.), *Multicultural counseling competencies: Assessment, education and training, and supervision (pp. 242-259)*. Thousand Oaks, CA: Sage.

Gloria, A. M. (2005). Understanding Chicana/o academic persistence decisions: Examining psychological, social, and cultural variables. Manuscript in preparation.

Gloria, A. M., & Castellanos, J. (2003). Latina/o and African American students at predominantly White institutions: A psychosociocultural perspective of cultural congruity, campus climate, and academic persistence. *The majority in the minority: Expanding the representation of Latina/o faculty, administrators and students in higher education*, 71-92.

Gloria, A. M., & Segura-Herrera, T. M. (2004). Ambrocia and Omar go to college: A psychosociocultural examination of Chicanos and Chicanas in higher education. In R. J. Velasquez, B. McNeill, & L. Arellano (Eds.), *Handbook of Chicana and Chicano psychology* (pp. 401- 425). Mahwah, NJ: Lawrence Erlbaum

Gloria, A. M., Castellanos, J., Lopez, A. G., & Rosales, R. (2005). An examination of academic nonpersistence decisions of Latino undergraduates. *Hispanic Journal of Behavioral Sciences, 27*(2), 202-223.

Gloria, A. M. & Castellanos, J. (2009). Latinas/os and their communities. In *Council of National Psychological Associations for the Advancement of Ethnic Minority Interests (Ed.), Psychology education and training from culture-specific and multiracial perspectives*, 12-18.

Gloria, A. M., Castellanos, J., Dueñas, M., & Franco, V. (2019). Academic family and educational Compadrazgo: Implementing cultural values to create educational relationships for informal learning and persistence for Latinx undergraduates 1. *In Schools and Informal Learning in a Knowledge-Based World* (pp. 119-135). Routledge.

Goldrick-Rab, S. (2010). Challenges and opportunities for improving community college student success. *Review of Educational Research*, 80(3), 437-469.

Goldrick-Rab, S. (2016). *Paying the price: College costs, financial aid, and the betrayal of the American dream*. University of Chicago Press.

Goldrick-Rab, S., Broton, K., & Gates, C. (2013). Clearing the path to a brighter future: Addressing barriers to community college access and success. University of Wisconsin. Prepared for the Association of Community College Trustees and Single Stop USA.

Graham, M. J., Frederick, J., Byars-Winston, A., Hunter, A. B., & Handelsman, J. (2013). Increasing persistence of college students in STEM. *Science, 341*(6153), 1455-1456.

Griffith, A. (2010). Persistence of Women and Minorities in STEM Field Majors: Is It the School That Matters? *Economics of Education Review, 29*(6): 911–922

Gross, J. P. K. (2011). Promoting or perturbing success: The effects of aid on timing to Latino students' first departure from college. *Journal of Hispanic Higher Education*, 10, 317–330.

Gross, J. P., Zerquera, D., Inge, B., & Berry, M. (2014). Latino associate degree completion: Effects of financial aid over time. *Journal of Hispanic Higher Education*, 13(3), 177-190.

Guimond, S., Begin, G., & Palmer, D. L. (1989). Education and causal attributions: The development of" person-blame" and" system-blame" ideology. *Social psychology quarterly*, 126-140.

Guinier, L. (2015). *The tyranny of the meritocracy: Democratizing higher education in America*. Beacon Press.

Gusa, D. L. (2010). White institutional presence: The impact of Whiteness on campus climate. *Harvard Educational Review*, 80(4), 464-490.

Gutiérrez, E. B. (2010). *Ganas of showing the way: A grounded theory study of Hispanic presidents in higher education* (Doctoral dissertation*)*. Retrieved from Dissertations and Theses database.

Hallett, R. E., & Venegas, K. M. (2011). Is increased access enough? Advanced placement courses, quality, and success in low-income urban schools. *Journal for the Education of the Gifted*, 34(3), 468-487.

Hauser, R. M., Warren, J. R., Huang, M. H., & Carter, W. Y. (2000). Occupational status, education, and social mobility in the meritocracy. In *Meritocracy and economic inequality*, 179-229.

Heller, D. E. (2008). The impact of student loans on college access. *The effectiveness of student aid policies: What the research tells us*, 39-68.

Henry, G. T. (2009). Practical sampling. In *The SAGE handbook of applied social research methods*, 2, 77-105.

Hernandez, J. C. (2000). Understanding the retention of Latino college students. *Journal of College Student Development*, 41, 575-588.

Hernandez, P. R., Schultz, P., Estrada, M., Woodcock, A., & Chance, R. C. (2013). Sustaining optimal motivation: A longitudinal analysis of interventions to broaden participation of underrepresented students in STEM. *Journal of educational psychology*, *105*(1), 89.

Herrera, F. A., & Hurtado, S. (2011). Maintaining initial interests: Developing science, technology, engineering, and mathematics (STEM) career aspirations among underrepresented racial minority students. *In Association for Educational Research annual meeting*, New Orleans, LA.

Hill, N. E., & Torres, K. (2010). Negotiating the American dream: The paradox of aspirations and achievement among Latino students and engagement between their families and schools. *Journal of Social Issues*, 66(1), 95-112.

Holcomb-McCoy, C. (2010). Involving low-income parents and parents of color in college readiness activities: An exploratory study. *Professional School Counseling*, 14(1), 2156759X1001400111.

Hout, M. (2012). Social and economic returns to college education in the United States. *Annual Review of Sociology*, 38, 379-400.

Huang, G., Taddese, N., and Walter, E. (2000). Entry and Persistence of Women and Minorities in College Science and Engineering Education (NCES 2000-601). *National Center for Education Statistics*, U.S. Department of Education. Washington, DC.

Hurtado, S. (1994). The institutional climate for talented Latino students. *Research in Higher Education*, 35(1), 21-41.

Hurtado, S., Carter, D. F., & Spuler, A. (1996). Latino student transition to college: Assessing difficulties and factors in successful college adjustment. *Research in Higher Education*, 37, 135–157.

Hurtado, S., Inkelas, K. K., Briggs, C., & Rhee, B. S. (1997). Differences in college access and choice among racial/ethnic groups: Identifying continuing barriers. *Research in Higher Education*, 38(1), 43-75.

Hurtado, S., Milem, J., Clayton-Pedersen, A., & Allen, W. (1998). Enhancing campus climates for racial/ethnic diversity: Educational policy and practice. *Review of Higher Education*, 21(3), 279–302.

Hurtado, S., & Ponjuan, L. (2005). Latino educational outcomes and the campus climate. *Journal of Hispanic Higher Education*, 4(3), 235-251.

Hurtado, S., Eagan, M. K., Cabrera, N. L., Lin, M. H., Park, J., & Lopez, M. (2008). Training future scientists: Predicting first-year minority student participation in health science research. *Research in Higher Education*, *49*(2), 126-152.

Hurtado, S., Cabrera, N. L., Lin, M. H., Arellano, L., & Espinosa, L. L. (2009). Diversifying science: Underrepresented student experiences in structured research programs. *Research in Higher Education*, 50(2), 189-214.

Hurtado, S., Newman, C. B., Tran, M. C., & Chang, M. J. (2010). Improving the rate of success for underrepresented racial minorities in STEM fields: Insights from a national project. *New Directions for Institutional Research*, 2010 (148), 5-15.

Hurtado, S., Eagan, K., Pryor, J.H., Whang, H., & Tran, S. (2012). Undergraduate

Teaching Faculty: The 2010-2011 HERI Faculty Survey. . Los Angeles: University of California Los Angeles, The Higher Education Research Institute.

Ironsmith, M., Marva, J., Harju, B., & Eppler, M. (2003). Motivation and performance in college students enrolled in self-paced versus lecture-format remedial mathematics courses. Journal *of Instructional Psychology*, 30(4), 276-284.

Iverson, B. L. (2002). What my students have taught me. In C. A. Stanley & M. E. Porter (Eds.), *Engaging large classes : strategies and techniques for college faculty*. Bolton, MA :: Anker Publishing Company

Jackman, M. R., & Jackman, R. W. (1983). *Class awareness in the United States* (Vol. 343). Univ of California Press.

Jackson, D. L., & Laanan, F. S. (2015). Desiring to fit: Fostering the success of community college transfer students in STEM. *Community College Journal of Research and Practice*, 39(2), 132-149.

Jeffrey, B. (2008). Characterizing social settings as the basis for qualitative research in ethnography. In: G. Walford (Ed.), *How to do educational ethnography.* London, UK: The Tufnell Press (pp. 141 -164).

Jenkins, D. (2007). Institutional effectiveness and student success: A study of high-and low-impact community colleges. *Community College Journal of Research and Practice*, 31(12), 945-962.

Johnson, D. R. (2012). Campus racial climate perceptions and overall sense of belonging among racially diverse women in STEM majors. *Journal of College Student Development*, 53(2), 336-346.

Johnson, M. & Sheppard, S. (2004). Relationships between engineering student and faculty demographics and stakeholders working to affect change. *Journal of Engineering Education*, 93(2), 139- 151

Kanno, Y. & Grosik, S. A. (2012). Immigrant English learners' transitions to university: Student challenges and institutional policies. In *Linguistic Minority Students Go to College* (pp. 140-157). Routledge.

Kaplan, B. A. (1963). Issues in educating the culturally disadvantaged. *Phi Delta Kappan*, 70-76.

Karabenick, S. A., & Newman, R. S. (Eds.). (2013). *Help seeking in academic settings: Goals, groups, and contexts*. Routledge.

Karen, D. (1991). The politics of class, race, and gender: Access to higher education in the United States, 1960-1986. *American Journal of Education*, 208-237.

Kelchen, R. (2018). *Higher education accountability*. JHU Press.

Kitsantas, A., Winsler, A., & Huie, F. (2008). Self-regulation and ability predictors of academic success during college: A predictive validity study. *Journal of Advanced Academics*, *20*(1), 42-68.

Kokkelenberg, E. C., & Sinha, E. (2010). Who succeeds in STEM studies? An analysis of Binghamton University undergraduate students. *Economics of Education Review*, 29(6), 935-946.

Kuenzi, J. J. (2008). Science, Technology, Engineering, and Mathematics (STEM) Education: Background, Federal Policy, and Legislative Action. Congressional Research Service Reports. Paper 35

Ladson-Billings, G. (2000) Racialized discourses and ethnic epistemologies, *In: N. Denzin & Y. Lincoln (Eds) Handbook of qualitative research* (Thousand Oaks, CA, Sage), 257–277.

Ladson-Billings, G. (2006). From the achievement gap to the education debt: Understanding achievement in US schools. *Educational researcher*, *35*(7), 3-12.

Lane, T. B., Morgan, K., & Lopez, M. M. (2017). "A Bridge Between High School and College" A Case Study of a STEM Intervention Program Enhancing College Readiness Among Underserved Students. *Journal of College Student Retention: Research, Theory & Practice*, 1521025117729824.

Lankford, H., Loeb, S., & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational evaluation and policy analysis*, 24(1), 37-62.

Lapan, S. D., Quartaroli, M. T., & Riemer, F. J. (Eds.). (2011). *Qualitative research: An introduction to methods and designs* (Vol. 37). John Wiley & Sons.

Lareau, A. (2011). *Unequal childhoods: Class, race, and family life.* Univ of California Press.

Larrotta, C., & Yamamura, E. K. (2011). A community cultural wealth approach to Latina/Latino parent involvement: The promise of family literacy. *Adult Basic Education and Literacy Journal*, 5(2), 74-83.

Le, V. N., Mariano, L. T., & Faxon-Mills, S. (2016). Can college outreach programs improve college readiness? The case of the college bound, St. Louis program. *Research in Higher Education*, *57*(3), 261-287.

Lewis, O. (1971). The culture of poverty. *Poor Americans: How the white poor live*, 20-26.

Lichtenstein, G., Loshbaugh, H. G., Claar, B., Bailey, T. L., & Sheppard, S. (2007). Should I stay or should go? Engineering students' persistence is based on little experience or data.

Proceedings of the American Society for Engineering Education Annual Conference, Honolulu, Hawaii

Lindo, J. M., Sanders, N. J., & Oreopoulos, P. (2010). Ability, gender, and performance standards: Evidence from academic probation. *American Economic Journal: Applied Economics*, 2(2), 95-117.

Liu, A. (2011). Unraveling the myth of meritocracy within the context of US higher education. *Higher education*, 62(4), 383-397.

Litzler, E., Samuelson, C. C., & Lorah, J. A. (2014). Breaking it down: Engineering student STEM confidence at the intersection of race/ethnicity and gender. *Research in Higher Education*, 55(8), 810-832.

Lopez, G. (2001). The value of hard work: Lessons on parent involvement from an (im) migrant household. *Harvard educational review*, 71(3), 416-438

Luedke, C. L. (2018). "Es como una Familia": Bridging Emotional Support With Academic and Professional Development Through the Acquisition of Capital in Latinx Student Organizations. *Journal of Hispanic Higher Education*, 1538192717751205.

Lynch, A. K., & Rasmussen, D. W. (2001). Measuring the impact of crime on house prices. *Applied Economics*, 33(15), 1981-1989.

Mack, D. E., Tucker, T. W., Archuleta, R., DeGroot, G., Hernandez, A. A., & Cha, S. O. (1997). Interethnic relations on campus: Can't we all get along?. *Journal of Multicultural Counseling and Development*, 25(4), 256-268.

MacPhee, D., Farro, S., & Canetto, S. S. (2013). Academic self-efficacy and performance of underrepresented STEM majors: Gender, ethnic, and social class patterns. *Analyses of Social Issues and Public Policy*, *13*(1), 347-369.

Malin, J. R., Bragg, D. D., & Hackmann, D. G. (2017). College and career readiness and the Every Student Succeeds Act. *Educational Administration Quarterly*, 53(5), 809-838.

Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science Education*, 95, 877-907

Marans, A. E., & Lourie, R. (1967). Hypotheses regarding the effects of child-rearing patterns on the disadvantaged child. *Disadvantaged child*, *1*, 17-41.

Marin, G., & Marin, B. V. (1991). *Research with Hispanic populations*. Newbury Park, CA: Sage.

Mau, W. C. J. (2016). Characteristics of US Students That Pursued a STEM Major and Factors That Predicted Their Persistence in Degree Completion. *Universal Journal of Educational Research*, *4*(6), 1495-1500.

McCabe, J. (2009). Racial and gender microaggressions on a predominantly-White campus: Experiences of Black, Latina/o and White undergraduates. *Race, Gender & Class*, 133-151.

McDonough, P. M. (2005a). Counseling matters: Knowledge, assistance, and organizational commitment in college preparation. In *Preparing for college: Nine elements of effective outreach*, 69-87.

McDonough, P. M. (2005b). Counseling and college counseling in America's high schools. *State of college admission*, 107-121.

Means, B., Wang, H., Young, V., Peters, V. L., & Lynch, S. J. (2016). STEM-focused high schools as a strategy for enhancing readiness for postsecondary STEM programs. *Journal of Research in Science Teaching*, 53(5), 709-736.

Minikel-Lacocque, J. (2012). Racism, college, and the power of words racial microaggressions reconsidered. *American Educational Research Journal*, 0002831212468048.

Moncada-Davidson, L. (1996). Understanding success among central American immigrant students. *Latino Studies Journal, 7*(1), 3–32.

Montmarquette, C., Cannings, K., & Mahseredjian, S. (2002). How do young people choose college majors?. *Economics of Education Review*, 21(6), 543-556.

Mullen, A. L. (2010). *Degrees of inequality: Culture, class, and gender in American higher education.* JHU Press.

National Science Foundation (NSF) (2016a). *Who earns bachelor's degrees in science and engineering?* Retrieved from https://www.nsf.gov/nsb/sei/edTool/data/college-14.html

National Science Foundation (NSF) (2016b). *How much do S&E workers earn.* Retrieved from: https://www.nsf.gov/nsb/sei/edTool/data/workforce-08.html

Nauta, M. M., & Epperson, D. L. (2003). A longitudinal examination of the social-cognitive model applied to high school girls' choices of nontraditional college majors and aspirations. *Journal of Counseling Psychology*, 50, 448-457.

Neelsen, J. P. (1975). Education and social mobility. *Comparative Education Review*, 129-143.

Noguera, P. A. (2001). Transforming urban schools through investments in the social capital of parents. *Psychology*, *16*, 725-750.

Nowell, C. (2017). The influence of motivational orientation on the satisfaction of university students. *Teaching in Higher Education*, 22(7), 855-866.

O'Shea, S., Lysaght, P., Roberts, J., & Harwood, V. (2016). Shifting the blame in higher education–social inclusion and deficit discourses. *Higher Education Research & Development*, 35(2), 322-336.

Oakes, J. (2005*). Keeping track: Structuring equality and inequality in an era of accountability* (2nd Ed.). New Haven & London, Yale University Press

Ochoa, G. L. (2013). Academic *profiling: Latinos, Asian Americans, and the achievement gap*. U of Minnesota Press.

Ojeda, L., Navarro, R. L., & Morales, A. (2011). The role of la familia on Mexican American men's college persistence intentions. *Psychology of Men & Masculinity*, 12(3), 216.

Orfield, G., & Frankenberg, E. (2014). Increasingly segregated and unequal schools as courts reverse policy. *Educational Administration Quarterly*, *50*(5), 718-734.

Ost, B. (2010). The role of peers and grades in determining major persistence in the sciences. *Economics of Education Review*, 29(6), 923-934.

Padilla, R. V., Pedraza, P., & Rivera, M. (2005). Latino/a education in the 21st century. *Latino education: An agenda for community action research* (pp. 403 – 423). Mahwah, NJ: Lawrence Erlbaum

Palmer, R., & Gasman, M. (2008). " It takes a village to raise a child": The role of social capital in promoting academic success for African American men at a Black college. *Journal of College Student Development*, 49(1), 52-70.

Palmer, R. T., Maramba, D. C., & Gasman, M. (Eds.). (2013). *Fostering success of ethnic and racial minorities in STEM: The role of minority serving institutions*. Routledge.

Palmer, R. T., Maramba, D. C., Gasman, M., & Lloyd, K. D. (2013). Charting the course: The role of minority serving institutions in facilitating the success of underrepresented racial minority students in STEM. In *Fostering Success of Ethnic and Racial Minorities in STEM* (pp. 23-37). Routledge.

Paschal, J., & Taggart, A. (2019). An Examination of the Role of First-Year College-Level Mathematics in STEM Field Major Persistence at a Hispanic-Serving Institution. *Journal of Hispanic Higher Education*, 1538192719853464.

Patton, M. Q. (2002). Purposeful Sampling. In *Qualitative evaluation and research methods* (3rd ed.). Newbury Park, CA: Sage Publications.

Peralta, C., Caspary, M., & Boothe, D. (2013). Success factors impacting Latina/o persistence in higher education leading to STEM opportunities. *Cultural Studies of Science Education*, 8(4), 905-918.

Perna, L. W., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. Journal of Higher Education, 485-518.

Perna, L. W., & Li, C. (2006). College affordability: Implications for college opportunity.

Peske, H. G., & Haycock, K. (2006). Teaching Inequality: How Poor and Minority Students Are Shortchanged on Teacher Quality: A Report and Recommendations by the Education Trust. *Education Trust.*

Price, D. V. (2004). *Borrowing inequality: Race, class, and student loans*. Lynne Rienner Publishers.

Porter, A. C., & Polikoff, M. S. (2012). Measuring academic readiness for college. *Educational Policy*, 26(3), 394-417.

Rainey, H. G. (2000). Work motivation. *Handbook of organizational behavior*, 19-42.

Raffaelli, M., & Ontai, L. L. (2004). Gender socialization in Latino/a families: Results from two retrospective studies. *Sex Roles*, 50(5-6), 287-299.

Rask, K. (2010). Attrition in STEM Fields at a Liberal Arts College: The Importance of Grades and Pre-Collegiate Preferences. *Economics of Education Review*, 29(6): 892−900.

Reardon, S. F. (2011). The widening academic achievement gap between the rich and the poor: New evidence and possible explanations. *Whither opportunity*, 91-116.

Reay, D. (2005). Beyond consciousness? The psychic landscape of social class. *Sociology*, 39(5), 911-928.

Reid, L. D., & Radhakrishnan, P. (2003). Race matters: The relation between race and general campus climate. *Cultural Diversity and Ethnic Minority Psychology*, 9(3), 263.

Reid, M. J., & Moore III, J. L. (2008). College readiness and academic preparation for postsecondary education: Oral histories of first-generation urban college students. *Urban education*, *43*(2), 240-261.

Riegle-Crumb, C., King, B., & Moore, C. (2016). Do they stay or do they go? The switching decisions of individuals who enter gender atypical college majors. *Sex roles*, 74(9-10), 436-449.

Reimers, F. (Ed.). (2000). *Unequal schools, unequal chances: The challenges to equal opportunity in the Americas (Vol. 5).* Cambridge, MA: Harvard University. David Rockefeller Center for Latin American Studies.

Reyes, O., Kobus, K., & Gillock, K. (1999). Career aspirations of urban, Mexican American adolescent females. *Hispanic Journal of Behavioral Sciences*, 21(3), 366-382.

Richards, K. A. R., & Velasquez, J. D. (2014). First-Year Students' Perceptions of Instruction in Large Lectures: The Top-10 Mistakes Made by Instructors. *Journal on Excellence in College Teaching*, 25(2).

Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (Eds.). (2013). *Qualitative research practice: A guide for social science students and researchers*. Sage

Robertson, J. (2002). Reflexivity redux: A pithy polemic on" positionality." *Anthropological Quarterly*, 75(4), 785-792.

Roderick, M., Nagaoka, J., & Coca, V. (2009). College readiness for all: The challenge for urban high schools. *The future of children*, 19(1), 185-210.

Rodriguez, K. M., Castillo, L. G., & Gandara, L. (2013). The influence of marianismo, ganas, and academic motivation on Latina adolescents' academic achievement intentions. *Journal of Latina/o Psychology*, *1*(4), 218.

Rogers-Chapman, M. F. (2014). Accessing STEM-focused education: Factors that contribute to the opportunity to attend STEM high schools across the United States. *Education and Urban Society*, 46(6), 716-737

Rothman, R. A. (2015). *Inequality and stratification: Race, class, and gender*. Routledge.

Royster, P., Gross, J., & Hochbein, C. (2015). Timing is everything: Getting students back on track to college readiness in high school. *The High School Journal*, *98*(3), 208-225.

Ryan, A. M., Gheen, M. H., & Midgley, C. (1998). Why do some students avoid asking for help? An examination of the interplay among students' academic efficacy, teachers' social–emotional role, and the classroom goal structure. *Journal of educational psychology*, 90(3), 528.

Saenz, V. B., & Ponjuan, L. (2009). The vanishing Latino male in higher education. *Journal of Hispanic Higher Education*, 8(1), 54-89.

Sahin, A., Cavlazoglu, B., & Zeytuncu, Y. E. (2015). Flipping a college calculus course: A case study. *Journal of Educational Technology & Society*, *18*(3).

Sayer, A. (2005). The moral significance of class. *Cambridge University Press*.

Scalise, A., Besterfield-Sacre, M., Shuman, L., & Wolfe, H. (2000). First term probation: Models for identifying high risk students. In *30th Annual Frontiers in Education Conference*. Building on A Century of Progress in Engineering Education. Conference Proceedings (IEEE Cat. No. 00CH37135) (Vol. 1, pp. F1F-11). IEEE.

Scrivener, S., & Logue, A. W. (2016). Building College Readiness before Matriculation: A Preview of a CUNY Start Evaluation. Research Brief. *MDRC*.

Scrivener, S., Gupta, H., Weiss, M. J., Cohen, B., Cormier, M. S., & Brathwaite, J. (2018). Becoming college-ready: Early findings from a CUNY Start evaluation. *New York: MDRC, July*.

Seymour, E. (2000). *Talking about leaving: Why undergraduates leave the sciences*. Westview Press.

Seymour, E., & Hewitt, N. M. (1997). *Talking About Leaving: Why Undergraduates Leave the Sciences*. Westview Press. Boulder, Colorado.

Shaver, K. G. (2016). *An introduction to attribution processes*. Routledge.

Shaw, F. (1963). Educating culturally deprived youth in urban centers. *Phi Delta Kappan*, 91-97.

Shaw, E.J., & Barbuti, S. (2010). Patterns of Persistence in Intended College Major With a Focus on STEM Majors. The *National Academic Advising Association Journal*, 30(2): 19−34.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of educational research*, 75(3), 417-453.

Smit, R. (2012). Towards a clearer understanding of student disadvantage in higher education: Problematising deficit thinking. *Higher Education Research & Development*, 31(3), 369-380.

Smith, T. B., Bowman, R., & Hsu, S. (2007). Racial attitudes among Asian and European American college students: A cross-cultural examination. *College Student Journal*, 41(2), 436-444.

Soldner, M., Rowan-Kenyon, H., Inkelas, K. K., Garvey, J., & Robbins, C. (2012). Supporting students' intentions to persist in STEM disciplines: The role of living-learning programs among other social-cognitive factors. *The Journal of Higher Education*, 83(3), 311-336.

Solórzano, D. G. (1998). Critical race theory, racial and gender microagressions, and the experiences of Chicana and Chicano scholars. International Journal of Qualitative Studies in Education, 11(1), 121–136.

Solorzano, D., Ceja, M., & Yosso, T. (2000). Critical race theory, racial microaggressions, and campus racial climate: The experiences of African American college students. *Journal of Negro education*, 60-73.

Solorzano, D. G., & Bernal, D. D. (2001). Examining transformational resistance through a critical race and LatCrit theory framework Chicana and Chicano students in an urban context. *Urban Education*, *36*(3), 308-342.

Solorzano, D. G., & Yosso, T. J. (2001). Critical race and LatCrit theory and method: Counter-storytelling. *International Journal of Qualitative Studies in Education*, *14*(4), 471-495.

Solorzano, D., Allen, W. R., & Carroll, G. (2002). Keeping race in place: Racial microaggressions and campus racial climate at the University of California, Berkeley. *Chicano-Latino L. Rev*., 23, 15.

Sorokin, P. A. (1998). *Social mobility (Vol. 3*). Taylor & Francis.

Spitzer, T. M. (2000). Predictors of college success: A comparison of traditional and nontraditional age students. *NASPA Journal*, *38*(1), 82-98.

Stage, F. K., Lundy-Wagner, V. C., & John, G. (2013). Minority Serving Institutions and STEM. *In Fostering success of ethnic and racial minorities in STEM: The role of minority serving institutions*, Pg. 16.

Stevens, T., Olivarez, A., Lan, W. Y., & Tallent-Runnels, M. K. (2004). Role of mathematics self-efficacy and motivation in mathematics performance across ethnicity. *The Journal of Educational Research*, 97(4), 208-222.

Stine, D.D., & C.M. Matthews (2009). The US science and technology workforce. *Federal Publications*: 644.

Strayhorn, T. L. (2013). Impact of institutional climates of MSIs and their ability to foster success for racial and ethnic minority students in STEM. *In Fostering success of ethnic and racial minorities in STEM: The role of minority serving institutions*, 33-45.

Strayhorn, T. L. (2018). *College students' sense of belonging: A key to educational success for all students*. Routledge.

Stets, J. E., & Turner, J. H. (Eds.). (2014). *Handbook of the Sociology of Emotions* (Vol. 2). Springer.

Stewart, S., Lim, D. H., & Kim, J. (2015). Factors influencing college persistence for first-time students. *Journal of Developmental Education*, 12-20.

Suarez-Orozco, C. & Suarez-Orozco, M. (1995*). Immigration, family life, and achievement motivation among Latino adolescents*. Stanford, CA: Stanford University Press.

Tan, D. L. (2002). Majors in science, technology, engineering, and mathematics: Gender and ethnic differences in persistence and graduation.Norman, Okla: Department of Educational Leadership and Policy Studies.

Tai, R. H., Sadler, P. M., & Mintzes, J. J. (2006). Factors influencing college science success. *Journal of College Science Teaching*, *36*(1), 52.

Terrell, N. (2007). STEM Occupations: High-Tech Jobs for a High-Tech Economy. *Occupational Outlook Quarterly.* Vol 51, no. 1 26-33.

Tierney, W. G., & Duncheon, J. C. (Eds.). (2015). *The problem of college readiness*. SUNY Press.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL; London, England: University of Chicago Press.

Tita, G. E., Petras, T. L., & Greenbaum, R. T. (2006). Crime and residential choice: a neighborhood level analysis of the impact of crime on housing prices. *Journal of quantitative criminology*, 22(4), 299.

Torres, J. B., & Solberg, V. S. (2001). Role of self-efficacy, stress, social integration, and family support in Latino college student persistence and health. *Journal of vocational behavior*, *59*(1), 53-63.

Torres, J. B., Solberg, V. S. H., & Carlstrom, A. H. (2002). The myth of sameness among Latino men and their machismo. *American Journal of Orthopsychiatry*, 72(2), 163-181.

Trimble, M. J., Pheatt, L. E., Papikyan, T., & Barnett, E. (2017). Can High School Transition Courses Help Students Avoid College Remediation? Estimating the Impact of a Transition Program in a Large Urban District. Retrieved from: https://ccrc.tc.columbia.edu/media/k2/attachments/can-high-school-transition-courses-help-students-avoid-remediation.pdf

Troy, A., & Grove, J. M. (2008). Property values, parks, and crime: A hedonic analysis in Baltimore, MD. *Landscape and urban planning*, 87(3), 233-245.

Tyson, W., Lee, R., Borman, K. M., & Hanson, M. A. (2007). Science, technology, engineering, and mathematics (STEM) pathways: High school science and math coursework and postsecondary degree attainment. *Journal of Education for Students Placed at Risk*, 12(3), 243-270.

University of California Accountability Report, 2018 (2018). Retrieved from: https://accountability.universityofcalifornia.edu/2018/welcome.html

U.S. Census, (2015). Projections of the Size and Composition of the U.S. Population: 2014 to 2060. *Current Population Reports*. Retrieved from: https://www.census.gov/content/dam/Census/library/publications/2015/demo/p25-1143.pdf

U.S. Department of Education (2011). Common Core of Data (CCD), "NCES Common Core of Data State Dropout and Completion Data File," School Year 2008–09, Version 1a, (Washington D.C.: NCES 2011).

U.S. Department of Education (2016). Digest of Education Statistics. Washington D.C.: NCES.

U.S. News (2019). U.S. News Best Colleges. Retrieved from: https://www.usnews.com/best-colleges

Valencia, R. R., & Black, M. S. (2002). " Mexican Americans Don't Value Education!"--the Basis of the Myth, Mythmaking, and Debunking. *Journal of Latinos and Education, 1(2), 81-103.*

Wacquant, L. J. (1998). Negative social capital: State breakdown and social destitution in America's urban core. *Netherlands journal of housing and the built environment*, 13(1), 25.

Walpole, M. (2003). Socioeconomic status and college: How SES affects college experiences and outcomes. *The review of higher education*, 27(1), 45-73.

Warburton, E. C., Bugarin, R., & Nunez, A. M. (2001). Bridging the Gap: Academic Preparation and Postsecondary Success of First-Generation Students. *Statistical Analysis Report. Postsecondary Education Descriptive Analysis Reports.*

Wang, X. (2013). Why students choose STEM majors motivation, high school learning, and postsecondary context of support. *American Educational Research Journal*, 0002831213488622.

Wang, X. H., & Yang, B. (2003). Why competition may discourage students from learning? A behavioral economic analysis. *Education Economics*, 11(2), 117-128.

Watkins, J., & Mazur, E. (2013). Retaining students in science, technology, engineering, and mathematics (STEM) majors. *Journal of College Science Teaching*, 42(5), 36-41.

Watt, K. M., Powell, C. A., Mendiola, I. D., & Cossio, G. (2006). Schoolwide impact and AVID: How have selected Texas high schools addressed the new accountability measures?. *Journal of education for students placed at risk,11*(1), 57-73.

Weiner, B. (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational psychologist*, 45(1), 28-36.

Weis, L., & Fine, M. (2004). *Working method: Research and social justice*. Routledge.

Weis, L., & Fine, M. (2012). Critical bifocality and circuits of privilege: Expanding critical ethnographic theory and design. *Harvard Educational Review*, 82(2), 173-201.

Weitzman, E. R., Folkman, A., Folkman, M. K. L., & Wechsler, H. (2003). The relationship of alcohol outlet density to heavy and frequent drinking and drinking-related problems among college students at eight universities. *Health & place*, 9(1), 1-6.

Wells, R. (2008). Social and cultural capital, race and ethnicity, and college student retention. *Journal of College Student Retention: Research, Theory & Practice*, 10(2), 103-128.

Walpole, M. (2003). Socioeconomic status and college: How SES affects college experiences and outcomes. *The review of higher education*, 27(1), 45-73.

Whalen, D. F., & Shelley II, M. C. (2010). Academic success for STEM and non-STEM majors. *Journal of STEM Education: Innovations and research*,11(1/2), 45.

White, K. R. (1982). The relation between socioeconomic status and academic achievement. *Psychological bulletin*, 91(3), 461.

Valencia, R., & Black, M. (2002). Mexican Americans don't value education! On the basis of myth, mythmaking, and debunking. *Journal of Latinos & Education*, 1(2), 81–103.

Van Etten, S., Pressley, M., McInerney, D. M., & Liem, A. D. (2008). College seniors' theory of their academic motivation. *Journal of Educational Psychology*, 100(4), 812.

Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race ethnicity and education*, 8(1), 69-91.

Yosso, T., Villalpando, O., Delgado Bernal, D., & Solórzano, D. G. (2001). Critical race theory in Chicana/o education. *National Association for Chicana and Chicano Studies Annual Conference. Paper 9.* http://scholarworks.sjsu.edu/naccs/2001/Proceedings/9

Yosso, T. J., Parker, L., Solorzano, D. G., & Lynn, M. (2004). From Jim Crow to affirmative action and back again: A critical race discussion of racialized rationales and access to higher education. *Review of Research in Education*, 1-25.

Yosso, T. J. (2006). *Critical race counterstories along the Chicana/Chicano educational pipeline*. Routledge.

Yosso, T., Smith, W., Ceja, M., & Solórzano, D. (2009). Critical race theory, racial microaggressions, and campus racial climate for Latina/o undergraduates. *Harvard Educational Review*, 79(4), 659-691.

Yosso, T., & Lopez, C. B. (2010). Counterspaces in a hostile place. *Culture centers in higher education: Perspectives on identity, theory, and practice,* 83-104.

Zarate, M. E. (2007). Understanding Latino Parental Involvement in Education: Perceptions, Expectations, and Recommendations. *Tomas Rivera Policy Institute*.

Zarate, M. E., & Burciaga, R. (2010). Latinos and college access: Trends and future directions. *Journal of College Admission*, 209, 24-29.

Zumbrunn, S., McKim, C., Buhs, E., & Hawley, L. R. (2014). Support, belonging, motivation, and engagement in the college classroom: A mixed method study. *Instructional Science*, 42(5), 661-684.