REBIRTH THROUGH STRUGGLE: A QUALITATIVE CASE STUDY OF LATINX STUDENTS' ENGINEERING IDENTITY

A Dissertation

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by
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AUTHORIZATION TO SUBMIT

DISSERTATION

This dissertation of Diana Garza, submitted for the degree of Doctor of Philosophy in Educational Leadership with a major in Educational Leadership and titled "Rebirth Through Struggle: A Qualitative Case Study of Latinx Students' Engineering Identity," has been reviewed in final form. Permission, as indicated by the signatures and dates given below, is now granted to submit final copies.

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To my colleague who shares the same last name, Dr. Alicia Garza. We don't always get to choose our family. Dr. Garza I embrace wholeheartedly among my family tree. She has been a huge supporter and encouraged me the entire time even back when it was only an idea starting to take shape. She was my *guía* [guide] and first introduced me to the concept of *nepantla*, as we navigated so many first and unknowns in higher education. Thank you.

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Dedication

While she passed away prior to my getting a doctorate, I dedicate this effort to my mom, Juanita Garza, who taught me to reach for the stars, even when it didn't seem possible.

Abstract

Institutions with performance-based funding (PBF) programs have had mixed outcomes, yet there have been positive gains for STEM students. Research focusing on supporting STEM students has primarily addressed majority student concerns. This study focused specifically on the Latinx engineering student experience. What strategies do Latinx engineering students at institutions with PBF programs make use of to navigate their postsecondary STEM academic program, and how do those strategies align with the critical elements in PBF with a STEM incentive? Four Latinx engineering majors were asked about their experiences utilizing a blend of the methods of narrative inquiry and *testimonio.* A program administrator was interviewed and shared her perspective on supporting Latinx students. Using a *nepantla* theoretical framework, the results indicate students found strength through relationships with their family and through study groups. Through the reflection process, they gained a renewed confidence in their paths through academia. Institutions could support the process by providing structure to make it easier for students to connect and have staff available to navigate the process.

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Introduction

"Because I, a mestiza,

Continually walk out of one culture

And into another,

Because I am in all cultures at the same time,

Alma entre dos mundos, tres, cuatro

Me zumba la cabeza con lo contradictorio.

Estoy norteada por todas las voces que me hablan

Simultaneamente." (Gloria Anzaldúa, 1987, p. 22).

[A soul between two worlds, three, four

My head buzzes with the contradictory.

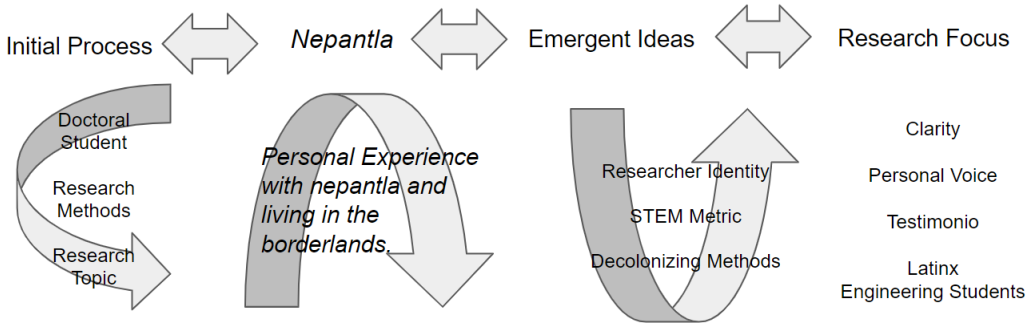
I am ruled by all the voices that talk to me simultaneously.]

Anzaldúa, a self-described Tejana, mestiza, queer feminist, introduced us to nepantla, the theoretical framework for this study. *Nepantla* is the Nahualt word, in Spanish, describing the space between two bodies of water. Anzaldúa elaborates on the definition as a spiritual embodiment (*cuerpo espirutu*) of the in-between spaces and the discomfort experienced (Anzaldúa, 2015). The doctoral process requires many steps including something as seemingly simple such as choosing a research topic. The process is designed to nurture the academic pursuit of knowledge and push us beyond our comfort zone. If done well should stretch our mind and ways of thinking as we make the connections between what we have learned as we add our own personal interpretation.

My doctoral journey included many times where I was in my own *nepantl*a, as a student, scholar, and full-time working professional. Pivotal moments pushed me from one world into another, from student and novice to professional in academia where I have been in leadership roles. I went back and forth from seemingly more mainstream topics as could be expected, or perhaps more welcome by others, to the twists and turns where I allowed my study to go. My doctoral process represents my own journey through nepantla as I navigated multiple worlds and managed the discomfort. In Figure 1 there is a visual representation of the process as my personal identity as a Latina forged the direction of my study as I found and exercised my voice through the process.

Figure 1

Research Process and Vision Through Nepantla



This dissertation is the outcome of my experiences as I navigated my personal connection and allowed the topic to fully emerge. Initially I was focused on a quantitative study with a strong focus on performance-based funding. The topic evolved as I searched for a significance to the study and something missing in the literature. My own questions were piqued as I found Li's (2020) study on performance-based funding found the STEM metric to be effective. That concept led to a focus on Latinx engineering students where I felt using an indigenous research method*, testimonios*, would better amplify the student voice, giving them power in their story.

The process evolved as I reflected along the way and adjusted. The reflection process is a crucial part of the process as shared by qualitative scholars (Saldana, 2018).

In determining a research method and exploring various options I began to see how the entire process privileges certain voices. The inclusion or omission of subjects lends credibility and even legitimizes certain ideas. The doctoral journey for me has amplified my voice. I have felt comfortable speaking in certain spaces, yet knowing I will soon have a doctorate empowers me to speak up even more. I wanted to provide that opportunity for the research participants. As I narrowed down the topic and focus it was apparent I wanted to empower the participants voices through *testimonio* as the methodology. It also became important to me to honor my own indigenous roots by choosing an indigenous research method. My journey led me to Anzaldúa, a scholar I met in person decades ago. The significance of the interaction and her influence on my life was not fully recognized until I embarked on this journey. I now realize I have navigated nepantla my entire life and like Anzaldúa, have emerged from the discomfort a stronger version of myself.

Colleges and universities have historically relied on students adapting and shifting their own mindset to fit institutional culture. Students not persisting were thought to be lacking and deficient. The changing demographics along with population declines could incentivize institutions to consider new enrollment management and retention techniques and position students in a way to drive services. The rise in Hispanic Serving Institutions (HSI) has accelerated in the last five years (Brown & Mangan, 2021, Garcia, 2019). Hispanic Serving Institutions (HSI's) by definition are focused on the number of Hispanic students enrolled, not the ability to recruit and retain, or actually serve students. ~~Professor~~ Gina Ann Garcia, has studied HSIs and first coined the term "servingness" or the idea of how well Latinx students are

being served (Garcia, 2019). Institutions long term viability will be tied to how quickly well they begin pivoting to adjust and set plans in motion to be student ready.

Higher education enrollments have been declining across the country (Barshay, 2018; Grawe, 2018; Lozano et al., 2013; Prescott, 2019; Weissman, 2021). Public and private universities have reported not meeting enrollment expectations making recruitment exceptionally competitive (Bruinincks et al., 2010; Carlson, 2020). The population decline has attributed to these changes. The quick drop in enrollments due to reduced fertility rates starting in the Great Recession of 2007-09 is known as the enrollment cliff (Copley & Douthett, 2020). Predictions estimate a 15% drop among college-aged students during 2025 and 2029 (Copley & Douthett, 2020). As enrollments shift and demographics change, prediction models and nimble changes will help universities prepare for the changes to come and mean the difference between staying in business and closing indefinitely (Carlson, 2020; Copley & Douthett, 2020; Grawe, 2018). Universities must respond to changing enrollments as legislatures face competing funding priorities (Copley & Douthett, 2020; Delaney & Doyle, 2014; Kearney, 2014).

Colleges and universities have struggled to maintain their budgets with the added challenge of declining federal and state funding (Baum et al., 2013; Dar & Lee, 2014; Delaney & Doyle, 2014; McLendon et al., 2009). Funding declines that started nearly twenty years ago continue, and legislatures cite a lack of credible outcomes as reasons for the drops. Universities must matriculate, educate, and graduate students, showing STEM outcomes (Hanson & Noterman, 2017; McLendon et al., 2009). Higher education institutions must demonstrate a compelling narrative and supportive cost-benefit analysis, especially to public policymakers who control legislative priorities and institution funding (Kelchen, 2018; Weerts & Ronca, 2012).

A funding incentive to increase enrollment in science, technology, engineering and math (STEM) especially among underrepresented students could produce the desired results they seek (Crellin, 2015; Shin, 2010). Legislators utilized performance-based funding, defined as a policy created in response to provide funding metrics and incentivize education gains, as a way to maintain consistency and achieve fairness. Competing budget demands at the state and federal level have made higher education funding process increasingly aggressive. As state budgets shrink, higher education funding continues to be highly competitive with other state and federal agency needs, prompting policymakers to create an equitable process to distribute funds through policies that support all students, including those deemed high-risk (Copley & Douthett, 2020; Kelchen, 2018; Ortagus et al., 2020). In response, policymakers have created performance-based funding (PBF) models to incentivize institutions to reach specific outcomes (Dougherty et al., 2016; Favero & Rutherford, 2020; Miller & Morphew, 2017; Minckler, 2016; Nisar, 2015; Ziskin et al., 2018). The goal of PBF is to incentivize institutions to support students and help them graduate (Kelchen, 2019; Li, 2019a). As funding challenges persist, PBF can provide broader college access and more college degrees to students. Institutions can optimize the funds used to support student success initiatives (Li, 2020; Miller & Morphew, 2017; Minckler, 2016; Sav, 2016; Ziskin et al., 2018).

Universities are in the business of graduating students. The demand for STEM degrees is cited in the literature to help the United States prepare for global concerns (Lee & Ferrare, 2019; Xu & Larson, 2015). STEM degrees are technical and have a long list of pre-requisites, where reliance on advisors and mentors for support can be crucial to students (Schreiner, 2018). Increasing the number of STEM degrees requires a complex approach involving support systems and programs designed to increase self-efficacy (Redmond-Sanogo et al., 2016; Rodriguez et al.,

2020). Improving current recruitment and retention could increase STEM graduates by addressing the disparity in degree attainment among women and historically minoritized STEM students. Research finds that female STEM degree attainment lags behind their male peers (Blackburn, 2017; Dell et al., 2018; Gayles & Ampaw, 2014; Miller & Hurlock, 2017; Rodriguez et al., 2020; Sassler et al., 2017**)**. Women enter STEM fields at the same rate as White males, yet their degree outcomes are lower (Blackburn, 2017; Lee & Ferrare, 2019). Understanding how to improve degree outcomes for all students and stop the "leaky pipeline" (Gayles & Ampaw, 2014; Sassler et al., 2017) may increase STEM degree outcomes. Historically minoritized students in STEM fields do not achieve the same degree attainment as their White peers (Hill, 2017; Riegle-Crumb et al., 2019; Secules et al., 2018). Retaining STEM students versus recruiting new students may serve as a cost-effective strategy worth pursuing by institutions.

Performance-funding models have gained popularity, despite empirical evidence showing minimal results (Dougherty et al, 2016; Li, 2020; Miller & Morphew, 2017; Umbricht et al., 2017). The unintended consequences from PBF implementation have caused concerns, especially when outcomes vary among students (Gándara, 2019; Ortagus et al., 2020; Favero & Rutherford, 2020). However, promising results indicate PBF models paired with incentives such as enrolling more STEM majors have better results (Hu & Villarreal, 2019; Li, 2020). Nonetheless, Kelchen (2018) found negligible results for underrepresented students when the funding incentive was only 1 or 2 percent.

Kansas, in 2005, was the first state to introduce a STEM incentive in its performance-funding model (Li, 2020). In 2020, thirteen states were using a STEM incentive in their PBF model. STEM majors require higher investments from institutions and states can receive additional funds through increased STEM degree attainment. Li (2020) found increased STEM

degree attainment in PBF models with a STEM incentive. PBF models are all different, with varying degrees of percentages for the STEM incentive, yet results indicate a 21% increase in graduates when a STEM incentive is present. What is not known is the extent to which the degree attainment applies to STEM underrepresented students. The results have been mixed when determining graduation outcomes for historically minoritized students at institutions with PBF (Favero & Rutherford, 2020; Gándara, 2020).

Performance-based funding models with incentives have produced positive results as noted above. Funding models with STEM incentives raised degree attainment (Li, 2020). However, it is unknown how effective PBF models with STEM incentives achieve improved degree attainment for historically minoritized STEM students. There has been limited success with the PBF incentives for underrepresented students (Canning et al., 2019; Gándara & Rutherford, 2018; Hu, 2019; Secules et al., 2018). To what extent has a PBF model with a STEM metric helped all STEM students, including historically minoritized students who have not previously attained the same level of degree completion? This study focused on Latinx engineering students, to better understand this group of minoritized students. The study's above question explored the idea of sources of strength during difficult times. There is limited research to date that goes into this level of detail.

Purpose of the Study

The purpose of this study is to explore the above questions and add to the literature to understand how to better support Latinx engineering students. The research on PBF has focused on quantitative measures and homogeneous populations of students. Pursuing the intersectionality of data may provide nuanced findings and shed additional insight. The results of

this study may add an equity-minded perspective to the research on performance-based funding outcomes with particular focus on one student population.

Statement of the Problem

Economist Nathan Grawe (2018) closely followed enrollment patterns and their implications for colleges across the United States. He created the Higher Education Demand Index (HEDI) as a way to forecast enrollment trends. The HEDI prediction model looks at drops in fertility rates, trends among institutions, enrollments by gender and ethnic groups, and family income. All are essential components Grawe deemed vital to an improved prediction. He emphasized that the Great Recession "not simply delay(ed) births-it eliminated them" (2018, p. 6). Grawe predicted a rapid decline in college enrollments as children reach college age starting in 2026. While there are reasons to be pessimistic, some indicators provide an opportunity for growth. Identifying enrollment gaps, and leveraging institution strengths, will be essential to maintain or minimize predicted drops (Grawe, 2018).

Enrollment drops across the country require new approaches. The ability to reach previously underserved groups could augment outcomes and serve as a foundation for recruitment strategies. The use of PBF continues and identifying best practices can add to the educational pipeline and body of literature. The PBF models used in 32 states have provided only modest gains and challenges with institutional responses have developed (Favero & Rutherford, 2020). To achieve the desired funding benchmarks, institutions have made changes disproportionately affecting underrepresented students, either intentionally or unintentionally (Ortagus et al., 2020). Such findings indicate equity gaps for those students (Favero & Rutherford, 2020; Gándara, 2019; Hu & Villarreal, 2019; Kelchen, 2018). Students in this

category may have lower test scores, are low-income or minoritized, or first-generation students (Kelchen, 2019; Kelderman, 2020; Ortagus et al., 2020).

The second wave of PBF models were introduced around 2007 (Miller & Morphew, 2017), and included incentives to minimize adverse impacts, and some have shown promising results. Research indicates funding models with specific incentives can support success initiatives compared to institutions without the incentive (Gándara & Rutherford, 2018; Letizia, 2016; Li, 2019, 2020; Ziskin et al., 2018). But not all incentives have shown results. Even models with an incentive for underrepresented students have produced mixed outcomes (Canning et al., 2019; Hu, 2019; Secules et al., 2018). Dougherty et al. (2016) looked at PBF programs in Indiana, Ohio, and Tennessee, states that made changes to PBF policies. These three states had higher graduation rate increases attributed to the PBF models. Positive changes include increased advising and student support staff and better articulation and transfer agreements. While well intended, they found unintended results included new goals and initiatives, impacts on accreditation efforts, lowered admissions standards, and fewer disadvantaged students enrolling (Dougherty et al., 2016).

Raising STEM students' degree completion may increase the United States global competitiveness (Adkins, 2012; Riegle-Crumb et al., 2019). Improving STEM degree attainment rates for women and minoritized students is a challenge supported by previous research (Blackburn, 2017; Gayles & Ampaw, 2014). Li (2020) found the STEM incentive in PBF models improved degree attainment. To what extent does the funding model's STEM incentive help all students increase degree attainment, particularly minoritized STEM students who have not previously attained the same level of degree completion. The study focused on the student experience while they were part of a larger ecosystem that included the STEM incentive.

The number of women attaining STEM degrees has increased from 37% in 1980 to 50% of all STEM degrees earned (Sassler et al., 2017). Despite increases in the science, technology, and engineering jobs, women comprised 12%-25% of the engineers in 2013-2017 (Beddoes, 2018; Sassler et al., 2017; Schilling & Pinnell, 2019). Reasons for the gender disparity in engineering compared to the medical field have been attributed to lack of interest, not enough math preparation in high school, and more substantial interest in liberal arts studies (Schilling & Pinnell, 2019). Limited support in the workforce has driven women to seek other employment outside traditional STEM disciplines (Schilling & Pinnell, 2019).

Background

Financial support for public, four-year institutions has fluctuated for several decades, primarily on a downward trend (Abdul-Alim, 2017; Baum et al., 2013; Buschman & Sjoquist, 2017; Klein, 2015; Li, 2017; Oreopoulos & Petronijevic, 2013; Pulley, 2014) Institutions historically received state funding and rely on allocations to support their mission (Li, 2017; Meotti, 2016; Pulley, 2014; Sav, 2016; Ziskin et al., 2018). The financial crash of 2007-08 was a turning point towards declining appropriations. Over time institutional costs have risen, state appropriations declined, and expenses covered by students have increased (Baum et al., 2013; Dar & Lee, 2014; Hu & Villarreal, 2019; Li, 2017; Oreopoulos & Petronijevic, 2013; Spencer & Hensly, 2015). During the 1960s, the United States was among the top leaders in educating high school students (Baum et al., 2013; Meotti, 2016). Declining higher education funding will make it challenging for universities to support efforts to create an educated college population and maintain the globally competitive status from the 1960s (Baum et al., 2013; Klein, 2014; Meotti, 2016).

States have experienced competition for funding priorities making colleges and universities vulnerable to funding cuts (Li, 2017; Ortagus et al., 2020). A legislative response has been to create policies and address institutions through performance-based funding models (Gándara, 2019; 2020). While widely used across the United States, the first models were not very useful in meeting concerns (Letizia, 2016). The second wave of models, were updated and included incentives to encourage universities to meet metrics and improve student outcomes (Gándara, 2020; Hu & Villarreal, 2019; Kelchen, 2018; Letizia, 2016). The incentives added included support for groups deemed at-risk such as first-generation and underrepresented, or historically minoritized students (Gándara, 2020; Gándara & Rutherford, 2018; Kelchen, 2018; Li, 2019b).

Results show some groups can benefit from the changes. The first study to focus on the STEM incentive in PBF, Li (2020), found the incentive increased degree attainment. Graduating more students in science, technology, engineering, and math (STEM) fields is a goal set by the National Science Technology Council (2018). Increasing the number of STEM graduates would help the United States maintain competitive in a global world (Allen & Zhang, 2016). The goal is within reach by increasing female and minoritized students' persistence rates that start as STEM majors and switch (Blackburn, 2017; Riegle-Crumb et al., 2019). Female students enrolled in higher education and STEM majors at the same rate as men, but only have a fraction of the STEM degrees (Beddoes, 2018; Gayles & Ampaw, 2014). The literature shows the disparity found among women in STEM fields (Gayles & Ampaw, 2014). Underrepresented, historically minoritized student enrollments have been increasing at higher rates than before, yet not in STEM degree attainment (Riegle-Crumb et al., 2019).

This study will examine the experience of Latinx engineering students attending a public institution with a performance-based funding (PBF) models with a STEM metric. The degree attainment for STEM students increased (Li, 2020). What was not know is how the incentive addressed the degree outcomes for underrepresented minority students, typically not the same for all students. The literature lacks empirical research to illustrate how PBF can be used as a leverage to improve degree persistence rates of female and minoritized students in STEM. This study may add to the knowledge base about supporting underrepresented minority students in STEM. The PBF models continue to gain adoption across states. Identifying the details when the incentives work could help other states replicate and, in turn, help more students.

The United States benefits from having an educated workforce ready to tackle challenging problems (Bruinincks et al., 2010; Cantor et al., 2015). Universities are on the front lines of adult education, and higher education is ideally poised to train many people on numerous subjects. During his term, President Barack Obama determined the United States would increase rates of college-educated citizens by 2020 (Li, 2019a; Oreopoulos & Petronijevic, 2013; Walker, 2016). The goal to increase college graduates increased slightly, but the United States graduation rates fell short of having the highest rate of college-educated citizens in the world. Increasing the nations' talent pool and the number of people able to use creativity and problem solving would help the United States remain globally competitive. Identifying ways to generate support for advanced degrees and provide the support needed to succeed could advance the United States' ability to compete globally.

The reviewed literature showed PBF models have been found ineffective at meeting performance goals (Gándara, 2019; Gándara & Rutherford, 2018). Some institutions responded with a more selective admissions process, and underrepresented and historically minoritized

students were adversely impacted (Favero & Rutherford, 2020; Hu & Villarreal 2019). Institutional behavior has changed in response to performance-based funding (Hurwitz & Smith, 2018; Liu, 2011b; Schreiner, 2018). The updated funding models are used to incentivize institutions to meet recruitment and graduation goals and supporting specific student populations that require additional support. Research suggested including demographic measures, income, and the number of first-generation students would more accurately reflect the work an institution has done and by including the percentage of at-risk students supported (Gandara & Rutherford, 2018; Hillman et al., 2014; Kelchen, 2019; Li, 2019b). PFB strategies vary across states. Some states include equity-based ratings in their models and provide additional funding for supporting underrepresented and Pell-eligible students (Kelchen, 2019; Kelchen & Stedrak, 2016; Li & Kennedy, 2018).

Increasing the number of STEM graduates has been a priority for the National Science Foundation. The National Science Foundation suggested the United States needs to increase the number of STEM graduates to remain globally competitive (Allen & Zhang, 2016; National Science Technology Council, 2018; Riegle-Crumb et al., 2019). College graduates are a strategic component of having a ready workforce and universities prepared to provide the training and knowledge need to respond and anticipate global concerns. Adding a STEM incentive to PFB models was first started by Kansas in 2005. In 2020, there were 13 states with STEM incentives in the PBF model (Li, 2020).

Scholars have raised the question regarding the amount of funding necessary to provide an adequate incentive. Even with different PFB models and funding percentages, universities have raised admissions standards to meet the metrics, making it harder for underrepresented students to enroll (Dougherty et al., 2016; Kelchen, 2018). Funding model incentives have

supported gains among STEM (Li, 2020) and mixed results for underrepresented students (Gándara & Rutherford, 201; Kelchen, 2018; Li, 2019b). Latinx students and low-income students have experienced enrollment increases, especially when the premiums continue over time (Gándara & Rutherford, 2018; Li, 2020).

Research Questions

To what extent has a PBF STEM with incentives metric helped all STEM students, including historically minoritized students who have not previously attained the same level of degree completion? That question derived from Li's (2020) study and this study will explore the strategies used by Latinx engineering students to navigate their academic program.

This study may add to the research on performance-based funding with a STEM metric and how to improve Latinx student outcomes. This study examined the experience of Latinx engineering students attending a public institution with a performance-based funding (PBF) models with a STEM incentive.

Research Questions:

1. What strategies do Latinx engineering students make use of to navigate their postsecondary STEM academic program?
2. How do those strategies align with the critical elements in PBF with a STEM incentive?

Nepantla will be used as the theoretical framework. It will not be part of the questions asked during the interviews. The concept of nepantla will be used when analyzing the responses.

Description of Terms

This study uses terms that may be unfamiliar. This section identifies and defines the less familiar terms used in the study.

Enrollment Cliff. This term refers to the quick drop in college enrollments, starting with the Great Recession in 2008-09 and the decline in fertility rates (Copley & Douthett, 2020), predicted to impact college enrollments starting 2026 (Grawe, 2018).

First-Generation Student. First-generation college students are the first in their families to attend and graduate from college. They are more likely to be low-income from ethnic minority backgrounds and comprise 25% to 33% of the college-aged student population (Gibbons & Woodside, 2014; Gist-Mackey et al., 2018; Williams & Ferrari, 2015).

Great Recession. The Great Recession started in December 2007 and is a time when the economy dropped in 2008. The endpoint is considered June 2009 (Schmidt, 2018).

Historically minoritized Students. "Students of color" and "underrepresented" are other terms for minoritized. They are not minorities in many cases, depending on the context, but have been historically minoritized (Benitez, 2010; Pichon, 2019; Stewart, 2012). According to Pichon (2019), “minoritized students, refers to individuals that are not the majority population on campus based on race, ability, sexual orientation, income, religion, and other memberships (p. 56).

Latinx. The term Latinx is used as a gender-inclusive term versus the feminine or masculine form of the word Latina or Latino (del Río-González, 2021; Garcia, 2019). Salinas & Lozano, (2019) conducted an environmental scan and concluded “Latinx is a meaningful and transformative word that promotes gender inclusivity, and thus a respect for basic human dignity. As institutions of higher education continue to seek excellence in diversity, multiculturalism, and social justice, they must understand the significance of gender-inclusive language and its impact on the campus community” (p. 313).

Nepantla. *Nepantla* is the Nahuatl word, in Spanish, describing the space between two bodies of water. Anzaldúa elaborates on the definition as a spiritual embodiment (cuerpo espirutu) of the in-between spaces and the discomfort experienced by individuals (Anzaldúa, 2015). In this study the concept of nepantla is used to frame the results of the *testimonios* after the interview process.

Performance-based funding (PBF). The type of model used when states allocate funds to institutions based on identified metrics. The models and metrics vary among states and often include enrollments, graduation rate, and student success (Dougherty et al., 2016; Kelchen, 2018; Li, 2019a).

Public University. The term university and college are used interchangeably in this paper. In some cases, the university is a larger unit, and a college is smaller (Baum et al., 2013).

Servingness. The term servingness is attributed to Gina Ann Garcia (2019) to describe the extent to which university programs and support services are designed to meet the needs of students in a truly serving model.

STEM. The term STEM is an acronym for science, technology, engineering, and math. The U.S. Department of Education website (http://www.ed.gov/stem) outlines several initiatives that promote growth in STEM fields. The Classification of Instructional Programs (CIP) definition from the Department of Education was used in this study, which includes engineering, engineering technology/technicians, computer and information science, biological and biomedical science, math and statistics, science technology/technicians, physical science, and health and related clinical science (National Center for Education Statistics).

STEM incentive. The metrics used in performance-based funding to incentive particular outcomes. The STEM incentive is intended to increase STEM graduates (Li, 2020).

Testimonios. Resembling narrative stories, *testimonios* "consist of life stories usually told by a person from a marginalized group in society, to an interlocutor who can write down and disseminate them" **(**Prieto & Villenas, 2012, p. 414).

Underrepresented Students. Groups that are not the majority among student enrollment populations are considered underrepresented (Gándara, 2019; 2020; Kallison & Cohen, 2010).

Significance of the Study

This study centered on minoritized students, specifically Latinx engineering students. The focus emerged after initial research of PerformanceBased Funding and the impact on institutions and the student populations that truly benefit. The research of PBF is primarily quantitative (Ortagus et. al., 2020). Qualitative data allows us to gain a deeper understanding of the issues. In research findings, data is often shared as a whole, grouping all students as one category, or even grouping all underrepresented students as URM. In putting all students into one group we fail to miss the nuances and opportunities to affect change. Disaggregated data is necessary. The challenges and solutions for Latinx students may not be the same for Black students. In this study a qualitative analysis was used to better understand the student experience for the Latinx engineering participants.

The Researcher's Personal Experience

The researchers personal experience with *nepantla* and interest in supporting STEM students drove this study's focus on indigenous research methods and ultimately Latinx engineering students. The process was driven by reflexivity and interest in finding a gap in the literature. While there is a general understanding of lack of gender and ethnic diversity in STEM we have utilized few resources to change the representation. There is a representation of the

process as shown earlier in Table 1 as the researcher determined the topic, reflected on *nepantla*, thought about the gap in the literature, and how to give participants and voice.

STEM and Minoritized Latinx Students

State funding provided to public universities has been decreasing over the last two decades (Jaquette & Curs, 2015; Li, 2017; Pulley, 2014). Public universities previously relied on state funding to sustain their budget and now must consider other alternatives. In response to competing requests and limited funds, legislators have relied on performance-based funding in attempt to distribute funding equitably among institutions (Gándara, 2019, 2020; Ziskin et al., 2018).

Despite literature showing a lack of evidence for PBF, these models have gained the support of legislatures. Data from the National Conference of State Legislatures in 2015 showed that 75% of states (32 in total) were using a form of PBF (Favero & Rutherford, 2020). The funding models persisted in states, and critiques arose. The universities' response to the models included raising the admissions score cut off to obtain higher GPAs, graduate more students, and raise their institutional scores for PBF (Favero & Rutherford, 2020). There was evidence of universities admitting more students with lower financial needs. The additional funding possibility changed institution behavior, not always in the best interest of students (Kelchen & Stedrak, 2016). The second wave of the models included incentives to support particular student groups. The second wave models evolved in 2010, focusing on funding for outputs, performance, or specific measures such as STEM degrees (Favero & Rutherford, 2020; Letizia, 2016).

STEM degree attainment is needed for the United States to maintain a competitive edge. Research shows that while women enroll in higher education at equal rates to men, they receive a fraction of STEM degrees (Beddoes, 2018; Gayles & Ampaw, 2014; Riegle-Crumb et al., 2019).

Women enroll and graduate from college at equal rates to men. In STEM fields the enrollment and graduation of women is a fraction of the rates for males. Understanding what helps retain and graduate women in STEM is a gap in the literature.

The Leaking Pipeline and Student Attrition

The framework of the "leaky pipeline" is common in literature explaining the absence of women in STEM. The leaky pipeline is meant to highlight women and underrepresented minorities either are not on the path towards graduation or exit at many points along the way, as in leaks. Another prevalent model used is Tinto's model of student attrition. It has been used to explain how students background prior to college shapes their experiences. Those with strong connections to the university have better academic outcomes. The model has been criticized for the need for students to adapt to the university at the expense of their own culture (Gayles & Ampaw, 2014).

Historically minoritized students (students not identified in the majority campus population based on race, ability, sexual orientation, income, religion, and other memberships) enroll in STEM degrees at the same rates as other ethnicities yet have not achieved the same level of degree attainment (Beddoes, 2018; Riegle-Crumb et al., 2019). Demographic gaps in achievement among Latinx students, the group with the most increased enrollment gains, pose a barrier and opportunity (Richert, 2018). Li (2020) found a lack of empirical studies related to the STEM metric in PBF models.

STEM Incentive Models and PBF STEM Incentive Models

The study results may suggest the STEM incentive increased STEM degrees by 21%, while institutions without STEM incentives did not graduate as many STEM students. When comparing institutions without PBF models to STEM-incentivized PBF, there was a difference

of 5% more STEM degrees with the incentive. The number of degrees increased to 6% the following year and continued to hold the longer the program was extended. Li (2020) suggests future research focused on single states to look closely at the details.

Reviewed literature showed performance-based funding models with incentives work. Li (2020) found models with STEM incentives raised degree attainment. Scholars have found limited success with the PBF incentives for underrepresented students (Canning et al., 2019; Gándara & Rutherford, 2018; Hu, 2019; Secules et al., 2018). Has the STEM incentive raised degree attainment for all students? It is unknown how effective PBF models with STEM incentives achieve improved degree attainment for historically minoritized STEM students. There is no research to date that goes into this level of detail.

Beddoes' (2018) study focusing on policy in engineering admission programs found little thought was given to the admissions process or other policy impact on underrepresented students. Beddoes found "policy was dismissed as a cause of or solution to underrepresentation" by the engineering faculty interviewed (Beddoes, 2018, p. 1569), which was believed to be a "shortsighted" approach to understanding policy. This research focused on the intersectionality of policy found in PBF models, STEM degree outcomes, and impact to historically minoritized students.

Theoretical Framework

> *Necesitamos teorías* [we need theories] that will rewrite history using race, class, gender, and ethnicity as categories of analysis, theories that cross borders, that blur boundaries—new kinds of theories with new theorizing methods . . . We are articulating new positions in the "inbetween," Borderland worlds of ethnic communities and academies . . . social issues such as race, class, and sexual difference are intertwined with the narrative and

> poetic elements of a text, elements in which theory is embedded. In our *mestizaje* theories we create new categories for those of us left out or pushed out of existing ones. (Anzaldua, 1990, xxv-xxvi).

This study examines the experience of Latinx engineering students attending a public institution with a performance-based funding (PBF) models with a STEM metric. Through this focus persistence and support systems utilized by Latinx engineering students are explored. Latinx engineering students are not well represented in engineering (Clark et al., 2021; Perez-Felkner, 2018; Verdin, 2021). Getting more students to graduation is definitely a worthwhile endeavor. Engineers have higher levels of financial security. Identifying strategies utilized by students to get through the unknowns as they navigate unfamiliar territory is essential to increasing the STEM pipeline. A theoretical framework cognizant of intersectionality and multiple realities was most appropriate. The work of Gloria Anzaldúa and the concept of nepantla (between worlds) seemed an appropriate fit. Scholars have used nepantla to refer to the unknown, the discomfort or space of mixed realities (Abraham, 2014; Bergman, 2015; Chavez, 2015; Keating, 2006; Mora, 1993; Prieto & Villenas, 2012). Using nepantla as the theoretical framework provides context for the research question. The research explores learning about the experience of Latinx engineering students and how nepantla intersects as they navigate the world of home and academia.

Nepantla

Latina feminist Gloría Anzaldúa started research and work on borderlands theory, focusing on the physical border between Mexico and Texas. The work evolved to a more three-dimensional concept and the actual space between worlds described in the Nahuatl word called *nepantla* (Abraham, 2014; Chavez, 2015; Keating, 2006; McWhirter & Cinamon, 2020; Prieto &

Villenas, 2012). Nepantla is a specific way of describing the discomfort of the in between when navigating two different realities (Anzaldúa, 1987). Anzaldúa frames nepantla as the process of growth through the change. She specifically focuses on the re-birth process through introspection of the challenges faced. College students face a tremendous number of changes from the beginning of their undergraduate studies through graduation. They are faced with many unknowns as they progress their education. The *nepantla* theoretical framework seemed appropriate as the research looks at a population of Latinx engineering students as they describe their experiences and ~~the~~ persistence.

Chavez (2015) suggested Latino students embrace nepantla as a form of knowledge and strategy to navigate educational environments often very different than their home environments. Third world scholars position *nepantla* in a "thirdspace" where the enlightenment comes after the struggle or challenges experienced (Chavez, 2015). College students learn to navigate the expectations from faculty, administrators, financial aid staff, and family and must become adept at moving between the different needs. *Nepantla* is a way of identifying the process and providing support through discomfort and unknown. There is an overview of the *nepantla* framework in Table 1, as it shows an overview of the research as it intersects with higher education.

The funding models, initially designed to provide a consistent measurement and improve results by higher education institutions. Alternatively, the models have been found ineffective, especially towards underrepresented student groups (Canning et al., 2019; Gándara & Rutherford, 2018; Hu, 2019; Secules et al., 2018), while beneficial for STEM majors (Li, 2020). STEM as a field is generally associated with strong political connections and positive community associations. In PBF models, STEM incentives support degree attainment (Li, 2020).

Table 1

Nepantla in Engineering Education

Latinx Engineering Students Persistence (Nepantla)

	Higher Education	
Institution Financial Stability		Institution Enrollments
Shrinking Financial Allocations		Changing Demographics
Performance Based Funding		Enrollment Cliff
STEM Incentive		Minoritized Student Enrollments
Engineering Students		Latinx Students

Minoritized students are not always seen favorably by legislators and supported by institutions (Gándara, 2019). They do not have the political capital and influence found with STEM groups. The positioning of those groups, as minoritized or STEM students via a social construct provides a lens to view the unintended consequences of PBF. The *nepantla* theory sheds light on the groups' struggle to gain access to power. Schneider and Ingram (1993) refer to a group's power as either advantaged or contenders and their social construct as dependents or deviants. The social construction of groups amplifies when policymaking helps some groups and not others, often producing inequities (Ingram et al., 2006; Wagner & Morris, 2018).

Positionality Statement

Research is subjective by the nature of topics chosen. In this study the researcher is a Latina who grew up in a migrant farmworker family, straddling multiple worlds like Anzaldúa,

and navigating school as a bilingual English and Spanish speaker. She was the first in the family to obtain a college degree and learn how to embrace the differences. Obtaining a college education has been life changing for the researcher. Her professional work in Student Affairs has been spent supporting students obtain a college degree working among minoritized populations and holding the same identity. She has been drawn to identifying and removing obstacles to student success.

As a scholar, her work focuses on engineering students, STEM, and how to improve graduation outcomes for all engineering students. Her experiences as a Latina in a predominately White institution have impacted her interest to support and empower historically minoritized students. She is also the parent of two Latina STEM students and strongly supports their choice to pursue science and computer science majors all while encouraging them to nurture their artistic side as musicians. The researcher believes in the power of education to change lives.

Overview of Research Methods

Creswell & Guetterman (2019) stated "the problem, the questions, and the literature reviews help steer the researcher toward either the quantitative or the qualitative track" (p. 11). Performance-based funding research has been explored through both a qualitative and quantitative lens. This research study looked at the ways Latinx engineering students push through difficult times and persist. The *nepantla* theoretical framework used by other scholars to describe the straddling of cultures.

A qualitative study was best to gain personal first-hand accounts and gather student *testimonios* or personal narrative. This study included responses in English and Spanish conducted by the bilingual researcher. Challenges arise when conducting qualitative research in other languages (van Nes, et al, 2010). Care must be taken to minimize interpretation lost in

translation. To increase validity the researcher conducted the interview and provided the translation to preserve the intent of the speaker.

Standard conventions (APA style guide) were followed by the use of italics for all Spanish words. There are scholars suggesting not to italicize foreign words as it prioritizes the English language (Barokka, 2020). The researcher agrees with this but decided to continue with the more common convention by using italics.

Conclusion

Funding priorities continue to make decision making increasingly difficult. Public higher education institutions have relied on state and federal sources of financial support to maintain services. Legislators faced with competing priorities have been using variations of performance-based funding models to determine appropriations. The models are complex and vary across institutions and states. Similar peer institutions could be following completely different PBF models as determined by their governing body. The financial allocations can differ significantly. Some institutions can expect as much as fifty percent of their budget compared to others that get only two percent of their base budget. A small percentage may be insufficient motivation for institutions to comply. The costs to make changes, such as providing additional academic support for lower-scoring students, may not be cost-effective. Institutions with resources are better positioned to reach desired benchmarks making it harder for institutions with limited funding to compete. In some states, institutions get penalized for scoring at the bottom of participating institutions' list.

STEM incentives paired with the PBF models were found to increase graduation rates (Li, 2020). Attaining parity among students in STEM has proven difficult, with female and historically minoritized students lagging. As PBF models gain popularity and the STEM

incentive is added, learning the extent of all students' reach is essential. The finding provides opportunity to examine success and challenges with the potential to increase rates of STEM degree attainment and among previously underserved students.

Chapter II

Review of the Literature

Nepantla is a way of reading the world.

You see behind the veil, and you see the scraps.

Also, it is a way of creating knowledge and writing a philosophy,

a system that explains the world...you feel like you are living in the midst of chaos...

The art of composition—whether you are composing a work of fiction or your life,

or whether you are composing reality—always means pulling off fragmented pieces

and putting them together into a whole that makes sense (Chávez, 2015, p. 338).

Introduction

Historically, higher education has positioned itself as the source of knowledge, where minds seek an education. The idea of the student as consumer and seeker of knowledge has prevailed. This thinking has led to institutions setting up recruitment and retention structures mired in tradition. The model worked to keep institutions going, supported with other factors in place such as federal and state financial support along with a booming economy (Bennett & Law, 2021; Bennett & Law, 2020; Lingo et al., 2021). Yet times have changed. Financial support has dropped substantially (Bennett & Law, 2021; Klein, 2015; Lingo et al., 2021; McClure, 2019). Student enrollments have been dropping and student demographics have changed. The student as consumer has evolved and should shift to be the driver of services. In some cases, what has evolved is a dysfunctional relationship where students are seen by what they fail to bring to academia. This deficit approach has persisted and if not adjusted could fail to maintain or

increase retention rates, critical to maintaining a level of intellectual knowledge needed to make advancements.

Chapter two provides the reader an overview of the literature related to the work around Performance Based Funding and its evolution and the incentives and structures in place to make it work. The persistence of performance-based funding across the country is reviewed with a focus on the STEM incentive, which was found effective at graduating more students (Li, 2020). To get a better understanding of one population impacted there is focus on Latinx engineering students in a state with Performance Based Funding. The following is a list of the chapter headings.

Chapter Headings

Introduction
Theoretical Framework
Testimonios
Performance-Based Funding
Retaining Students
Sense of Belonging
First Generation Students
Funding Model Incentives
Historically Minoritized
Role of Higher Education
Changing College

Theoretical Framework

The theoretical framework used in this study is Gloria Anzaldua's concept of *nepantla*, the state of being between worlds. When describing nepantla, Anzaldúa was closely connected on a personal level even physical, as she referred to it, *cuerpo-espirito* (Anzaldua, 2007). Anzaldúa experienced *nepantla* daily. She was in a state of *nepantla* in her homelife as she navigated her environment as a queer Latina amongst Mexicans and Mexican Americans who didn't always accept her. The educational environment offered a similar process of negotiating identity and self. As a Latina student in predominately white environments, she was distinctly aware of the differences between herself and other students. She learned to acknowledge the differences without allowing it to consume her emotionally. She was frustrated in that state of discomfort and said it made her angry to be considered other, or different, which made her constantly angry (Anzaldua, 2007). In each of those roles she was not always accepted and learned to straddle the middle and move forward from there. Anzaldúa felt the process of awareness, discomfort and enlightenment was part of the discovery. The state of unknown and discomfort was a component and, in some ways, aided the process and helped with the awakening and enlightenment (2007). In engineering, students could benefit from telling their truth, or their story. It could be a way to take control of their environment which can be helpful in the process of building an engineering identity (McWhirter & Cinamon, 2020).

> I remember visiting with Gloria Anzaldua in the green room when
> she was our keynote speaker for Martin Luther King week in the 1990's.
> I was in my early twenties as a young professional in Student Affairs.
> While we were both born in Texas and identified as *Tejanas*,
> she didn't interact with Whites until she went to college, unlike me

> raised in a predominately White community and attended predominately White institutions. During our conversation, I was guided to use the word Latino, not Hispanic. Anzaldúa explained Hispanics is a word assigned to us that we didn't get to choose. Latina, that is how I define myself now, *todo se debe a* [all can be attributed to] Gloria Anzaldúa.
>
> -Diana Garza, 2021

The framework is relevant as Latinx engineering students learn to navigate multiple areas of student life and draw strength once they push past the discomfort when faced with challenges. The *nepantla* framework has been used by other scholars to provide context to Latinx engineering students' persistence as they navigate structures in higher education widely different from their home environments (Mejia et al., 2017; Scott & Tuana, 2017; Wilson-Lopez et al., 2016). Students see the differences and what is required to succeed. The worlds are not always harmonious with one another. Latinx students may come from a collectivist perspective and need to adopt an individualistic persona to readily navigate the higher education expectations. Table 2 shows the different access points in higher education that can cause an unknown state where navigating the normative standards can be challenging. Students are in a state of shifting priorities as deadlines and personal lives are interwoven. The access points include finances, demographics, self-identity, and language, so critical for emergent language speakers.

Testimonios

The sharing of a personal story or account or the retelling of something witnessed is testimonio. Chicano scholars have used it both as a way of sharing an account of events and as a research method (Huber, 2009; Reyes & Rodriguez; 2012). It is similar to narrative research, yet

a distinction between the two is *testimonio*. It is meant to incite some action or reflection (Bernal et al, 2012; Reyes & Rodriguez; 2012). *Testimonios* are considered an indigenous research method (Chilisa, 2020; Smith, 2021). Cantú (2012) used it as a theoretical method when working with Chicanas in STEM. Like Anzaldúa, Cantú's frustration led her to consider liberatory methods or an additional opportunity for both scholar and research participant to feel like they are sharing their voice (Bernal et al., 2009; Bernal & Villalpando, 2002; Cantú, 2012; Huber, 2009). Cantú was a participant of The Latina Feminist Group (1990) who utilized *testimonios* as their top choice to honor and illuminate the participant voices. The scholars are aligned in using the term *testimoniando* when the act of storytelling is taking place (Bernal, et al., 2009; Bernal & Villalpando, 2002; Cantú, 2012; Huber, 2009).

Table 2

Student Experiences in Nepantla

Nepantla in Higher Education	
Financial Access	Institution Financial Requirements
Overrepresented Demographic	Underrepresented Demographic
Identity as STEM Scholars	Not seeing self, reflected in curriculum & faculty
Identity as Engineering Students	Latinx not pictured as Engineers
Dominant Language Fluency	Limited English (dominant Spanish speaker)

Identifying a way to honor the stories shared in research and legitimize the knowledge is what has prompted some scholars to consider the apartheid of knowledge, or the ways certain knowledge is prioritized or deemed legitimate (Bernal & Villalpando, 2002; Huber, 2009). The use of testimonio is not widely known and dismissed by some academic colleagues as Huber

shared through her personal experience (2009). *Testimonios* provide a personal account and additional counter story viewpoint to the dominant narrative (Bernal & Villalpando, 2002; (Prieto & Villenas, 2012).

Performance-Based Funding Models

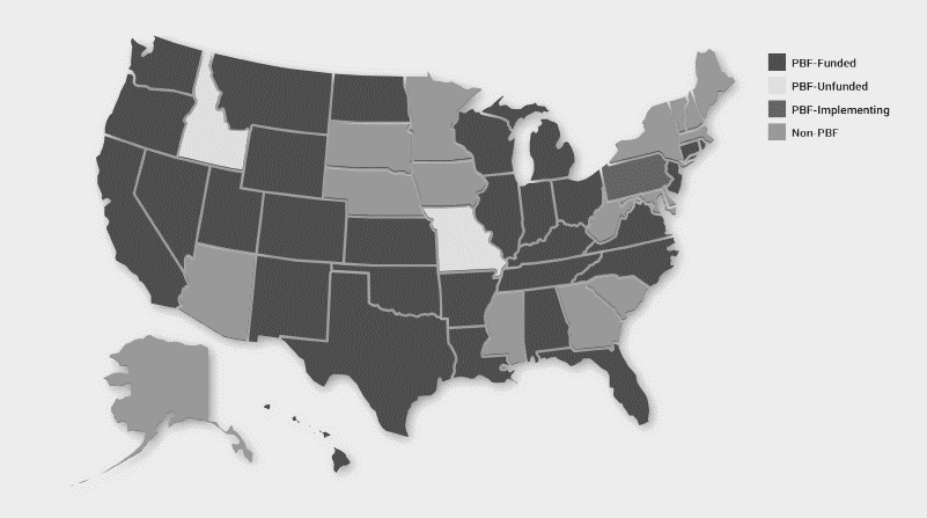
The nation counts on colleges to train our future leaders and cultivate critical thinking skills. Our global environment demands higher-level thinking and interdisciplinary teams to stay globally competitive (Cantor et al., 2015). Previous interventions by higher education did not reach desired metrics of graduating more students and demand new approaches. Changing demographics and enrollment patterns require innovation in supporting students previously underserved (Brown, 2019; Casas & Ryan, 2010). Legislators charged with allocating funding to universities responded with accountability-based funding models to incentivize institutions and provide better student outcomes (Thelin, 2019). States implemented performance-based funding to incentivize institutions and meet educational benchmarks supporting and graduating students (Gandara, 2019; Kelchen, 2019; Li, 2019a; Oreopoulos & Petronijevic, 2013; Zimmerman, 2014). There are 30 states with funded, performance-based funding models, as shown in Figure 2. Two states shown in white have models in place, but no funding allocated.

Scrutiny over funding and university outcomes started picking up momentum in 1980 (Baum et al., 2013; Jung, 2010). The first outcomes-based model used in higher education originated in the 1920s, and by 2020, thirty-two states were using PBF models, while two of those aren't funded (Dougherty et al., 2016; Gándara, 2019; Gándara, 2020; Rosinger et al., 2020). Funding models vary by state with different funding allocations and metrics (Weerts & Ronca, 2012). Performance-based funding models usually have four levels of alignment among the PBF models, institution type, amount of funding, metrics, and other additional incentives (Li.

A.Y, 2019a). The funding levels seen in the first models were not as sustainable as other priorities emerged (Li, 2017; Meotti, 2016; Sav, 2016). State funding allocations during the 1980's and 1990's shifted away from higher education, prioritizing K-12 funding, health care, and law enforcement increases.

Figure 2

Performance-Based Funding Status in 2020



The landscape of performance-based funding in 2020 by Rosinger, K., Ortagus, J., Kelchen, R., Cassell, A., & Vorhees, N. (2020). InformEd States: Higher Education Policy Brief. Reprinted with permission.

Performance based funding models vary among states and institutions. There are four factors considered when looking at different PBF types (Li, 2019a). The first consideration is institution type and whether it is two or a four-year institution. The next thing to look for is the amount of funding. Some institutions get a large percentage which can really incentive institutions to make changes. The incentive can be substantial and drive progressive change that can really make an impact. Other institutions award a small amount that may be so insignificant that it does not really make a difference or impact the outcomes. The outcomes typically include

things like graduation and retention rates, job placements, or even credit hours earned. Other incentives include an at-risk student metric, Pell-grant eligibility, or even a STEM metric (Li, 2019a).

Performance-based funding models are used for consideration when determining financial support at the state and federal level. Characteristics to consider for accountability models include using standard, agreed-upon measures that have a high impact on students, such as looking at the cohort default rate. The models have progressed in phases from PBF 1.0 up to the 3.0 models used now. When states started with Phase 1, the policy creation, they relied on information from other states with PBF models. Phase two involved research and data to create the 2.0 models (Gándara, 2019; Li, 2017). The evidence was used to either support or dispute the use of PBF. In 2016, Dougherty and his colleagues took a closer look at Indiana, Ohio, and Tennessee, providing an in-depth look at three states. The states chosen are known leaders in PBF 2.0 models. In Table 3, we can see when the 1.0 and 2.0 programs began in those states, starting with Tennessee in 1979, Ohio in 1995, and Indiana in 2007. The third characteristic identified shows the percentage of funding allocated, ranging from six to 90% of state funding (Dougherty et al., 2016). The allocations vary by type of institution and state. Institutions that get a larger percentage of support from the state appear to be providing a more significant return on the investment (Ortagus et al., 2020).

Table 3

Programmatic, Political, Social & Economic Characteristics of the Case Study States

State Characteristic	Indiana	Ohio	Tennessee
1. Year performance funding was established[a]			
1.0 program	2007	1995	1979
2.0 program	2009	2009	2010
2. Sectors of public higher education covered by the state's performance funding 2.0 program	Universities and community colleges	Universities and community colleges	Universities and community colleges
3. Proportion of state appropriations based on performance funding 2.0 indicators	6% of higher education funding (fiscal year 2013–2014)	80% of funding for universities and 50% of funding for community colleges (fiscal year 2013–2014)	Approximately 85 to 90% of state higher education appropriations; the remainder is accounted for by utilities, major equipment, and similar expenses

From "Looking inside the black box of performance funding for higher education: Policy instruments, organizational obstacles, and intended and unintended impacts," by K. J. Dougherty, S. M. Jones, H. Lahr, R. S. Natow, L. Pheatt, & V. Reddy, 2016, The Russell Sage Foundation Journal of the Social Sciences; 2 (1) p. 151.

To gain more points on PBF rankings, institutions could admit students with top SAT scores and incomes. When that happens, enrollments show fewer underrepresented students who tend to be lower-income (Dougherty et al., 2016; Hillman et al., 2014; Ogunkoya, 2019). Demographic changes across the country, coupled with this practice, could have long-term enrollment consequences, limit access, and impact college graduates' percentage. Proponents of PBF models believe they promote effective methods in recruiting, retaining, and graduating students. At the same time, non-PBF supporters cite shortcomings. Differences in gains among affinity groups found in PBF models have prompted revisions and additional changes in future models (Hu & Villarreal, 2019; Miller & Morphew, 2017).

Each funding process is different as individual states determine how to allocate financial resources. Some rely on an outside agency or board; others create models such as performance-based funding or use no specific metrics at all. The extent to which participants implement the

models varies as much as the models, as shown in Table 4. Institutional buy-in ranges from passive to active use, such as changing policy to influence decisions (Gandara, 2019).

Proponents argue PBF models help constituents, including legislators, students, faculty, and interested community members compare institutions (Li, 2019a; Woolard, 2015). Data available for comparisons include retention, graduation, tuition, and the number of STEM, first-generation, and Pell grant recipients that graduate. Considering financial barriers are the biggest obstacle to student retention and success, learning more about an institution's financial stability is a valuable data point (Miller & Morphew, 2017; Oreopoulos & Petronijevic, 2013). Students can compare an institution's ranking. All students, in particular, first-generation students, would benefit and navigate the college search process easier with additional information. Those who against PBF models feel it fails to meet intended goals. Research supports it could have a disproportionate effect on populations that will require additional resources to support, which typically includes low-income, first-generation, and minoritized students (Hillman et al., 2014; Kelchen & Stedrak 2016; Ogunkoya, 2019).

Table 4

Stages of Evidence Use

	Stage	*Definition*	
Most Passive Use	Reception	Policy actors receive evidence, but do not necessarily consume the information (e.g., by reading or listening to it).	
↓	Cognition	Policy actors read and understand the evidence.	
	Reference	Evidence changes policy actors' beliefs r elating to problem definition or policy-agenda priorities.	
Most Active Use	Effort	Policy actors attempt—successfully or unsuccessfully—to drive decisions with the evidence.	
	Adoption	Evidence influences policy decisions.	Evidence Is Influential
	Implementation	Evidence affects implementation practices (those that result from the adopted policy).	
	Impact	Policy implementation, which is based on evidence, is deemed successful and beneficial.	

"Does evidence matter? An analysis of evidence use in performance-funding policy design" by D. Gándara, 2019, Review of Higher Education; Baltimore, 42(3), p. 995. Reprinted with permission.

Kelchen (2020b) found little evidence that PBF models were adversely impacting students of color. Other studies found the opposite (Cox et al., 2017; Gandara, 2019; Jung Cheol Shin, 2010). Comparing models is complex as not all metrics are identical, even among the PBF 2.0 models. Providing incentives for ethnicity and low-income students lessens the possibilities of overlooking populations that require additional services (Cox et al., 2017; Gandara & Rutherford, 2018). In addition to outcomes, equity concerns have followed PBF policies (Rosinger et al., 2019). The findings include fewer low-income students enrolled or re-directed to certificate programs and funding disparities among institutions (Rosinger et al., 2019).

In 2009, elected officials, university delegates, and state representatives in Arizona worked together to identify higher education goals and state budgets correspond to goals (Anderes, 2017). There was an opportunity for input and to influence outcomes. While the PBF

model did not gain approval, the ability to compare institutions evolved. It became possible to identify goals met as previously agreed upon by the group. They went through three phases of the process to make access to funding equitable and involved constituents. The institution presidents were working together to provide suggestions providing a broader perspective (Anderes, 2017). Despite the work and investment in the process, legislators did not fund the PBF model created. The elected officials could not agree on the funding priorities and support for higher education institutions (Anderes, 2017). They could not put their differences aside and agree on funding the institutional goals via the PBF model. As shown in other research, legislators may be more willing to fund issues they support (Anderes, 2017; Davies & Good, 2014; Woolard, 2015). Favero & Rutherford (2020) framed their work on policymaker's responses to PBF using the theoretical foundation of deck stacking. The idea is that policymakers from state or flagship institutions are well represented and may create the model with their institution in mind while hurting less-resourced institutions (Favero and Rutherford, 2020). Deck stacking disadvantages less-resourced groups.

Retaining Students

University administrators review student retention numbers as indicators of institutional health and responsiveness (Walker, 2016). New teaching methods and supporting and retaining students' will be necessary to remain competitive in an increasingly changing higher education landscape (Li, 2019b; Walker, 2016). If institutions fail to respond, they could be in jeopardy of facing financial consequences that could mean closing indefinitely (Bruinincks et al., 2010; Kezar, 2011). A new process addressing shortcomings can benefit students and help the institution increase its enrollment numbers. There is an opportunity to support and retain first-generation students and meet their needs as it has not been well done already (Brown, 2019;

Casas & Ryan 2010; Schmidt, 2018). First-generation, low-income, and minoritized students have not graduated at the same level as their White peers (Brown, 2019; Casas & Ryan 2010; Samuelson & Litzler, 2016; Schmidt, 2018). Universities can respond to the challenge and support an evolving demographic that historically has been poorly served, raising overall enrollment and retention. Entities outside higher education like the Lumina Foundation have lent their support. The foundation website has a section focusing on PBF which states that "outcomes-based funding on its own will not guarantee increased attainment, but when coupled with effective student success initiatives, it can help boost the number of students earning certificates and degrees" (Miller & Morphew, 2017, p. 767).

Distinct demographic changes have been visible among ethnic groups in higher education. The percentage of White students started declining since the Great Recession, while enrollments increased among minoritized students (Brown, 2019; Carlson, 2020; Grawe, 2018; Jordan, 2020; Osei, 2019). The decline in White students began with a drop in fertility rates from 2008 (Grawe, 2018; Osei, 2019). In contrast, minoritized students are attending college at higher rates than before. There has been an increase in the number of Hispanic Serving Institutions ((Brown & Mangan, 2021, Garcia, 2019). The retention and graduation of minoritized students have not kept pace with the majority population and could pose an opportunity for institutions looking to maintain or grow enrollments (Aguirre-Covarrubias et al., 2015; Brown, 2019; Rodriguez et al., 2019). As demographics continue to shift, recruiting, and retaining minoritized students makes financial sense for universities (Carlson, 2020; Grawe, 2018).

Sense of Belonging

The sense of belonging is the extent to which engineering students feel they belong and are supported (Sax et al., 2018; Verdín, 2021a; Verdín, 2021b). This study will use Strayhorn's (2018) definition of belongingness and sense of belonging:

> a sense of belonging refers to students perceived social support on campus, a feeling or sensation of connectedness, the experiences of mattering or feeling cared about, accepted, respected, valued by, and important to the group (e.g., campus community) or others on campus (e.g., faculty, peers; p. 17)

Engineering education literature has found a link between sense of belonging and student success (Rodriguez & Blaney, 2021; Sax et al., 2018; Verdín, 2021a; Verdín, 2021b). The more students feel supported and connected their odds of persisting and graduating go up.

Students feeling a connection to their community fulfills a basic human need to be a part of something (Verdín, 2021). The sense of belonging is important for all students, yet there appears to be a gap in the literature showing the extent it holds true for minoritized populations (Rodriguez & Blaney, 2021; Verdín, 2021a; Verdín, 2021b). STEM environments are prone to be male-oriented and could be especially difficult for minoritized students to navigate (Rodriguez & Blaney, 2021; Verdín, 2021a; Verdín, 2021b). Rodriguez & Blaney (2021) focused on Latina engineering students' sense of belonging. They found Latina students had a stronger sense of belonging the more they aligned with majority students and assimilated and less so when they retained Latinx cultural attributes including language. Latina students did not align with some of the disrespectful behavior towards faculty expressed by their white male peers. Findings included "creating inclusive spaces" and increasing the Latina representation to increase Latina students' sense of belonging (Rodriguez & Blaney, 2021).

Verdín (2021b) found minoritized students defined sense of belonging as including being respected and in a safe environment while majority students described it as fun and friendly. Seeing oneself represented as an engineer was also not found to hold true for minoritized students to the same degree as majority students (Verdín, 2021b). Alternatively having a strong interest in engineering and doing well in classes for Latinas was a stronger predictor of belongingness (Verdín, 2021b). Increasing the number of Latina students to a critical mass would help students see themselves represented and be more apt to create a support structure aligned with their interests. Supporting this idea of majority or minoritized groups, Latinas were not always inclined to join student led women's organizations as they didn't always feel welcome (Rodriguez & Blaney, 2021). Key components that assist minoritized students increase their sense of belonging according to Verdin (2021a) include:

- Providing an environment where students can get help from instructors to clarify course materials
- having instructors present
- an environment of mutual respect was created by faculty
- an opportunity for students to utilize their personal or home experience to solve an engineering problem

Latina students' sense of belonging could be strengthened with the research findings presented and assist with increasing the number of engineering graduates (Verdin, 2021a).

First-Generation Students

Students first in their families to attend college are considered first-generation college students (FGS). First-generation college students are apt to be low-income, from ethnic minority backgrounds, and comprise 25% to 33% of the college-aged student population (Gibbons &

Woodside, 2014; Gist-Mackey et al., 2018; Williams & Ferrari, 2015). Success rates vary for FGS compared to continuing education students who are not the first in their family to obtain a college degree. Higher education professionals could learn more about supporting first-generation students and adjusting responses to different student types versus based solely on the majority experience. Programming and academic support will vary for students from different backgrounds and traditional rates of access to higher education including underrepresented, low-income and first-generation (Pyne & Means, 2013).

As the first in their family to attend college, they are navigating many things with little guidance. Student self-perception can impact their self-efficacy due to perceived weaknesses in their preparedness and exacerbate their hesitancy to seek help due to the belief that they should know the material (Pyne & Means, 2013). In some cases, the students find themselves negotiating their college dream while responding to family expectations and aspirations. The family tie can provide strength and be a source of frustration to maintain ties with their family while creating a new identity as independent students. The two directions can be hard to navigate simultaneously. Research showed that intrusive advising, involved faculty, and data analytics can help retain students (Keels, 2013; Li, 2019a).

Students' reflection of their knowledge gives them a deeper understanding of their role as scholars, especially FGS. Faculty should help students understand and utilize their cultural capital as foundational knowledge and how that influences their current behavior. Guided support to facilitate FGS prior knowledge provides additional confidence, which helps with persistence (Castillo-Montoya, 2017). Advisors are sought out by students for guidance and benefit from additional knowledge in knowing best practices with FGS (Wang & Nuru, 2017).

First-generation students have higher financial needs resulting in higher rates of student employment than continuing education students. They have high financial needs and must pay to supplement their expenses, help their family, or pay for college (Canning et al., 2019; Nunez & Sansone, 2015). Research shows that working does not necessarily impact persistence rates. However, the number of hours worked and employment impact degree completion (Nunez & Sansone, 2015). Students that work up to 35 hours per week at off-campus jobs and have inflexible schedules, tend to have negative academic implications (Nunez & Sansone, 2015; Wiggins, 2015). Financial obstacles impede students from studying due to time spent working, thinking about how to finance their college education, and the emotional burden of managing expenses and having short study time (Canning et al., 2019; Destin & Svoboda, 2018; Millea et al., 2018; Wang & Nuru, 2017).

Three main characteristics impede progress for FGS, pre-college preparation, ease of college transition, and adapting to the college environment (Wang & Nuru, 2017). When comparing the groups, the Department of Education found that FGS are 20% likely to graduate within 10 years in comparison to 42% of those continuing education students (CES, Student Center, 2019).

Funding Model Incentives

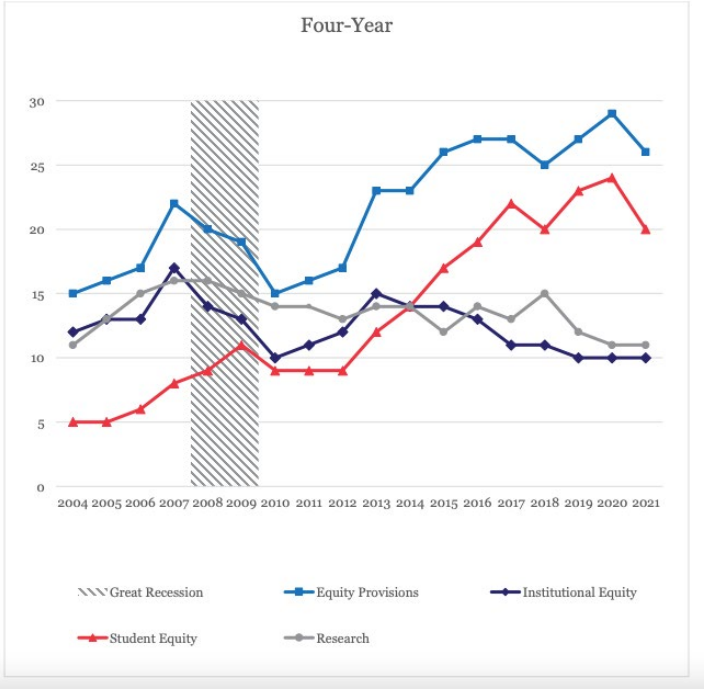
The cost to attend a university has outpaced inflation levels, and while state funding increased slightly, it has not kept pace. Institutions must demonstrate a cost-benefit, especially to public policymakers who control legislative priorities (Kelchen, 2018). Policymakers created PBF models to incentivize institutions to reach specific outcomes. The first models focused on increased enrollments. All models and incentives are different, yet further models provide incentives to obtain additional funds. Research shows the models demonstrate slight enrollment

increases yet also create unintended consequences such as raising admissions rates and adversely affecting specific populations (Kelchen, 2018).

Updated PBF models include an incentive for supporting at-risk students. There has been an increase in equity provisions as shown in Figure 3. Looking at data over 11 years, Kelchen (2018) found PBF models negatively impacted underrepresented, low-income, and adult students. There was a slight advantage relative to enrollment. The enrollment of African American students increased to 10.3 percentage points when there was an at-risk PBF metric versus no PBF or incentive. Latinx student enrollments were slightly higher, at a rate of 4.4 percent at institutions using PBF. The overall findings were minimal, yet in some cases, the incentive was 1% or 2% of the budget, perhaps not a sufficient incentive to be worthwhile (Kelchen, 2018).

Figure 3

Equity and Research Provisions



Lingo, M., Kelchen, R., Baker, D., Rosinger, K., Ortagus, J., & Wu, J. (2021). The landscape of state funding formulas for public colleges and universities. Image reproduced with permission.

Increasing the number of graduates in science, technology, engineering, and math (STEM) has been a priority for the National Science Foundation (Barbehon, 2020; Li, 2020; Xu & Larson, 2015). A small percentage of STEM graduates create a large proportion of solutions for the country (Oreopoulos & Petronijevic, 2013; Spencer & Hensly, 2015). The United States wants to maintain prominence as a leader in science and technology advancements, prompting educators to ramp up efforts to increase STEM graduates. Identifying best practices in STEM retention helps with degree attainment.

Women now enroll and graduate from college at equal or slightly higher rates to men. In STEM fields, the enrollment and graduation of women is a fraction of the rates for males. Understanding what helps retain and graduate women in STEM is a literature gap (Barbehon, 2020; Gayles & Ampaw, 2014). The leaky pipeline concept used to explain the absence of women in STEM highlights that women and underrepresented minorities either are not on the path or exit at many points along the way, like leaks in a pipe (Gayles & Ampaw, 2014). There is research on women in STEM, yet considerably less on underrepresented students in STEM. Research shows Black and Latinx students choose STEM fields at the same rate as White students, yet gaps in STEM degree persistence remain, especially among Blacks and Latinx students (Riegle-Crumb et al., 2019).

Gayles and Ampaw (2014) looked at persistence rates among women in STEM. Consistent with other studies, their research supports the idea that women in STEM have higher persistence levels consistent with their parent's income and academic levels. Faculty interaction, as well, has a more substantial positive effect on women. Women with stronger academic

backgrounds persist at higher rates, yet it doesn't translate to shorter graduation timelines than men in STEM fields. Future studies could determine the degree of faculty interaction and a difference among the STEM majors (Gayles & Ampaw, 2014).

White students are better academically prepared than Black and Latinx students (Riegle-Crumb et al., 2019). This academic preparation gap is consistent with all majors, yet Black and Latinx students are more likely than White students to leave STEM majors than other majors. Black students are 19% more likely than Whites to switch out of a STEM major, and Latinx students 13% more likely (Riegle-Crumb et al., 2019). All student participants found STEM courses competitive. However, FGS students were two or three times more likely than continuing generation (CG) students to find it so. When asked about their motivations for attending college, the FG students were apt to mention family or other group-type goals, while the CG students were more independent and focused on themselves (Canning et al., 2019). Students in rigorous programs may develop a mechanism to succeed and maintain persistence. Canning and colleagues (2019) share the following comment:

> Thus competition within a STEM course may force students to adopt authentic, self-serving goals (e.g., to compete with and best others) and reinforce the common perception that STEM fields are less likely to serve the helping motives and communal goals that FG students often report for obtaining a STEM degree (p. 7).

Much of this apprehension has been attributed to FG students. Even FG students with a better financial position still had higher rates of self-doubt that when compared to CG students of lower-income backgrounds. The "financial privilege" was less influential than college generational status (Canning et al., 2019).

Adding a STEM incentive to PFB models was first started by Kansas in 2005. In 2020, there were 13 states with STEM incentives in the PBF model (Li, 2020). The results suggest the STEM incentive had an outcome of increasing STEM degrees by 21%. Institutions without STEM incentives did not graduate as many STEM students. When comparing institutions without PBF models to STEM incentivized PBF models there was a difference of 5% more STEM degrees with the incentive. The number increases to 6% the next year and continues to hold the longer the program is in place (Li, 2020). A study limitation was not considering states with additional STEM incentives at the high school level, which could impact results.

Over time states have added metrics to incentive outcomes. Certain states have been adding a STEM metric to their PBF policy (Li, 2020). Kansas was the first state to introduce a STEM metric in 2005, followed in 2007 by New Mexico. The wave of states continued with Ohio in 2009, Pennsylvania in 2010, Arkansas, Illinois and Indiana in 2011, Arizona and Michigan in 2012 and the following in 2013: Maine, Minnesota, Mississippi, and Nevada (Li, 2020).

Li (2020) suggests future research focus on single states to look closely at the details affecting outcomes. In the study, Arizona, Illinois, Mississippi, and Ohio had the most substantial increases. Idaho and South Dakota, two states without PBF policies, resulted in decreased STEM degrees. The control variables' discussion included a brief mention of ethnicity, but the data was not included. Li (2020) found "STEM degree attainment, with a higher percent of Black/African American students associated with more STEM degrees attained" (p. 338). There was no specific correlation found between degree outcomes and ethnicity or gender.

Historically Minoritized Student Incentive

Representation levels in engineering have not reached parity. White men continue to be overrepresented and women account for 20% of the engineering degrees (Clark et al., 2021; Perez-Felkner, 2021; Verdín, 2021b). The term minoritized has been used to specifically describe the ethnic populations that have been impacted by exclusionary and often racist or discriminatory practices (Verdín, 2021b). Research on engineering students provides a broad perspectives with suggestions capturing a homogenous group, not always relevant to minoritized students (Rodriguez & Blaney, 2020; Verdín, 2021b). Minoritized students have not reached the save levels of degree attainment and research.

Incentives to increase degree attainment and historically minoritized student (students not identified in the majority campus population based on race, ability, sexual orientation, income, religion and other memberships) success can increase graduation rates when done well. The process of identifying PBF metrics can negatively impact minoritized students (Gándara, 2020; Kelchen, 2020b) and has resulted in intended and unintended outcomes (Ortagus, 2020). Legislators can influence policy and determine funding models on pre-approved metrics. Kelchen (2018) found little impact on underrepresented students' enrollment from PBF efforts consistent with other research efforts (Li, 2019b; Ortagus et al., 2020; Umbricht et al., 2017). Table 5 displays a list of states with PBF policies and the specific equity metric for institution type, low income student, racially minoritized students and even the underprepared students.

Table 5

Funded Performance-Based System Equity Metrics, 2020

	Sector(s)	Low-income students	Racially minoritized students	Adult students	Acad. underprepared students
Alabama	Two-year	Yes	Yes	Yes	No
Arkansas	Both	Yes	Yes	Yes	Yes
California	Two-year	Yes	No	No	No
Colorado	Both	Yes	Yes	No	No
Connecticut	Two-year	No	No	No	No
Florida	Both	Yes (four-year)	Yes (four-year)	Yes (four-year)	Yes (four-year)
Hawai'i	Both	Yes	Yes	No	No
Indiana	Both	Yes	No	No	No
Illinois	Two-year	Yes	No	Yes	Yes
Kansas	Both	Yes	Yes	Yes	Yes
Kentucky	Both	Yes	Yes	No	Yes (two-year)
Louisiana	Both	Yes	Yes	Yes	No
Michigan	Both	Yes (four-year)	No	No	No
Montana	Both	Yes	Yes	Yes	Yes (four-year)
Nevada	Both	Yes	Yes	Yes	Yes (two-year)
New Jersey	Four-year	Yes	Yes	No	No
New Mexico	Both	Yes	No	No	No
North Carolina	Two-year	No	No	No	Yes
North Dakota	Both	No	No	No	No
Ohio	Both	Yes	Yes	Yes	Yes
Oklahoma	Both	Yes	No	No	No
Oregon	Four-year	Yes	Yes	No	No
Rhode Island	Both	Yes (four-year)	Yes (four-year)	No	No
South Carolina	Two-year	No	No	No	No
Tennessee	Both	Yes	Yes	Yes	Yes
Texas	Two-year	Yes	No	Yes	Yes
Utah	Both	Yes	No	No	No
Vermont	Both	No	No	No	No
Virginia	Two-year	Yes	Yes	No	No
Washington	Two-year	Yes	Yes	No	Yes
Wisconsin	Both	Yes	Yes	Yes (two-year)	No
Wyoming	Two-year	No	No	No	No

"New Evidence on the Evolution and Landscape of Performance Funding for Higher Education," by K. O. Rosinger, J. Ortagus, R. Kelchen, A. Cassell, & L. C. Brown, 2022. InformedEd States: Higher Education Policy Initiative, p. 31, Reprinted with permission.

Pennsylvania and Ohio, two states with a consistent history of PBF models, were the focal point of Li's (2019) study on equity metrics and the resulting campus actions. In Ohio, 80% of performance funding ties to outcomes. Ohio offered an incentive and extra funding for course and degree completions based on income, underrepresented ethnicity, and students over 25 years of age. Pennsylvania used a formula of access and achievement gaps focusing on income via Pell Grant eligibility and students of color (Li, 2019b). The results fell into two categories: "retention strategies to increase success among underrepresented students and unintended consequences of

increasing selectivity" (Gándara, & Rutherford, 2018; Hu & Villarreal, 2019). Ortagus et al. (2020) also found intended and unintended consequences of PBF.

The incentives provided did not significantly improve underrepresented students' outcomes (Li, 2019b). In response to admissions practices, research supports changes by universities that impact student populations differently. Some institutions raised admission criteria, possibly making it harder for students of color to attend (Kelchen, 2018; Ortagus et al., 2020; Umbricht et al., 2017). Universities previously able to support students continued with supportive measures while colleges with fewer resources continued to struggle. The metric proved insufficient to improve outcomes for historically underrepresented students. Li (2019) suggests additional research is needed to determine the ideal reward structure necessary to prompt systemic changes.

Gándara (2020) uses policy design theory (PDT) to analyze the design process, prioritize issues that focus on particular populations, and whether they gain or lose. The theory suggests groups are prioritized based on pre-determined social constructs. Gándara (2020) looked at the 10 governing boards' implementation processes in Colorado. The PBF model, created in two phases, included the policy formulation and implementation processes after the bill's approval. The new model focused on three areas including role and mission, and university student enrollments, in addition to performance. Stipulations provided a 10% premium for Pell-eligible students. The board proposed a 5% premium for underrepresented minority students' credit completion during the discussion yet later dropped during appropriations despite the Colorado Center for Higher Education approved model. Legislators dropped the recommendation for underrepresented students during the process, while premiums for underserved and low-income students remained. believed their constituents would not approve funding for racial/ethnic

minorities. It was an example of Gándara's focus on PDT, where certain less visible groups may lose in the process (Gándara, 2020).

Role of Higher Education

Colleges and universities have long been considered the hallmark of American education. Since colonial times, families have sent their young adults entrusted to a specific institution for training and education (Grawe, 2018; Thelin, 2019). Universities are considered the ultimate pathway to obtain knowledge and are poised to educate citizens (Abel et al., 2014; Paino, 2014). American institutions emerged along with the birth of our nation during early colonial times. The thirteen colonies evolved along with the foundation for the country. Ideas on the value and role of educating our citizens were taking shape (Owens, 2011; Thelin, 2019). Colonies arose with a focus on religious freedom. College and universities focused on a strong spiritual foundation to educate young men and establish a Christian spiritual and moral foundation (Owens, 2011). The religious focus became the driving force for the new institutions. For example, Harvard College was founded in 1636 by New England Puritans to "know God and Jesus Christ" (Owens, 2011, p. 530).

The College of William and Mary in 1695, and Brown University in 1764, were founded during colonial times and still exist (Owens, 2011; Thelin, 2019). In the 1880s and 1890s, 14 institutions were considered among the great American institutions' leaders. The list includes Harvard, Columbia, Princeton, and Yale University, universities that consistently outrank their peers (Owens, 2011). Institutions' primary mission was to educate White males from wealthy families and slowly evolved to include women and students of other ethnicities and religions (Thelin, 2019). The role of a university and the students it serves has shifted, and institutions

with changing demographics have responded and adapted their services to meet the student population's needs (Tierney, 2011).

Higher education has evolved since colonial times and is at a turning point. As costs rise and outcomes are scrutinized, the need for a college education and its value is paramount (Liu, 2011a; Oreopoulos & Petronijevic, 2013). The country benefits from having an educated workforce ready to tackle challenging problems (Liu, 2011b; McMillan & Overall, 2016; Spencer, 2015). College graduates are more likely to gain employment and have higher earnings over their lifetime (Bruinincks et al., 2010; Mitchell et al., 2015; Oreopoulos & Petronijevic, 2013). Universities play a role in educating their citizens, making more informed decisions, and influencing the overall quality of life.

Increasing our talent pool to use creativity and problem solving will help the United States remain globally competitive. The national pandemic starting in 2019 has shown us how globally connected our world is, and solutions must reflect that reality (Dong et al., 2020). There is a need to have a trained workforce ready to tackle complex global challenges. Colleges and Universities are poised to respond and prepare our citizens to lead creative problem solving and quickly train an educated workforce (Cantor et al., 2015; Grawe, 2018). While in office, President Obama determined the United States would have the highest rate of college-educated citizens by 2020, preparing a workforce to respond to global challenges (Kelchen, 2020b; Oreopoulos & Petronijevic, 2013; Walker, 2016). The United States, once an education leader, dropped in comparison to gains by other countries. The level of college degree attainment increased to 49% in 2018. It was short of the 60% goal set by the Obama Administration. China's goal of accelerating college graduates' rate should incentivize the United States to follow suit and remain competitive internationally (Jung, 2010; Liu, 2011b).

After several years of decline, college graduation rates have increased slightly (National Student Clearinghouse, 2020; Xu, 2017). Universities review retention data and identify practices to improve persistence and retention (Jenkins, 2020; Jordan, 2020; Wilson et al., 2015; Xu, 2017). Institutional success at graduating students should be a top consideration (Osei, 2019; Roggow, 2014). Universities that effectively utilize their budgets and retain enrolled students can maximize recruitment (Xu, 2017). Colleges and universities benefit from retaining and graduating students in the educational pipeline. Resources spent on recruiting students are suitable investments, evident as students graduate (Levin & Garcia, 2018; Paino, 2014; Xu, 2017). This model is essential as the college graduation rate was recently declining, with only a recent spike in graduates during the last year (National Student Clearinghouse, 2020; Xu, 2017).

Changing College Enrollments

The idea of a college education has gained interest. As the economy declines during a recession, more people consider getting an advanced degree (Livingston, 2019; Schmidt, 2018). In 2011, a few years after the Great Recession, there were 20.4 million students enrolled, yet the number dropped by 1.3 million only four years later (Bound et al., 2010). The enrollment drop reduced the percentage of available students and added financial implications for institutions serving their educational needs. As the balance continues to shift, students will be in higher demand among institutions and drive needed services (Keels, 2013). If institutions fail to offer or respond to student services, they could risk losing their base. Students will be in a more significant position to shop around and find a specific university that meets their needs (Casas & Ryan, 2010). Institutions not responding to students could lose current and future enrollments (Bound et al., 2010; Curs & Singell, 2010).

The Great Recession began December 2007 and is considered to have ended in June 2009. During that time, a shift took place. Families were looking for employment and a way to make ends meet and delayed starting a family (Schmidt, 2018). The population and demographics in the United States have been changing as fertility rates started dropping during the recession (Livingston, 2019; Schmidt, 2018; Tartar et al., 2020). The Great Recession impacted various areas of the economy, including the population decline. As time goes on, there will be fewer people to fill jobs and sustain growth. The impact will become evident in less than a decade, giving institutions time to respond. In the educational arena, K-12 through higher education should prepare to adjust to fewer students and the corresponding budget implications. The institutions counting on increased enrollments will be impacted and need to re-assess growth. The entire recruitment process will change as students' numbers decline (Osei, 2019; Schmidt, 2018).

The population decline starting decades ago has not been the same across all ethnic groups. The rate of decreases among ethnic populations is varied, with the most significant reductions among Whites and continued projected decreases in the future. The estimates project the non-Hispanic White population to decline by 20 million in four decades to 179 million by 2060 (Vespa et al., 2020). Factors contributing to the decline include an aging population that will soon start dying faster than the rate of fertility changes (Vespa et al., 2020).

The American population will continue to age and become more diverse. Historically, for decades, the majority of the students in higher education has been White males. Initially, the focus for American Institutions was to meet White, wealthy men's needs (Thelin, 2019). The curriculum and campus culture revolved around White male students at conception. Higher education has slowly evolved to include female students, and now the gender representation is

nearly split, and in many cases, with a higher percentage of women (Brown, 2019; Casas & Ryan, 2010).

According to the Census Bureau, the United States has become more diverse (Brown, 2019; Schmidt, 2018). The increase has taken place over time, with more growth taking place in the last decade. The most significant population increase is two or more ethnicities, followed by Asians and the Latinx population (Vespa et al., 2020). Predictions estimate that by 2060 one in three Americans will be non-White (Schmidt, 2018; Vespa & Medina, 2020). The population shifts have resulted in fewer White students and more Latinx students enrolling, a demographic model with historically lower enrollment rates in higher education, other than at Hispanic Serving Institutions (Garcia, 2019; Jordan, 2020; Levin & Garcia, 2018). The changes have been reflected in institutional enrollments as Latinx students enroll at higher rates than before (Casas & Ryan, 2010; Garcia, 2019; Jordan, 2020; Levin & Garcia, 2018; Young, 2016). Responding to a diverse demographic is essential for universities to maintain current approaches.

Conclusion

Higher education is at a turning point. As education costs rise and outcomes are scrutinized, the value of accountability increases (Liu, 2011a, 2011b; Oreopoulos & Petronijevic, 2013; Zimmerman, 2014). Determining the value of each institution as a college investment is a challenging yet important endeavor. The process must be robust and include measures that consider institutional differences, students served, and outreach to all students (Li, 2019a; Oreopoulos & Petronijevic, 2013; Zimmerman, 2014). Current performance-based funding models fail to consider the characteristics needed to accurately reflect the different institutions and factors such as their size, tuition, and support systems. Despite the flaws in the models, they continue to be a data point or element for consideration when determining funding at the state

and federal levels (Gandara, 2019; Liu, 2011b). The models designed to incentivize institutions and provide better outcomes for students (Gandara, 2019; Kelchen, 2019; Li, 2019a; Oreopoulos & Petronijevic, 2013; Zimmerman, 2014) have yielded intended and unintended outcomes (Ortagus et al., 2020).

Results from a previous study indicate PBF with a STEM incentive could increase graduation outcomes for students. The results from this study can support retention efforts for minoritized students and identify options for addressing Latinx students' needs, a reason to consider in light of the demographic shifts predicted. Students should drive services. Higher education has adjusted its focus since inception, and it is time to focus on students and their needs. Students should no longer be seen by what they fail to bring to academia in a deficit mentality. Meeting students' needs where they should be the focus and driver of services.

Chapter III

Research Design

"First world researchers have enjoyed the privilege of the written word and have used the written text as the forum for debate and legitimizing knowledge. Unfortunately, the majority of the researched-two thirds of the world population- are left out of the debate and do not therefore participate in legitimizing the very knowledge they are supposed to produce"

(Chilisa, 2020, p. 86).

Introduction

The idea of research as neutral and free of bias offers a one-sided perspective. The very nature of the topics chosen, research subjects identified and the way the methodological approach is identified and evolves is at the researcher discretion, either adding to a body of literature or identifying a gap, neither merely neutral. The research process led the author to self-discovery, further introspection and in particular, the language and understanding of the third-space environment that is her professional home. It added meaning while navigating through nepantla as a scholar and as a minoritized individual her entire life living among the majority in academic and professional life.

As the researcher, I understand the sentiment qualitative researcher Johny Saldaña (2018) conveyed in his keynote address at The Qualitative Report research conference when he said, "You can't learn how to tell someone else's story until you first learn how to tell your own." Qualitative researchers must learn to understand themselves which is what I needed to do along the way. That self-reflection became a necessary part of my process. It was essential to frame the problem space and center the needs of students as I referenced my own narrative for context. In

Figure 4, Research is Devotion, Saldaña expands on this idea. Devotion to the research starts with a purpose, which includes a vision. The belonging component involves other individuals either independently or by working with groups. The making meaning is the culminating step as the immersion with the ideas continues and provides a sense of satisfaction.

Figure 4

Research is Devotion

"Researcher, analyze thyself. International Journal of Qualitative Methods" by J. Saldaña, 2018. 17(1), p. 6. Reprinted with permission

Research supports increased STEM degree attainment in PBF funding models with the STEM incentive. Models with incentives to support at-risk students negatively impacted recruitment yet may have helped support retention efforts (Kelchen, 2018; Li, 2020). Li (2020) suggested future research could "analyze single states to more intricately tease out the impacts of

a STEM incentive in performance funding policies" (p. 329). This study explored the lived experiences of Latinx students participating in one of the PBF STEM incentive programs.

This qualitative research study explored the strategies used by Latinx engineering students as they navigate their academic program. The nepantla framework looks for points in the journey where student develop strength as they face challenges along the way. The participants represented two students in the beginning, or first two years of their program and two in the latter part of the program nearing graduation. This study used the thirdspace concept of *nepantla* a “Nahualt word for the space between two bodies of water, the space between two worlds” (Chávez, 2015, p. 338). The *nepantla* framework identified by Latina scholar Gloria Anzaldúa was used to explore Latinx engineering students academic experience. College students embrace their role as student, child, sibling, academic, and scholar and gain confidence often leading to continued persistence as a student. The research focus was to examine the experience of Latinx engineering students. Focusing on a specific group will help us learn more about how they gained strength. The *nepantla* lens will help identify key areas during the process of navigating their multiple worlds in academia. This chapter provides a review of the research design process and methods used, information and theory related to the process, and the researchers' involvement. The research utilized *testimonios* as the methodology to further explore the research questions. Table 6 provides a visual of where *testimonios* is positioned among traditional and decolonizing methodologies.

Decolonizing Research Methods

Research paradigms follow a pre-scripted pattern. The idea of research with a deference to Western research as the dominant paradigm by which all others are measured continues (Smith, n.d.; *The Sage Handbook of Qualitative Research, 3rd Ed*, 2005). Datta (2018) explores

how indigenous research helps the community and researcher. The process of decolonization helps the unlearning and learning process while honoring the indigenous approaches. He stressed that "decolonizing research training is culturally appropriate and effective for both the participant's community and the researcher when conducting research with Indigenous communities" (Datta, 2018, p. 3).

Table 6

Decolonizing Methods – and Positioning Nepantla

Decolonizing Methods	**Nepantla**	**Traditional Methods**
Testimonios (personal reflection)	Researcher Journal Researcher Positionality	Narrative Design Collective Stories

Research Design

Qualitative research provides rich analysis of personal narratives. Narrative research provides an opportunity for the researcher to "construct meaning, make sense, and engage in the world making" (Golsteijn & Wright, 2013). This qualitative study focused on the student experience and utilized *testimonios* to gain an understanding of Latinx engineering college students self-determination and ability to persist while navigating unknown environments found in academia, often completely different from their home or previous educational settings. The goal was to identify strategies Latinx engineering students make use of to navigate their postsecondary context (or specifically their academic program provide an examination of asset building tools utilized by Latinx engineering students at institutions with a performance-based funding STEM incentive.

Qualitative methods provide rich in-depth analysis of a topic. The methodology was chosen to further probe the lived student experience and through *testimonios* develop an understanding of how they find strength and resilience to persist. This study aimed to get a more in-depth look at PBF models with a STEM metric. Performance-based funding models with incentives have produced results. Funding models with STEM incentives raised degree attainment (Li, 2020). However, it is unknown how effective PBF models with STEM incentives achieve improved degree attainment for historically minoritized STEM students. There has been limited success with the PBF incentives for underrepresented students (Canning et al., 2019; Gándara & Rutherford, 2018; Hu, 2019; Secules et al., 2018). To what extent has the metric helped all STEM students, including historically minoritized students who have not previously attained the same level of degree completion? There is no research to date that goes into this level of detail. This study explored the lived experiences of a Latinx population of students in the programs and add to the literature to better understand the student. This study adds an equity-minded perspective to the research on performance-based funding outcomes.

Narrative Research Design

Quantitative and qualitative methods have different strengths and support various research goals (Creswell & Guetterman, 2019; Maxwell, 2013). Both have merits and lend to the overall research objective, yet ultimately what should drive the design are the research questions (Creswell & Guetterman, 2019; Maxwell, 2013). The research questions in this study elicit input to gain understanding of student's identity and how they navigate their environment.

Testimonios closely follow a narrative design. The Latina Feminist Group got together starting in 1993 and in 2001 created a collective of stories written by Latina scholars in a book called *Telling to Live: Latina Feminist Testimonios* (2001). The book is a collective of

testimonios or *papelitos guardados* (safe papers, secret papers) as the scholars referred to them. The idea of *papelitos guardados* was first brought up by María Luisa Lomas, where she shared them as documents written up and kept from others until it felt safe to share. *Testimonios* are personal narratives that can be difficult to recall and can have a liberatory effect when shared (Cantú, 2012, *Telling to Live: Latina Feminist Testimonios*, 2001).

Testimonios

Western methodologies position groups outside the majority as Other. Huber (2009) shares that "in the field of education, dominant ideologies of meritocracy, individualism and color-blindness can mask the complex struggles of Students of Color and the systems of oppression that create the conditions for those struggles" (p. 1). She discussed the apartheid of knowledge in academia and argued that *testimonios* as a methodology serve to disrupt that direction.

The process of interviewing participants to gather *testimonios* allows the individuals to share their personal account. To value the participant voice, effort has been made to decolonize the research method and the use of *testimonio* was deliberate to allow the participants and researcher perspective to be heard. Scholars have used *testimonios* to encourage stories to emerge (Bernal et al. 2009; Cantú, 2012; Chávez, 2015; Fuentes & Perez, 2016; Huber, 2009; Latina Feminist Group, 2001; Reyes & Rodriguez, 2012). *Testimonios* are personal reflections or a

> "verbal journey that allows the individual to transform past experiences and personal identities, [towards] creating a new present and enhancing the future, moving from individual and personal tragedies towards shared strengths" (Cienfuegos & Monelli, 1983, p. 46).

The use of *testimonios* is particularly useful when working with students of color to provide a voice and a method of empowerment through the process (Bernal et al. 2009; Cantú, 2012; Chávez, 2015; Reyes & Rodriguez, 2012).

Reyes & Rodriguez (2012) indicate *testimonios* are different from other qualitative methods because the process is meant to incite a call to action. They go on to say that it is meant to be "intentional and political" a thought supported by other feminista scholars (Bernal et al, 2012; Huber 2009). The researcher seeks information and the discovery in the findings leads to a suggestion that will empower the group being studied. Scholars should be considerate and thoughtful with every intent to do no harm (Chilisa, 2020). Feminista scholars empower their participants through the process of self-discovery and awareness (Bernal et al. 2009; Cantú, 2012; Latina Feminist Group, 2001; Reyes & Rodriguez, 2012).

Research Questions

This study examines the experience of Latinx engineering students attending a public institution with PBF models with a STEM metric. The study examined several states that use performance funding models with a STEM metric.

The research questions were:

1. What strategies do Latinx engineering students make use of to navigate their postsecondary STEM academic program?
2. How do those strategies align with the critical elements in PBF with a STEM incentive?

Participant Selection Strategies

The number of Latinx students in engineering is less than twenty percent on most campuses and nears the single digits in many cases (Dell et al., 2018; Perez-Felkner, 2019). The

starting point was to find a group of students that met the criteria; Latinx, engineering major, at an institution with a Performance-Based Funding model and STEM metric. Li (2020) identified states using PBF and the STEM metric, as previously shown in Table 9. The following table 14 identifies the States with Performance Based Funding and the STEM Metric and the year the program was introduced.

Funding models demonstrate that more changes are evident over an extended time period (Li, 2020). The PBF policy with a STEM metric was first started 2005 in Kansas followed by New Mexico in 2007. One of the earlier states was identified as ideal since it had both a PBF policy, STEM metric and a larger population of Latinx students. Four states introduced a STEM metric in 2013, as seen in Table 7 showing the Overview of the STEM Metric.

Table 7

Overview of the STEM Metric

STEM Metric Introduced	
Year	State
2005	Kansas
2007	New Mexico
2009	Ohio
2010	Pennsylvania
2011	Arkansas, Illinois, Indiana
2012	Arizona, Michigan
2013	Maine, Minnesota, Mississippi, Nevada

Once the state was identified the institution was next. The institution was identified due to a process of narrowing down. To best find the target institution and population, it was determined to choose a state with a longer history of PBF with a STEM metric and designated as a Hispanic Serving Institution to find a broader population of Latinx students to target. Purposeful sampling was used to narrow down the state to analyze.

The researcher reached out to the Associate Dean for Academic Affairs in the College of Engineering first and gained permission to interview students. The AD identified an engineering administrative staff to help identify the students based on the selected criteria. The IRB application for the researcher's home institution and the site institution was submitted. The IRB process provided the necessary permission and guidance to proceed. The researcher was in contact with the administrator identified by the Associate Dean through phone calls, emails and zoom meetings and discussed the research and the student criteria needed.

The students were identified by the institution. Once a student agreed to participate, an email was sent introducing the student to the researcher and the interview protocols continued from there. The students that met the criteria communicated with the researcher and were sent a follow up email coordinating follow up times to meet. Interested students were sent a permission form, and a Zoom interview time was scheduled. All interviews were approximately 60-90 minutes and took place electronically.

Data Collection Procedures

The process identified was used to best share a student perspective and give voice to the Latinx participants. *Testimonios* as a methodology were used to collect data by conducting interviews with an interview guide designed to elicit open ended stories (Creswell &

Guetterman, 2019; Reyes & Rodriguez, 2012). Participants were encouraged to give examples in the form of a story to the responses and on topics they found relevant. Giving the participant the option to choose provides for some new themes to emerge the researcher cannot predict (Golsteijn & Wright, 2013). There were five interviews. One interview was rejected because the participant was not an engineering major.

Recordings of the Zoom interviews, researcher notes, and transcripts were used to create a written portrait of the *testimonio*. All participants were allowed to respond in either English or Spanish. Two participants, a male and a female, responded in English and two participants, a male and a female, responded in Spanish.

Testimonios as Methodology to Amplify Voice

Testimonios were utilized as the primary research method. The participants were given a voice in the process of *testimoniando* (Bernal et al. 2009; Cantú, 2012; Latina Feminist Group, 2001). Scholars have structured the methodology to provide an opportunity for individuals to share their perspective and plant a seed for further conversations or actions (Bernal et al, 2012). While the testimonios are collected with one participant at a time a rich collective is created through the shared stories and common experiences discovered.

A research guide was created to help with the semi-structured interview process. The questions guided the direction of the conversation and was used to maintain consistency between interviews. The list of topics was used to make sure to cover the key areas, versus follow a set of specific questions (Golsteijn & Wright, 2013). The interviews were held over Zoom and recorded.

Phase One of Data Collection

Questions were identified to create an interview guide (Appendix S) asking about 10-15 topics intended to address a range of topics without being so narrow, often the case with semi-structured interviews. The questions were designed to learn more about the student, their family background, their language preference, personal academic struggles, thoughts about academic support available, obstacles encountered, academic challenges, faculty, sources of strength, reflections on struggles, something they found inaccessible, and individuals who were helpful along the way. The set of questions were meant to encourage the natural flow of conversation, versus stop conversation, a challenge encountered with semi-structured interviews (Golsteijn & Wright, 2013). The participants were encouraged to elaborate on a topic and provide an example and given ample time to finish prior to new questions being asked. The overview of Phase 1 and 2 data collection is shown in the Table 8, Data Collection Procedures.

Table 8

Data Collection Procedures

Data Collection Phase 1	**Data Collection Phase 2**
90-minute testimonio (semi-structured interview) Zoom-recordings Researchers' Journal	Individual follow-up Zoom recordings Researchers' Journal

The interview guide was tested with a Latina engineering student from the researcher's home institution. It was an opportunity to test the zoom format and use of the transcribing feature

and review the questions and modify accordingly. The student provided input and suggestions about the questions. The researcher adjusted the questions based on input from the student. The test interview was recorded and only a few notes were taken during the interview about observations or additional thoughts by the researcher to allow for fluid conversation. The recording allowed the interviewer to participate and make additional observations to keep the conversation fluid and organic. The technique was also helpful to gain the participants trust and make it feel like a conversation with a trusted friend.

Phase Two of Data Collection

The interviews were reviewed and transcribed first in Microsoft Word and then transferred to Microsoft Excel. Using Excel was helpful to note in separate columns the frequency of similar comments. While other software was considered ultimately guidance from Saldaña (2020) was followed relative to suggestions for novice researchers in keeping it simple. In Excel, the list was reviewed several times and analyzed for emergent themes. After the interviews the researcher reviewed the recordings and looked closely at the written discussion from the transcript and recorded images looking for common themes. The themes were recorded and noted with particular focus on common themes (Saldaña, 2016).

Data Analysis Procedures

The researcher kept a journal to capture observations and provide insights throughout the process. The journal was used to reflect on the interviews and reviewed during prior to each interview and during the writing. The transcript was reviewed multiple times and through the process of familiarity with the response's similarities began to emerge. The results were reviewed, and the common themes began to emerge. A list of themes was developed, 1). people, 2). engineering and self-discipline, and 3). educational pathways.

Each transcript was reviewed for frequency and specifics scenarios regarding each code. As the process was reviewed several times and narrowed down, ultimately two main codes emerged, 1). people and 2.) process. The themes were determined from the codes that included engineering as challenging, leadership skills, family and support system, and educational pathways.

Member Checking

To confirm the information being shared honored the sentiments accurately, each participant was sent a copy of the written transcript and the chapter draft. They were invited to make corrections as needed or provide additional clarification. One participant submitted edits regarding the quotes and further correspondence followed via email. There were minor edits, and the corrections were made in the final copy. The program administrator also responded with minor edits. She felt the summary accurately described the conversation and added additional details relative to the programs they collaborate with in their state system.

Role of the Researcher

In qualitative research, the researcher is closely involved with the participants. It is important to take precautions to remain impartial and not influence the results. The researcher is thought of as "gaining access" to the subjects and creating a relationship (Maxwell, 2013). An important principle to remember is "first do no harm" (Miles et al., 2020). The process of qualitative research involves maintaining a relationship with the participants and may influence the design, as long as it does not influence the results or responses (Maxwell, 2013). Scholars using *testimonio* as a methodology reflect the dual roles of the researcher as a participant and spokesperson when sharing the information (Cantú, 2012, *Telling to Live: Latina Feminist Testimonios*, 2001).

Researcher Positionality

This section was hard to write. The reflection process forced me to recall my own process of being in and out of *nepantla* my whole life. The dissertation process is a reflection of my life along the borderlands and the disarray, hurt and confusion that it has caused in my life. Writing the section was a reminder of the power of omission and how often people of color use various coping mechanisms to thrive or merely survive. We often have more than one narrative, a public and a private version used as needed and only by choice when perceived to be in a safe space. It is something I do without much thought. My initial inclination was the brief version. I elaborate a bit more with trepidation. I realize the shorter narrative is not just a way of protecting myself from over sharing and potentially making myself vulnerable by sharing a weakness or a way of others spotting a deficit, it's also a way of saving others from the discomfort. It is a way of sharing the version people want to see, the side of my journey that is free of problems without any microaggressions. The personal narrative I typically share follows along the lines of The American Dream, or the idea that one works hard, gets an advanced degree(s) and makes a contribution to their society and everything works out fine. It is by most accounts, an American success story. As I have maintained and preserved relationships in my primarily White spaces it has been my default story, and where I am most comfortable. In turn so are the individuals in the majority spaces I occupy. Not everyone is interested in hearing about microaggressions or want to learn about experiences when diversity is more about being the other, or always compared against the normative standard as White. In recalling and sharing this perspective I continuously go in and out of one world and into another. I have intentionally allowed you to experience it through the language as I shift from first to third person.

The first draft of my researcher positionality was a public, even sterile version. I started with a list of things about me, as if that would say it all. I did not initially elaborate. To do so is to be vulnerable. To lay out all of you exposes your insecurities and can be uncomfortable. In the end, it is my daily reality in deciding what and how to share things especially as I navigate mostly White spaces as other. It is a choice starting with my own introduction and how I pronounce my name, in English or Spanish. Growing up bilingual it was natural to go back and forth and not think twice about either language. I was allowed to fluidly go from one to the other without a need to create a border where one does not exist. When saying my name, I use both, but mostly introduce myself in Spanish, as a way of role modeling and empowering the college students I work with, that have hard to pronounce Spanish names to declare them proudly without the need for an English equivalent. I role model for my students how to create your own space as we navigate identity. It is my own nepantla while navigating my identity and embracing the version I chose to share.

As a doctoral student I have been pushed to report research findings and let the research do the talking. Research designs should follow a process that minimizes bias. Holmes (2020) discussed reflexivity as an opportunity for the researcher to reflect on her personal perspective and how it influences the study and the outcomes. The researcher can be intentional about their approach and how it will impact the direction, versus trying to lessen the influence. In this design, with a *nepantla* framework, a space of unknown, of being in between, the researcher has her own personal experience relative to navigating *nepantla* as a Latina in a predominately White setting. The researcher brought her own set of experiences and background to the study (Holmes, 2020; Maxwell, 2013). The researcher was able to relate to the feeling of uncertainty with one foot in one world with a step towards another (Anzaldua, 1987). This personal connection to the

topic provides a springboard and relevance when interacting with the participants and doing the research analysis (Holmes, 2020). To make this choice involves inviting an additional challenge, where validity will be expected by both the traditional and indigenous research methods. One cannot serve two masters. It will be likely that the dominant paradigms will be used to evaluate and analyze and used as a measure by which this research evolved, which could serve to be inaccurate and misguided.

Holmes (2020) identified four key aspects in determining positionality. The first is establish their ideas about the subjects. In this case, the researcher serves as an Assistant Dean in a College of Engineering at a different institution from the research participants. There was no established relationship with the interview participants. The second component suggested is to think about how the researcher is viewed among the participants, which can take time. The researcher should be able to determine her position and thoughts relative to the subject as the third consideration. In this case, the researcher identifies as an educator among engineering scholars, encouraging more students to pursue STEM fields. The idea of the fourth component as taking the time needed to develop a position was stressed. It should not be rushed. I reflected, went back, and wrote this section several times.

I am a Latina. Describing my gender and ethnic identity in one word is powerful. It reflects who I am. Deciding how I define myself has been a lifelong journey that I suspect is not over. I have been a minority among the majority most of my life and have been asked to define myself beyond being an American. “No, but where are your parents from?” is a common probing question when my initial response doesn’t suffice. You see, as a *Tejana*, born in Texas with family roots in Mexico I have lived in my own borderlands. I have had to choose one side or the other. Like Anzaldúa references in her work, in my family we were warned, indoctrinated even

to be careful of those from '*el otro lado'* [the other side] (Rebolledo, 2006). There was a very strong distinction between our family as Mexican-Americans and the Mexicans on the other side, as if the physical border somehow really made us different. It amounts to a piece of paper, and which citizenship you are allowed to claim. My family identity is wrapped in strong pride as American citizens. This distinction has made it harder for me to embrace my indigenous roots. My family didn't really talk about our indigenous roots, so I don't know the details. That investigation can be a future genealogy project when I have more time on my hands. I honor and respect the *raiz Mexicana* [Mexican roots] from which I come.

I am a PhD student and proud first-generation college graduate. My journey to the doctorate was long and required commitment to proceed even while decades into my academic career. As an Assistant Dean I realized I had reached the glass ceiling and there was little possibility I could aspire to promotions or apply for other positions without the academic credentials. I saw other people doing so, but they didn't fall into minoritized categories. It is simply part of my reality. I also didn't want to be seen as less than. It was my own validation and ability to participate in academic circles. I need those *papelitos* [papers] documenting I am worthy of entrance, to apply to new positions, to move in spaces not visibly welcoming to outsiders not already in the academic circle. The same *papelitos* I chose to utilize as I narrowed in on a research method. *Testimonios* with *papelitos guardados* [guarded papers] (Bernal et al. 2009; Cantú, 2012) was a natural fit. It was an extension of my identity.

I share my first-generation status as a strength, a badge of honor and testament to the extra work needed to get to where I am today. It is a journey I have essentially spared my daughters. As a mother of two daughters, I have instilled in them the power of a college degree. They have seen the difference it has made in our life. I am also a non-engineer among engineers.

It is as if I positioned myself intentionally in *nepantla*, a state of constant turmoil as I navigate a space that is not really mine. I have currently embraced the identity of Engineering Educator. I see the inequities minoritized students face and want to utilize my skill set and passion to encourage minoritized students to pursue engineering. I never considered engineering as a career path. It never crossed my mind even though I was strong in math and even tutored math. I was not a confident student and didn't see myself in an engineering environment which I equated with White males. I was not ready to navigate those unknowns and discomfort. Decades later, I have found my voice through this academic journey. This voice which comes with a responsibility to speak up for others and point out injustices and create a better educational environment for all students.

Assumptions

The study delimitations include the research questions, population, research methods, and theoretical framework chosen to explore. This study provided an in depth look at one group of students. Latinx engineering students became the focus. The selection of the population prompted the use of indigenous research methods including *testimonio* as the methodology. It was a way to honor the student voices. *Nepantla*, the theoretical framework chosen is also less known. All of these are very specific and cannot be widely generalized. Through the process of finding Latinx engineering students, the focal point became one state, and then one institution in the selected state. The institution selected is a Hispanic Serving Institution. That population would not be the same as students enrolled at a PWI and should not be generalized.

Limitations

Research must be objective. The researcher should avoid bias to get the best results possible. Being aware of any conflict of interest could help and adequately check or prevent

issues. The researcher in this study is a staff member at a public, four-year institution. The position held is not related to any financial decision making for the university and poses no conflict of interest related to this research study.

The researcher is following the assumption that the respondents have been truthful and responded accurately without omissions. The failure to include a piece of their narrative could change the interpretation of the results. The participants were encouraged to share, allowed to withdraw at any time and prompted to continue on their own.

Performance-based funding models vary considerably by state. The incentives and metrics used are different making it hard to compare. Comparisons across institutions are complicated as much customization exists at each institution. The results are broad and can be applied to similar institutions, yet each story presented by students is unique and difficult to generalize.

Chapter Summary

Research methods are chosen to provide the best responses to the research questions. In this research learning more about Latinx students, less well-known methods such as *testimonio* allow participants to not only share their story but provides them with a sense of purpose and even empowerment through sharing their narrative with others. *Testimonios* are meant to incite action, a response, which can help participants feel like they are contributing to something larger than themselves and their circle. The student participants were given an opportunity to share their experiences and provide insight into creating a more supportive engineering environment.

Chapter IV

Results

"For only through the body, through the pulling of flesh, can the human soul be transformed. And for images, words, stories to have this transformative power, they must arise from the human body – flesh and bone – and from the Earth's body – stone, sky, liquid, soil."

(Anzaldúa, 1987, p. 97).

Introduction

This chapter presents the research findings from the qualitative study. The data was gathered through Zoom interviews with participants using *testimonios* as the methodology. The interviews were transcribed by the researcher first in Word and then in Excel. They were then analyzed, coded, and reviewed for themes. There were two main codes that emerged 1) PEOPLE and 2) PROCESS. The code PEOPLE was supported by the two themes that emerged: support structure utilized by each student and the leadership style utilized. In the PROCESS code the two themes that emerged were engineering as challenging and educational pathways. The research questions and emerging themes are shown in the following two columns.

Research Questions	**Themes**
1. What strategies do Latinx engineering students make use of to navigate their postsecondary STEM academic program?	Support Systems Engineering as Challenging Educational Pathways Leadership/Independence
2. How do those strategies align with the critical elements in PBF with a STEM incentive?	Support Systems Engineering as Challenging Educational Pathways

An IRB application was submitted and approved for the researcher's home institution and the participants home institutions. All guidelines as specified in the IRB's were followed. The researcher worked directly with an administrator at the participants institution and identified students per the outlined criteria. The participants needed to identify as Latinx (or Hispanic, Latino or Chicano), and be enrolled as engineering major. Two participants needed to be in the first two years of their program and two in the latter part of their program. The students were identified by the administrator and connected to the researcher through email where further communication followed. The students were sent an email coordinating an interview date and time and sent a consent form. Each participant submitted the consent form prior to starting the interview. At the beginning of each interview the participants were thanked for their involvement and reminded they could withdraw participation at any time. They all agreed to continue.

Validity

The validity of the research is an important part of the process. The *testimonio* process is closely tied to the researcher and the care taken to work with the participants and make them feel comfortable. Reflexivity by the researcher can be a useful part of maintaining validity (Saldaña, 2016). A journal was kept and used to reflect on the process after each interview and other steps along the way. The journal gave the researcher an opportunity to review the process and reflect on pacing and allowing students ample time to share. The connection and establishing a rapport with the participants was an important step. The time spent up front helped make the students comfortable and the responses were forthcoming with ease. Each interview had a warmup period and the questions provided that type of structure and helped the process along. A challenge for indigenous research is that it must maintain validity by identified standards and by traditional methods as has been the default research. In this case the researcher followed the process which

included reflection and making participants feel at ease and provide ample time to share (Bernal et al. 2009; Cantú, 2012; Latina Feminist Group, 2001).

Indigenous research methods honor the participants (Datta, 2018; Smith, 2021). Previous models used have been called the "rape model of research" (Datta, 2018) in that the researcher takes what they need and leave when they are done without regard for the participants. Decolonizing research methods helps by honoring indigenous ways of knowing and giving them credit. This study looked at how to blend the methods of narrative inquiry and *testimonio.* The participants were provided time to respond and given an opportunity to make corrections.

Member Checking

To confirm the information being shared honored the sentiments accurately, each participant was sent a copy of the written transcript and the chapter draft. They were invited to make corrections as needed or provide additional clarification. One participant, Joaquin submitted edits regarding the quotes and further correspondence followed via email. There were minor edits in the Spanish quotations and the corrections were made in the final copy. It gave the researcher an opportunity to find out how the participant was doing as he neared graduation.

Research Participants

There were five student participants and one administrator at the same institution. Only four of the student interviews were coded and included in the findings. One of the students identified was a Chemistry major and not any type of engineering. The interview was conducted, but not transcribed or coded since the participant was not part of the desired demographics. The participants included two males and two females, and all were engineering majors, two chemical engineering majors, one civil engineering and one mechanical engineering major. Each student was given an opportunity to approve or select a pseudonym. Three students approved the

selected pseudonym, and one identified their own name. There is a breakdown of the student participants on Table 9 described by their pseudonym, major and the language used in the interview. The participant portraits are shared in order of class rank. The *testimonios* are shared starting with Julia, a second-year student and ending with Obie-Wan, a senior close to graduating.

Table 9

Participants

Participant Pseudonym	**Major**	**Class Standing**	**Interview Language**
Julia	Chemical Engineering	Sophomore	Spanish
Olivia	Chemical Engineering	Junior	English
Joaquin	Civil Engineering	Senior	Spanish
Obie-Wan Kenobi	Mechanical Engineering	Senior	English

The student participants, representing freshmen through senior year shared their personal account of life as engineering students. The stories represented each individual and were personal to their path, yet similarities were present. While all the participants were bilingual English and Spanish speakers, two student participants answered in English and two answered in Spanish. They all felt strongly about their choice of language for response.

Different themes emerged through the interviews. While it was not directly addressed in the questions, the role the Pandemic or COVID19 has played in their lives was present and mentioned by each participant. They each found a way to make it less of a barrier. The overwhelming response of success strategy utilized included other individuals. Three students stressed the value of study groups and the idea of placing them as highly important. The other

participant relied on a smaller network impacted both by a changed family relationship and challenges in meeting with others during the pandemic.

People were identified as the way to succeed. Individuals such as fellow classmates, study groups, faculty, advisors, and program support staff were critical to students' success in navigating so many unknowns in the university setting. One student gaining confidence in her language abilities utilized her bilingual peers to provide information needed. The challenges as students were made easier through relationships created. When asked, the answer was immediate, yet thinking of working with others as a success strategy was not readily identified.

This research focused on Latinx students' persistence strategies at an institution with performance-based funding. The *testimonios,* or personal student accounts shared some common themes and the most common being others. Students attend and take classes alone, but the key to their persistence and ultimate success is contingent on the ability they have at creating and forging relationships and utilizing them throughout their time as students. One strategy identified was relying on other students such as what can be found in study groups. Students who created such groups found them invaluable, a critical component of success. Key personnel such as trusted staff could also fill that role but not in the same way. Family members, above all were mentioned as critical support.

Results

The two overarching themes were PEOPLE and PROCESSES. While students enroll and attend class on their own, those that utilize help from family, peers and faculty or staff have a better experience and are more likely to graduate. it is with the support of others that the experience is enriched. The two senior level student participants even shared examples where they didn't want to ask others to study. It seemed awkward and they initially resisted the idea.

Once they saw how valuable study groups were to the learning process, they didn't hesitate. By then they had well-established study groups that persisted over time. They learned to form study groups despite the discomfort caused in asking others to join.

Question One

1. What strategies do Latinx engineering students make use of to navigate their postsecondary STEM academic program?

The results of the coding indicated the top strategies to navigate their engineering program was relying on PEOPLE and the PROCESSES utilized. The participants all discussed scenarios where they relied on support from others. Each story was unique yet included a support system including other individuals such as friends, family, faculty, and study groups. Three of the participants shared that study groups were the most important strategy for academic success. The participants utilized friends and study groups to learn the material and asked questions outside class. One of the participants relied on bilingual friends in her major to help translate material that wasn't clear, likely due to the language barrier. She found it helpful to get clarification from bilingual friends to navigate the concepts she couldn't understand. They participants were able to contribute to the learning and benefitted greatly from their peers. It provided a supportive community where the help was reciprocal, a give and take depending on the topic.

Family was highly influential in their choice of major and to provide a support system while at school. Three participants were in close contact with their family, communicating several times a week. The other participant had intentionally dropped communication with family after not feeling comfortable with their expectations. It caused some disruption yet made her stronger in her choice of direction.

The student educational pathways all differed. Of the participants only one was a first-time, full-time student who had not attended other universities and was in her first degree. Navigating higher education involved community college for two of the participants. They started at local community colleges on athletics scholarships with dreams of being baseball stars. They both transferred to the institution with the intent to major in engineering after realizing the pathway after baseball was limited. One of the participants had completed and undergraduate degree and was a second-degree seeking engineering student. Their pathways were different, yet they were thriving through the support structures they created along the way.

Question Two

2. How do those strategies align with the critical elements in PBF with a STEM incentive?

The PBF models are unique and vary by program and state. STEM incentives are focused on graduating students. The strategies utilized by the student participants helped them thrive on campus even when things were not ideal such as during the pandemic and had limited learning options. The number one strategy identified by three of the participants was study groups. The participants mentioned it was awkward to initiate study groups on their own. Carol (the program administrator interviewed) talked about coordinating the study groups and requiring students to participate which would take the burden off the student.

The institution has created numerous programs to support student success. The organization that Carol oversees provides intentional mentoring between students, and faculty/staff or other students. They have several programs where mentors are identified. The programs target incoming transfer students, first- and second-year students and the students getting closer to graduation as they get involved in research. The programs are scaffolded to support the student from the beginning to the end of their time as a student.

The student participants spoke highly of the organization. They were each involved in different programs. The institution provided connections with others, a supportive community, and a place for students to go and feel included. The program continued identifying and adding new components as the needs were identified. The conference for transfer students is only in its second year, for example, while the organization has been around since the 90's and is nearing its 28th year. They add programs accordingly and continue building on their retention efforts.

Summary

This chapter provides a summary of the process including the four interviews with Latinx college engineering majors and the lead institutions program administrator. While each student's journey is unique there were similarities. Similarities included a strong math foundation in high school and an influential parent to assist with the decision making. Each student utilized a support structure, including a parent, study groups and friends. They found the best way to consistently be prepared for classes is by utilizing a study group to review materials, study for tests or discuss nonacademic matters, like internships and job searches. Obie-Wan Kenobie stated emphatically, "Unbelievable. I'm telling you right now, I could not be in a position I am today, like, you know, maintain the higher, high GPA that I have, you know, have all these opportunities, if it wasn't for study groups."

Chapter V

Julia's Portrait

"Yo siempre supe que quería ser ingeniera, porque siempre me han gustado las matemáticas y me ha gustado a resolver problemas."

[I always wanted to be an engineer because I have always liked math and solving problems.]

– Julia 2021

Introduction

Julia has long brown hair and is wearing glasses. During the interview she is sitting at her desk in her room in an apartment she shares with her sister. We met in September, as the weather was getting cooler, and she was wearing a sweater. There were not many things immediately visible in the background, which made her bright pink fingernails stand out as she used her hands for emphasis when she talked.

I found Julia a very willing participant in the study. She was immediately relieved at the beginning of the interview to learn she could respond in Spanish. She started out shy at first, but quickly warmed up. Responding in her native language made the interview easier. The questions immediately got her thinking, and she added more detail as we continued. She clearly felt comfortable with the process. As the researcher, I found the tables had turned by simply proceeding in Spanish. While she was more comfortable in Spanish, I was proceeding in my less dominant language and felt as I were following, instead of leading the process, a change of roles that soon felt natural.

I asked Julia how her friends would describe her. She responded:

Muchos dicen que soy muy alegre. Que siempre me estoy riendo. Que me gusta mucho juntar a todos mis amigos. Eh, vamos todos a juntarnos, vamos a almorzar o vamos a

comer. O siempre me gusta estar juntando a todos. Para convivir. ¿Y qué más van a decir? No sé. [Lots of them would say I am very happy. That I am always smiling. That I like to get all of my friends together. Hey, let's all get together, to have lunch, or eat. I always like to get everyone together. To enjoy each other's company. And what else will they say? I don't know.]

During my time with her, I found that self-assessment to be spot on. She was very upbeat and positive and many of her responses included examples of interactions with family, friends, and her school network.

Navegando Idiomas/Navigating Language

Julia graduated from high school in Mexico. She was sent to the United States with an older sister by her parents to pursue higher education. In the United States, she decided to start back in high school because her English skills were not strong. She couldn't imagine going straight to university classes and not being able to understand the rapid fire of English, let alone master the subject material. At the time she didn't know what she wanted to study. What she was certain about however was knowing that she needed to improve her command of English before she could go on academically. She said,

"Si porque, yo decía, si no sé inglés, como voy a irme a la universidad sin saber el idioma. Qué es lo que voy hacer? [Yes, because I would tell myself, how am I going to attend the university without knowing the language. What am I going to do?]

She said it was not easy. It was difficult to manage friendships and relationships with others, without being able to communicate. She did not, though, find the schoolwork challenging. She talked at length about the struggles of acclimating to the high school environment. The subject matter was not the problem, she found everything easy academically. It

was the language barrier that posed the biggest challenge. The extra step of essentially repeating high school was difficult yet ended up being the best way to proceed.

In her introduction, Julia immediately shared a *nepantla* process of navigation, one of going between languages. She related her preference for her native tongue, the Spanish language. Her hesitation for coming to the United States was primarily focused on her aversion to English. In the end her quest for a better education led her to embark on the journey from Mexico to a state in the United States. She navigated both the physical borderlands when moving and the ambiguity and discomfort caused by returning to high school as a non-native speaker. Despite the challenges, when asked what she would do differently, her answer was nothing. The uncomfortable journey she experienced was irrelevant. She felt strongly it was the right decision and one she will be grateful to in the future, when she graduates as an engineer. This emergence from a difficult period is exactly what Anzaldúa described as the strength gathered from *nepantla*. It is the struggle, the discomfort and most importantly the newly framed reality afterwards that is the real strength gained through nepantla.

When I asked her to tell me more about herself, she immediately said she never really knows how to answer that question. She is never sure what to say, but ultimately shared the following, which included her experiences navigating high school for the second time and experiencing repeated challenges as a non-English speaker. The role of English as the dominant language has played a prominent role in her path as a college student. It has also been a large source of discomfort. Here is how she finally responded:

> *Que vengo de México, de un pueblo, que tengo aquí cinco años con este. Me gradué de méxico de high school, y luego me vine para acá, y me volví a meter a high school, o sea hice dos años mas. Ahorita yo tendría que estar acabando mi carrera, pero por el inglés,*

me baje dos años, para mas o menos agarrarle un poquito. Mis papas son mexicanos. Yo no me quería venir para acá porque no me gusta el idioma. Se me hace muy difícil. No soy buena para los idiomas. Hay personas que se les da mucho y a otros que no. Y ahorita, hay es como que es muy difícil para expresarme para mi. [That I come from Mexico, a town there, that I've been here five years, including this one. I graduated from a Mexico high school and later when I came here, I re-entered high school, or really two more years. By now I would be finishing my degree, but because of my English I dropped down two grades to more or less get the hang of it (English) a little bit. My parents are Mexican. I didn't want to come here because I don't like the language. It is hard. I am not good at languages. There are people who find it easy and others that don't. At this time, I find it difficult to express myself.]

Beyond your Comfort Zone

She elaborated on the difficulty by talking about going beyond your comfort zone. While unpleasant, it has helped her advance her goals of higher education.

Y como para salirte de tu zona de confort es también muy complicado. Entonces te quedas donde estás. Y ya, pues mis papás me mandaron para acá. Porque es mejor, la escuela acá. O sea hay mas oportunidades de trabajo, más todo. Me han ayudado mucho. Este, mis scholarships me han ayudado, o sea me han pagado mi escuela. No he pagado nada. [To get out of your comfort zone is also very complicated. Otherwise, you end up where you started. Well then, my parents sent me here. That is because the school is better here, or there are more opportunities for jobs, and everything. They (school) have helped me a lot. My scholarships have helped or have helped pay for school. I haven't paid anything].

It became clear why she struggled answering the question “Tell me about yourself.” There is so much to tell and deciding which version to share or withhold is difficult since there is discomfort and struggle. Her narrative about herself is still evolving and while on a positive trajectory, is still uncertain.

I asked Julia what drew her to engineering. She shared the following:

> “*Yo siempre supe que quería ser ingeniera, porque siempre me han gustado las matemáticas y me ha gustado a resolver problemas. Entonces un ingeniero siempre está improvisando. No improvisando sea, queriendo resolver cosas, o buscando la solución de un problema. Entonces eso a mi me gusta. Y por eso me metí para ingeniería, porque me gustan las matemáticas, y me gusta resolver problemas. O sea, siempre quiera saber una solución y poder investigarlo.* [I always wanted to be an engineer because I have always like math and liked resolving problems. In that case an engineer is always improvising. Not necessarily improvising as much as solving things or finding solutions to problems. That is what I like. That is why I went into engineering, because I like math, and I like to solve problems. Really, I always wanted a problem to investigate.]

The idea of being a problem solver for Julia, is what resonates the most about the engineering profession. Comparing that ability to solve problems, fix things and be in charge of her own educational college journey which has been full of unknowns and anxiety added insight. She fully recognizes that while challenging to go through, the end result of getting a degree from an institution in the United States will be a worthy reward.

The idea of pursuing engineering was quick, back in high school, but deciding which specific type of engineering took longer. She talked more about the process of choosing between

the engineering fields. Her eyes lit up, and she is visibly excited as she is talking about deciding between the engineering fields:

> *Si, pues desde la high school, quería ingeniería, pero no sabia en qué. Entonces en high school me preguntaba, en qué voy a estudiar, y luego pensé en ingeniería industrial, y dije, no. No me gustan las fábricas o máquinas, no. Y luego pense ingeniería civil? Ummm, no. No me gusta construir or carreteras. Y pensé diseñar, y dije no. Y así fue como decidí. Buscando uno por una. Luego dije ingeniería química, porque creas cosas. O sea prácticamente tu estas creando, eres química puedes crear cualquier cosa. [*Yes, since high school, I wanted to be an engineer, but I didn't know what kind. Then in high school I would ask myself, what am I going to study? And I considered industrial engineering and I said no. I don't like warehouses or machines, no. And then I thought civil engineering? Ummm, no, I don't like to build, or roads. I thought about design, and told myself no. That is how I decided. I went one by one. Then I said chemical engineering because you make things. Really, you are practically making things, you are a chemical (engineer) and can create anything.]

Academic Pathways

The thought process to narrow down to the type of engineering to pursue was ongoing for Julia. She struggled to decide and the process of elimination and weighing pros and cons is evident in this comment:

> *Bátalle mucho para decidir. Soy una persona bien indecisa. Y decía, hay si me gusta. ¿Y que voy a estudiar? Porque también había un estudio de ingeniería de negocios internacionales. Y decía, no quiero negocios. Todo mundo esta estudiando negocios. Todo mundo. Y decía, no, ¿como voy a estudiar lo mismo que todo mundo? No, y por eso.*

Hay gentes que cuando se proponen a algo lo logran. Entonces, dije, bueno, ingeniería química, y aunque esta difícil. Voy a estudiar ingeniería química. [I struggled a lot to decide. I am an indecisive person. I would say, yes, I like it. And what will I study? There was also a program in international business engineering. I would say, I don't want business. Everyone is doing business. Everyone. I would say, no, how can I study what everyone is studying? No, and that is why. There are people that set goals and master them. Then I said, ok, chemical engineering even if it's difficult. I will study chemical engineering.]

She believes she was given poor advice from an advisor and regrets not doing her own research about what classes to take or asking her friends. She believes she should have spread out her elective courses and not started out with so many easy classes. She shares her frustration here:

Es que, bueno yo le hecho mucho la culpa a mi advisor. Cuando yo empecé en la universidad, tomé puras clases fáciles. Como danza, o todas esas clases bien equis. Y me las puso todas el primer año. Y entonces ahora tengo puras clases difíciles. Tengo química orgánica, mass transfer, y luego numerical methods y estadísticas. Entonces tengo esas clases y digo porque la maestra, el advisor, no me dijo esto, pudiendo tomar las clases difíciles con los clases fáciles para que no se me complicara tanto. [Ok, well I blame my advisor a lot. When I first started at the university, I took all easy classes. Like dance or all those classes, so extra. He told me to take them all the first year. Now I have a bunch of hard classes. I have organic chemistry, mass transfer, numerical methods, and statistics. So, I have these classes and I wonder why the professor, the advisor, didn't tell me this, I could have taken hard classes with easy classes so it wouldn't be so difficult.]

As she shares her frustrations with her friends, fellow students they tell her not to listen to the advisors. She tells me, "*Muchos me dijeron. Es que, no confíes mucho en los advisors. Porque entre más dures en la universidad para ellos es mejor*." [Lots of people told me. You know, don't trust those advisors too much. The longer you take at the university, the better it is for them.]

Family

As we talk it is clear to me that Julia is very close with her family. She gets advice from her parents and lives with her sister, who is also a student. She and her sister go to Mexico often or at least a few times a month to visit on weekends. Her mom has given her advice about going to college and making sure she is prepared to make her own living without counting on anyone else. When I asked her about her sources of strength, she said her family. They have always been there for her, and she has no doubt will continue to be there for her throughout her life.

Study Groups

She seems to grasp material quickly. In her responses she shared a comment from a fellow classmate she studies with. "*Y me dice por qué te las aprendes tan rápido. Y le digo nomás échale ganas, (con una sonrisa grande en su cara) nomás enfócate en eso. Y decía, oh, ok.* [She would ask me why do you learn so fast? I would answer, just work hard (answering with a big smile on her face) all you have to do is focus on what you are doing. She would say, "oh, ok".] While she learns quickly there are areas where she needs help and relies on her peers. I asked what strategy she uses when she needs help:

> *"Siento que pregunto, pregunto a las personas de confianza. A veces muchas palabras son muy complicadas. Hasta a los que hablan inglés no lo entienden. Menos uno, que esta todavía aprendiendo. Entonces, pregunto a personas que hablan español. Y les digo.*

Cómo hiciste esto? O explícame esto. Ya cuando me lo explican es como que ya, ya lo aprendí." [I feel like I ask, I ask people I trust. Sometimes there are many words that are just too complicated. Even the English speakers have trouble understanding. Nonetheless a Spanish speaker, still learning. Then I ask people that also speak Spanish. I ask. "How did you do this? or, explain this to me". When they explain it, that's when I understand.]

I asked if there were any Spanish speaking faculty or staff. She said no and didn't expect that to be the case. Her strategy was to work around and navigate the challenge on her own. She utilized her support network, a group of peers she meets with regularly to study.

Julia has one friend that really helps her. They seem well suited to study together. As we talked about study strategies, she mentioned a study partner is ideal, "*Siempre es bueno tener alguien de tu carrera porque cuando te atreves, tienes que saber a quien preguntarle*." [It's always a good idea to have someone in your major because when you are stuck you have someone to ask.] She describes their study relationship:

"*Para mi clase de química, la amiga que va conmigo es bien inteligente, o sea, estudia mucho, mucho, mucho. Entonces cuando se me complica algo, le digo, oye, ayúdame a estudiar esto. Pero ella sabe métodos para estudiar, y me dice a pos, ten. Pero ella me tiene que, o sea me tengo que poner con alguien a estudiar porque si me voy a poner yo sola, no estudio. No me gusta estudiar*." [For my chemical class, my friend that goes with me is very smart, and she also studies, a lot, lot, lot. Then when I don't understand something, I ask her, "hey, help me understand this". She knows study methods and will explain to me. She needs to help me, or in other words I need to study with someone, if I don't study with someone, I am not likely to study alone. I don't like to study.]

There is one student she has developed as a steady study partner. She told me about how they work closely:

> *Tengo una compañera que tiene todas mis clases. Siempre andamos juntas, y para hacer tareas o sea ella me ayuda o yo le ayudo. Ella desde que empezó la carrera de ingeniería aquí ella es con la que más me acoplé. Me acoplé con otra (chava) pero se cambio de carrera.* [I have a friend that takes the same classes. We are always together, to do homework, or rather she helps me or I help her. Ever since she started in engineering she is the one I most work with. I had worked with another girl but she changed majors.]

She has another study partner she relies on who can also help her in Spanish. She describes the friend, who is also bilingual and Latino, as very intelligent:

> *Es que yo tengo un compañero que es muy inteligente también. Para la carrera y siempre sabe todo. ¿Entonces si yo tengo alguna duda le mando un mensaje '"le entendiste? explícame" y siempre que le digo "explícame" me manda, pues me explica todo perfectamente. O sea, lo escribe explicándome todo el problema.* [It's that I have a friend that is very intelligent. Anything regarding our major, he knows it. So when I have a question I ask, "Did you understand, explain it to me?" He explains everything to me perfectly. Or rather he messages me explaining the entire problem.

I asked her what things would be like if classes were in Spanish. She looks up with a big smile, and says:

> "*Entonces para mi seria mas fácil. Digo, si yo supiera inglés, todo sería diferente. Si supiera perfectamente el inglés no estuviera batallando porque a veces me da miedo entrar a un lugar y que me empiezan a hablar así el inglés y digo, no se lo que me dicen*."
>
> [Then for me everything would be easier. I think, if I knew English, everything would be

different. If I knew English perfectly, I wouldn't be struggling because sometimes I am scared to enter places and have people start asking me questions and I think, I don't know what they are saying.]

She thinks about the work involved for her and elaborates further:

"*Si a mi me lo explicaran todo en español yo se que lo entendiera, pero no. O sea, yo siento que yo estoy dando doblemente el esfuerzo porque lo estoy escuchando en inglés y tratando de entenderlo y luego queriendo traducirlo para poderlo entender. A veces, me duele la cabeza. Y digo, no, no es el estrés.*" [If everything was explained to me in Spanish I know I would understand it, but no. Or rather, I think that I am doing twice the work because I listen in English and try to understand then I translate to understand.]

I asked her about her involvement in student organizations. She has been involved in some professional organizations, the Society of Hispanic Professional Engineers (SHPE) and the Society of Women Engineers (SWE). As the talked more about the participation the language barrier came up once again. When she attended the SWE conference there were many Spanish speaking participants including those attending from her institution. She found it easy to relate to others and fully participate. As a SWE participant there was a member who was not bilingual but really tried make her feel at ease. "*Una vez fuimos a una conferencia con ese grupo. Fuimos a Orlando. Fue muy diferente el ambiente. Y luego no podía hablar español porque nadie hablaba español.*" [One time we went to a conference with that group. We went to Orlando. The atmosphere was very different. I couldn't speak Spanish because no one spoke Spanish.] She said the friend helping her used a translator when conversing.

The differences between the two organizations she joined were striking. The SHPE organization was much easier for her to connect with other students and make friends.

Participation in SWE was more difficult since no one spoke Spanish and she found stark differences in culture. She attended the SWE conference her freshmen year. She talked about the difficulty of talking and not feeling very comfortable. The student's activities very focused on the sessions and no evening activities. Not only was she unable to communicate, but she also didn't feel like herself, she couldn't laugh or really talk. It was hard. She was navigating spaces, that of being a conference participant and feeling like an outsider.

The next conference she attended with SHPE was very different as she explains: "*Pero este año fueron también a una convención de (ingenieros) los hispanos, iban puros mexicanos. Entonces el ambiente es bien diferente porque te puedes divertir, reír, y salen en las tardes.*" [This year a group went to an engineering conference for Hispanic students, the attendees from our school were all Mexican. The atmosphere was so different because you can enjoy yourself, smile, and go out in the evenings.] She determined it was a much better choice for her where she could get the professional development and not leave her identity behind. She could take her whole self. It was like being in *nepantla* as the SWE member, and she emerged a happier student after attending SHPE.

It was very clear to Julia that she should rely on her support system and student network. She indicated that they have helped her on numerous occasions. The advising challenge was one of the examples, so she now heavily leans on the peer support. In addition, she hasn't found any faculty or staff who can help with the language translations and relies on friends. She gave another example of how her friends have helped her find valuable resources:

> *"Y yo me he metido en muchas cosas por personas que voy conociendo. Por ejemplo, ahorita estoy en el programa de STEM. Ya vez que "Carol" le dijo de mi. Me metí por otra amiga que me dijo que estaba en ese programa. Y yo le dije, dime de ese programa.*

> *Y de que se trata. Y te van a ayudar? Por eso siempre son muy importantes las amistades. Te dicen, métete aquí. Métete allá. Puedes hacer el otro. Y es como yo entre a este programa*." [I have gotten involved in lots of things because of people I've gotten to know. For example, right now I am in this STEM program. You know, "Carol" told you about me. I got in this program because a friend told me about it. I asked her, "tell me about the program. What is it for? Will they help?" That is why it is very important to have friends. They tell you go here, go there. Do that. That's how I got into this program.]

Creativity

At the end of the interview, I asked Julia if there was anything I hadn't asked about. She didn't come up with anything specific as she felt we covered lots of topics. When reviewing the transcript, the recurring theme I hadn't asked about was creativity. She was regularly finding ways to re-charge and do something different. She first mentioned it relative to her interest in chemical engineering. The idea of making things is fascinating to her as she explains here:

> *El otro día estábamos haciendo un lab, y allí mismo nos enseñaron un material que nosotros creamos. Es lo que usan para crear las playeras, los vasos, muchas cosas, y todo eso. Es muy interesante.* [The other day we were making something in the lab and right there they were showing us a material that we can create. It's what is used to make sweatshirts, cups, lots of things like that. It is very interesting.]

She chose engineering as a way to find solutions to problems. The process of creating new materials gave her an opportunity to create solutions in new ways.

She mentioned her interest in doing nails or manicures to do something entirely different from school. It was something she enjoys and now since people pay her, it is an additional source

of income. I had already noticed her bright pink nails and now realized it was one of her creative outlets. When I asked her how she manages stress she said she watches movies or gets together with friends. Here is her preparation before an exam:

> *Porque siempre una semana antes, estoy estresada. Estoy piense y piense y me duele hasta la cabeza de pensar en los exámenes. Y lo único que hago es como que, pongo una película o poniendo uñas. Te relajas poniéndote uñas y hablando con la clienta. Y ya, entonces, dices ya, se me paso.* [I am always stressed a week before. I am thinking and thinking and get a headache from thinking about the tests. The only think I can do is put on a movie and do nails. You relax putting on nails and talking with the client. Then I think, ok, it's (stress) over.]

She thinks the idea of changing what you are doing is what really helps. She elaborates, "*Si, porque cuando aprendes o cuando vas a estudiar tienes que ir con la mente descansada, no estar más estresada con la misma escuela, entonces no, te pones a ver una película y el cerebro se descansa porque no estás pensando en nomás lo que estás viendo*." [Yes, because when you learn or when you study you need to start with a relaxed mind, not stressed with school, so then putting on a movie you mind relaxes and you are only thinking about the video.]

Julia has navigated college life and learned to overcome the challenges. The biggest obstacle has been the language barrier. She feels she is doing double the work during the translation process. Her solution to master difficult material was to cultivate a key network of bilingual friends who have helped her during the difficult lessons. Her family has also been a strong part of her support network. She counts on them for advice and enjoys her family time on a regular basis.

While she may not be aware of her *nepantla* journey Julia has experienced times where she emerged with a new understanding after a difficult time. Anzaldúa explains the value of *nepantla* is not so much the journey but the emergence and understanding in the end. Julia has experienced a difficult time and has emerged confident and knowledge that she will persist. She has faced challenges, yet the outcome has been worth the struggle.

Chapter VI

Olivia's Portrait

"I love the science, but I don't want to do science that can't be applied.
You know, so I want to be there to scale it and actually provide
solutions to…the people or whatever needs solutions."– Olivia 2021

Introduction

I met Olivia in the Zoom room after a few technical difficulties. The link wasn't working and required a password. We emailed a few times and finally met in Zoom in October. She was wearing a maroon beanie and a sweater. Under her hat, I could see her light brown curly hair was medium length, past her shoulders. She was at home in the apartment she shares with her boyfriend. Olivia had a strong self-assurance about her. She is the oldest in a family of three with two brothers. Her responses reflect the strong family bond and moments shared together during her childhood. She often mentions examples including how involved her mom was in elementary and high school education, including buying educational books and supplementing instruction at home. Olivia is a Chemical Engineering major with a minor in brewing.

Academic Pathways

Olivia attended private school until she transferred to the local public high school. She found the experience both new, which prompted some anxiety, and exciting. She loved meeting new people and most of all getting to experience new things. It was her first opportunity to see people different from herself. One lesson she learned then and still appreciates today is that people with different viewpoints can still get along. She enjoyed the new experience very much and in retrospect wishes she had gone to a public school sooner.

Olivia is a second-degree seeking student. I got the sense that she did all the right things asked of students. She graduated from high school, chose a major and proceeded to college and even got a degree. The outcome after following the prescribed process, was not as she expected. Olivia chose chemical engineering as a second degree after finding dissatisfaction the first time around with a chemistry degree. She says she simply went too fast and didn't think things through. When she graduated with a bachelor's degree even though she had enjoyed the classes, she ended up unhappy. In retrospect she has learned to slow things down. I think it has made her more confident in her decisions.

She thinks part of what happened is that she chose a major and was doing things based on her parents' expectations and had not taken her own feelings into account. She proceeded without much thought. She elaborates a bit on the process,

> I graduated high school and I was positive that I wanted to be a doctor. Um, so, I…that was my initial plan. So, I studied chemistry first with the intention of like going to med school, and I finished chemistry. And then I decided med school was too many years, so I did a nurse practitioner. And then I worked at the hospital for a year. I didn't like it, and I decided to go back to school, basically.

As a returning student having reflected on what she wants makes her more focused and self-assured. She shares,

> I think in my experience is very different to what other students have. Just because I am very aware of the things I like, so I'm more interested in taking classes that I like. Obviously, you know, you have to take the core classes which is like the thermo and like the material balances and energy, and all of these other hard classes, but I have really taken the time to take electives that I like, and even take the opportunity to take classes

> that, you know, maybe they're not part of the degree plan, but I think I might get something out of it in the future that I would like. So, I think it's very different for me because I think my peers are more interested in graduating and just getting a good job, and since I've already done that, I'm more focused in actually doing something I enjoy.

Getting the first chemistry degree and not being happy, in addition to going against her parents' wishes makes her more determined to do things her way. I asked her if her parents were pleased that she selected chemical engineering as the second degree. She didn't know since they are no longer in touch. Olivia has charted a course for herself that she feels strongly about. The first time around through college didn't give her the desired result. She's reflected and is ready to proceed doing things differently.

We talked a bit about what she is learning in her classes and in outside projects. She mentioned that she doesn't have a chemical engineering mentor at the time due to staff faculty vacancies. She has been working with biology and materials science faculty and seems to be enjoying the exchange from different perspectives. The examples she gave include being creative and interdisciplinary in nature. She is drawing on different disciplines and enjoying the thought process that creates better solutions. She shared an example of a project,

> Yeah, so I'm studying biomaterials, and I am creating fabric out of biomaterials, but essentially what we want is to proof these fabrics. And so, we want to grow them on agricultural waste and hopefully plastic waste. But the problem we're doing right now is that we need to find a way to degrade the plastic without creating harsh conditions, right? So, without burning it, without using harsh chemicals so that's …or finding a way to make using green chemistry but basically to break down the plastic. And that's where it's been a little bit tricky.

Her description was a great example of the combination of interests and the types of things that have captivated her attention. You could hear the excitement in her voice. She decided to choose a new major and seems to be very content with her choice.

Priorities

In visiting with Olivia, I learn that she is no longer in touch with her family. I didn't directly ask what happened. It didn't seem appropriate. I didn't want to intrude. Yet in her examples she mentioned several reasons that likely caused the strained relationship. She shared that she is not close with her siblings or parents. It sounds like they have very specific expectations of her, and she disagrees, causing a rift. She added,

> They are both chemical engineers. So, my parents are very strict. My parents are very, like, the type where you're either an engineer, a doctor, or a lawyer. That's the kind of structure you're raised in. Um, so when I decided that I didn't want to, like, do a job that I didn't like, it was very hard. So, yeah, we've had like ups and downs, like in a relationship. So yeah…we're not very close.

While she made the decision to disagree and do things her way, it seemed to cause some discomfort. She indicated it was atypical of a Mexican family. The responses to my questions about who was influential included her mother yet answering seemed challenging. I got the sense I only heard part of the story. As a researcher I can understand. It kept me from probing further. There are parts of ourselves we chose not to share with others. It can be hard to share and emotionally difficult. I wanted to keep the interview going and not have a reason to stop. She elaborated regarding her family,

> I think it's harder from a culture standpoint because Mexicans are very, you know, close and you're, you're supposed to do what your parents say. And like my parents are very,

> they grew up in very, like traditional households and they're very traditional in the sense that they, they believe that kids should stay at home until, you know, they get married and like all that stuff, and it just wasn't what I wanted.

Making decisions and not changing your mind doesn't make the process any easier. She stands by her decision, yet it seems to be a source of pain. I asked if she had done what they wanted if their relationships would be different. She confidently answered no. She knows if she didn't follow her own decisions she would be "very resentful towards them" and ultimately regret that she didn't do what she wanted.

Study Groups

The pandemic was not a question I asked, yet it came up during each interview. It impacted everyone. Olivia shared the difficulty in working with others especially when the learning switched to a remote format. It made the challenges of getting a group together even harder. Her preferred class modality is meeting in person, which was not happening. She likes in person classes best and group work challenges. She shared,

> I think, the faculty at least the chemical engineering, they've been trying hard to like to figure out a way on how to make sure that we don't feel alone. Apparently a lot of people dropped out because I assume they felt it was too hard and like they're not learning, or if they're having a hard time learning by themselves because honestly for hybrid, you really have to put in the hours to learn by yourself… there's even some classes that even if you go in person, you have to learn by yourself because it's just a lot.

She mentioned that perhaps it would be easier if she had always learned that way. She started learning in a traditional classroom meeting in person. That is her preference. She was

aware that the department was concerned about losing classes and figuring out a way to get students together. She elaborated,

> Again, that's why one of our professors, forced us to like be in a group project that we could like spend more time together like talk and…work on homework assignments together and do stuff like that. So yeah.

She's had classes online and says it's been hard to interact with her peers. She said the faculty were trying to get the students engaged, but it was difficult since they were online. When I asked her preference for class modality she shared,

> I prefer to go in person. Honestly, I think hybrid is very hard, because, well, I don't know. I think, maybe it's because I'm not used to it. Um, I mean, I grew up with like books and going to class and doing this stuff. So I think if you're used to it, you know how to do it, so but if you're not, it's kind of hard to focus, and like, you know, pay attention and not get distracted by things going on around in your environment or stuff like that and I feel like when you go in a classroom, and you're there for an hour and a half and maybe I don't pay attention as much. You know, I won't pay attention for the hour and a half, but I'll pay attention for like sporadically 45, minutes, 55 minutes, 50 minutes, or you know a little bit more… when you're home I think it's a lot harder to pay attention.

The other participants shared the importance of study groups. Olivia was indifferent about study groups and primarily shared the challenges of meeting with groups. Meeting with others added extra work to figure out schedules and the added difficulty when everyone isn't contributing. As a second-degree student she has been through the experience of taking and passing classes. She graduated once; she can do it again. She is very independent which may have prompted her desire to work alone as the default option or path of least resistance. This

didn’t mean she avoided help or working with others. In Olivia’s case she relied on help from faculty and staff on a consistent basis. She realized in high school that teachers were willing to help if you asked. It was a strategy she found helpful and didn’t hesitate to ask.

Faculty

She credits the strong academic foundation she gained in middle and high school for the desire to keep learning. She mentioned a few high school teachers who really made learning exciting and fun. It was then she realized teachers are there to help. Olivia shared more on asking faculty questions,

> I've always been very extroverted, and my professors, so I always made it a point to like get to know them. So, I know everybody, every single professor I've ever had. Either by logging in, on their consumer web, or actually asking if I can go in person. So yeah. So, again, you go, you do the homework, you ask your questions. You're there and you ask them if you don't understand anything … So, for me it's always been, like, a habit…I think it's just something I've always done.

She had learned along the way there was no need to struggle alone. The faculty will help and all you need to do is make the time and ask.

Family Relationships

It was clear there had been a strong bond with her family at one point. She repeatedly gave examples of how involved her mom was. Here are a few of those responses,

1.) But honestly, I think the main reason why I know so much is my mom. My mom when we were very young, we, she always taught us stuff. So, for example, when I was in fifth grade, we were learning about hydrolysis, I mean obviously I don't think you said the word hydrolysis, they said something else, like separation of water or

something like that and we had to choose a science experiment. And I remember my mom told me, like, "Oh, like, since you were learning hydrolysis like let's do an actual, like hydrolysis experiment." And I was like what do you mean? …So that's what we did. I was like in the fifth grade.

2.) But yeah, but all that was kind of like my mom, always she would always sit down with us and give us math and like sit with us and make sure that we understood the math and always like, if she thought we weren't learning enough she would make sure that we learned more. So, for example, I remember seeing like algebra stuff when I was like in sixth grade. And then by the time I got in eighth grade it was stuff that … I already knew, because my mom wanted to us.

3.) So, I think, yeah… I had good teachers, because they gave us a lot of homework and stuff like that on their level … but if there was any gap my mom built it.

It was hard for her to explain the family dynamics. She tried and this was the explanation: "So, I don't know, it's, it's, it's a complicated relationship, that's just what it is." I am satisfied with that answer. Things can be complicated and even more so with family. The idea of solving the communication challenges can be full of emotional conflict and not always have the desired effect. As a student it seems easier to focus on the task at hand and continue with classes and graduate. This could be an area Olivia returns to later in life and makes peace with her decision or revisits the family dynamics.

Stepping Beyond your Comfort Zone

Olivia was born in Mexico and moved to the United States with her parents when she was young. She first attended a private school prior to switching to the public high school. It took

some adjustments, but she feels it was a positive change. It was a good decision in her mind. Being in the public high school introduced her to new people and other ways of thinking.

Deciding what she wants in life even if it means not agreeing with her parents has caused some tension. It has required her to be strong in her beliefs and stick to her decision. She has stepped out of her comfort zone by not following her parents' wishes. She disagrees with some of their suggestions and other ideas about her decisions. While that likely causes stress, it possibly outweighs the added burden of not being true to herself if she followed her own dreams. The price to pay is likely higher if she ignored her own priorities.

I asked Olivia what she was most proud of. Prior to the pandemic she had been living in Germany and was frustrated she had to come back to the United States. She had decided to pursue a degree there, but it made no sense if she had to be online and not be able to explore her surroundings. She gave more details,

> I think what I am most proud of is, when I took my job here, I moved from Germany, and I lived there for two and a half years. I was going almost on three, and I, I learned German. I'm fluent in German. I took the test to get into the university and I got in, for chemical engineering. But to study chemical engineering in German. Uh, so yeah, that's probably the thing I'm most proud of, but then COVID hit and that just ruined everything. So COVID hit, it got behind, it got delayed I was going to have to take classes online, and I just didn't see the point. Living in Germany and not really going to university and staying online. It was just not for me. So, I decided to come back. So yeah, that's what I'm most proud of.

Germany helped Olivia explore being in another country and decide what career to pursue. The experience helped her decide on a major. She learned more about herself and her

interests. She also had an opportunity to be independent and learn a new language. She is now trilingual and speaks English, Spanish and German. She shared,

> When I lived in Germany, I moved to Berlin. I walked. There's a, there's a like neighborhood of Berlin that is known for its art galleries. But it's like a combination of art galleries and studios. So, the difference between the studio is at the studio there can be artists there, but there can also be engineers working there and there can be other people that do projects together to create art or installations and stuff like that. So, it's a mix of everything. And that's when I realized that's what I want to do, like, that's, I do not want to be like in a box, (making a box with her hands) which is why I don't like research because it's very in a box, you know, you have to you have to get the money to get the project to get this, to get that, but you don't have the liberty to do what you want and if it doesn't work out, you don't have the liberty to like go another direction, without getting funding for it, and having someone to support your idea.

The exploration out of the country led her to fully realize her passion for making things without the confines placed in certain fields. It helped her see a different way of practicing engineering that matched her interests. The engineering research process in academia requires a certain amount of oversight relative to funding, which Olivia dislikes. Experiencing a different way of approaching engineering with a connection to art was the combination that most appealed to her and gave her a new direction.

Creativity and Finding Balance

When I asked Olivia if there was anything else I hadn't asked that she would like to share, she was ready with a response. She wanted to let me know that what has really helped her find balance between the challenging academics in engineering is art. She takes art classes to

relax. It has helped her step out of her comfort zone. She takes the classes to push her beyond the boundaries in an area that she doesn't excel. Even so she finds the balance very helpful and shares the following,

> STEM classes are extremely competitive. Everybody's like trying to get the best GPA, the best grade, like everybody's trying to be on top of it. You know, even the professors are like, you know, it's hard. They're just always like, go, go. Like I have to do this. I have to do that. I need that. I need this like blah blah blah, but especially STEM students. They're just crazy like trying to get the best grades and like trying to do everything that they don't really take the time to like take care of themselves and you know, relax for a minute. So, I think that's, that's been my strategy, this whole time, I've taken an art class, even though it doesn't count towards my degree (laughs), but I think it's super useful.

The art classes for Olivia were a way to disconnect from her STEM classes. It was like Julia's creative outlet being painting fingernails to distract her from studying. Olivia saw a connection between art and STEM and enjoyed the change of pace. She noticed the difference in approach between how she did the assignments compared to the art students. She shared her observation,

> I like to be challenged. I love art. When you sit in those classes. It's just like … even like the color combinations they use, and I can even sense it like they come they approach it in a very, like, oh, I'm gonna get this, and I approach it in a very thematic, in a kind of scientific way.

Olivia reflected on her first college experience as a student and made some changes prior to returning as a second-degree student. The art classes were helpful to get her thinking in a different way. She recommends that to other students especially in demanding disciplines. She

emerged from her *nepantla* experience with a new perspective. She chose a different major and has sought a more balanced approach. It was important to her to take classes outside her major. She feels strongly that it will allow her to try something new and challenge her in a way her engineering classes aren't doing. To be clear, she feels out of her element in the art classes yet knows it is helpful in the long run. She is purposely adding in some discomfort and the challenge of the unknown. Previous experience has taught her it will create a better outcome. Her first degree, the reflection and later emergence through *nepantla* taught her she can emerge stronger and more confident.

Chapter VII

Joaquin's Portrait

"Porque la verdad es que ingeniería es muy difícil y no cualquiera lo puede tomar, y más estando afuera de casa. La verdad es que no está fácil."

[The truth is that engineering is very difficult and not everyone can do it, and it's even harder being away from home. The truth is, that it's not easy.]

– Joaquin, 2021

Introduction

Joaquin's positive attitude and friendly demeanor were immediately evident. He was in his room at home for the Zoom interview. He had short brown hair and was wearing a solid-colored t-shirt. I couldn't see much of the background behind him. His personality and positive attitude were what came to life and really shone through. I mentioned I would give him a pseudonym to maintain anonymity. He just went with the flow and said it was fine. I asked if he had a name in mind or if I should choose and he said I could choose. I mentioned to him that I was considering Joaquin and he agreed. He quickly embraced the name Joaquin. I knew we were off on a good start.

Joaquin completed the interview in Spanish. We started the interview conversing in Spanish as we were making small talk. He asked at the beginning what language we were using for the interview before I even got an opportunity to propose the option. He asked the question first. I responded that we could proceed in the language he was most comfortable in. It put him in a position where he was using his dominant language and his answer was immediate. He said he wanted to continue in Spanish since he could communicate better. "*No, pues, me sale mejor en español (smiling).*" [No, well, it's going to be better in Spanish. (smiling)] I very much believe

that to be true since he was very comfortable and shared freely. I've only heard him speak in Spanish. He was very expressive and elaborated on his answers. Proceeding in Spanish made him more comfortable. It also turned the tables for me as Spanish is no longer my dominant language. I rarely have an opportunity to practice and find it harder to converse quickly. It was a great way to put the participant at ease.

Education for Greater Purpose

Through his responses I could see that he is extremely passionate in his pursuit of engineering and desire to make a difference for others. I was especially interested in learning more about why he chose civil engineering. Joaquin repeatedly talked about helping others and improving things around him as a civil engineer. He chose civil engineering and completely identifies as someone interested in not simply building in the literal sense, but in a figurative sense as well. He gave numerous examples where he is involved in the creation and maintenance of a project or group.

Joaquin is very interested in learning from others and sees engineering as a way of helping others, especially under-served communities like his own back in Mexico. His engineering identity is strong along with the interest in serving others. He elaborates,

> *Para mi, ser un ingeniero es ayudar a la gente que se pueda transportar de alguna manera. Siendo de México es que no tenemos muy buena calidad. Las carreteras están mal. Si vienen a mi estado o algo y estoy encargado de las carreteras yo quiero que las carreteras estén perfectas para cualquier turista. Todo eso siento que quiero ayudar la gente para que se sientan mejor. Y en un futuro poder tener una compañía. No una compañía simplemente pura gente de aquí. Internacional, yo quiero tener internacional donde se puedan combinar culturas y este ambiente crea algo bien bonito. Porque el*

> *chiste de ir a trabajar es de irte feliz. ¿Para que me quiero ir a trabajar todo amargado? Yo no quiero eso.* [For me, being an engineer means being able to transport people somehow. Being from México we don't have high quality. The roads are poorly built. I want people who visit my state and I am in charge of the roads, that they are perfect for every tourist. I want to do these things so people feel better. In the future I want to have my own company. Not a company with only people from here. International, I want international, so the cultures can combine and the environment is amazing. What is the point of working if you aren't happy? I don't want that.]

Getting an education for Joaquin is more than obtaining a degree. He wants to gain knowledge from others in the academic sense and apply it to the future. He is close to finishing his degree and doesn't see it as an accomplishment. He is proud of that, but he wants to do more. This was his response when I asked his thoughts on graduation. *Todavía siento que no he hecho algo bueno. Sí me voy a graduar, pero quiero hacer algo más.* [I still don't think I've done enough. Yes, I'm about to graduate, but I want to do more.]

He elaborates on that as we talk about his academic goals and what he plans to do after graduation. The degree is a way to open other opportunities and gain knowledge to utilize at work. He continues,

> *Si me interesa la escuela claro que sí, y me emociona tener el promedio, pero yo estoy viendo más allá quiero tener una buena vida, tener buenas relaciones, tener gente con quien confiar. Y la educación nomás tenerla aquí y aplicarla en el trabajo.* [I like school, of course I'm excited about this goal but I am looking beyond that to a better life, to improved relationships and people around me to confide in. The education is simply something to have and apply at work.]

Joaquin is nearing the end of a chapter as he completes his degree. In his case it makes him anxious to begin the next phase, in anticipation of better things to come. Graduation is a time of unknowns. There is a feeling of accomplishment from being done with the added emotion of what comes next. Joaquin is experiencing the discomfort of not knowing and looking forward to the next adventure and unaware, the growth experienced in the reflection as in *nepantla.* He anticipates the next phase while in a ruminating phase as the options are presented and he decides on the next steps after graduation.

Navegando Idiomas/Navigating Language

He moved to the United States during his sophomore year in high school and didn't know any English. He says it was hard. He found himself moving away from his family and learning a new language in a different environment. In high school he started in a military academy and credits the regimented schedule for helping him adapt. In the academy they were not allowed to speak Spanish. Doing so resulted in doing push-ups. He is grateful for the structure and respect he was taught there. He recalls the difficulty during that time,

> *En la prepa, una prepa militar, los primeros días, sin saber inglés, si los primeros días estuvieron difícil. No le voy a decir que no. Si lo acepto… Yo no sabía escribir inglés. Yo no sabia nada de inglés. Entonces un diccionario y un traductor, todos los días. Ir a checar el ensayo… Y es como un trabajo. Es un trabajo que tienes que tener todo listo para presentar todo bonito y presentable. Al principio no fue fácil los dos idiomas. Porque yo pensaba en español. Necesito pensar en inglés…Y así aprendí a hablar inglés.*
>
> [In the military academy, those first few days without knowing English, yes, those first days were difficult. I won't deny it. I accept that… I didn't know how to write in English. I didn't know any English. So, then a dictionary and translator every day. Check your

> essays…Just like a job. It's a job you have to have well done and ready to present all nice and pretty. That's how it went. At first it wasn't easy. I thought in Spanish. I need to think in English. That is how I started learning English.

The time of adjustment can be difficult. Joaquin was in a position where the only option he identified was to figure out how to thrive, and he did. He saw no other choice. It was the friendships he created that helped him get through this time; friendships he's maintained since high school. He shared the following:

> *Pero se dejaron venir todos los amigos. Hice muy buenos amigos que hasta ahorita yo estoy viviendo con ellos en la universidad. Hasta ahorita voy con ellos a comer. Si ellos están en la ciudad, yo voy. Es una relación que se creo muy bien, pero en la parte de inglés sí fue muy difícil para mi. Porque nosotros llegamos a escribir ensayos. Yo no sabia escribir inglés. Yo no sabia nada de inglés.* [That's when I started making friends. I made very good friends and am still in touch today living with them on campus. We still go out to eat together. If they are in town, I go see them. It's a strong bond that was established, in part because learning English at the time was difficult for me. We would write essays together. I didn't know how to write in English. I didn't know any English.]

The friendships helped him get through a difficult time. They helped each other and provided support for one another. He has a positive attitude and eagerness to learn new things. His interest in working with others and in teams he credits to the military academy and his time as a baseball player during his first two years at the community college on a scholarship. He loves playing baseball and feels the lessons learned on the field extend to the camaraderie off the field and his interest in working in teams. He gave an example of tutoring others on his baseball team. As he shares the story you can hear the pride in his voice from helping others

Peer Groups

Joaquin enjoys going to school to learn and improve things within his control. It is as if he approaches everything as an opportunity to learn, such as interactions with peers, faculty, and prospective employers. A repeated theme in his sharing is the strength gained from working with others. He even talks about choosing friends. He shares a bit more,

> *Siempre supe escoger mis amigos. Y siempre supe tener mi carácter. De yo llevarme con los que me tengo que llevar. No me tengo que llevar con gente que no es. Pero ahorita todos mis amigos de la primaria seguemos haciendo amigos. Fíjese que nos juntamos y todos de lo que hablamos, es de la primaria y secundaria. ¿Qué es eso? A veces nos quedamos dos tres cuatro horas. Pero eso es lo bonito.* [I always knew how to choose friends. I always know how to be strong. I get along with those I must. I don't have to get along with people that don't matter. But now all my friends from high school have continued to be friends. We still get together, the same group from high school. What is that? Sometimes we meet for three or four hours. But that is what makes it special.]

Joaquin has a strong friend group and peer study group that have helped him along the way. He talked about the give and take in the study sessions and how valuable it has been. He shares his thoughts on working with others,

> *A mi me gusta mucho estar con la gente. Aprender de la gente. Porque para mí, sí es importante la escuela, pero la experiencia de la vida, nadie te lo puede quitar. Y siempre por eso cualquier consejo que me pueden dar, pues es una ventaja para mi, ya me lo están dando, y yo lo aplico.* [I like to be around other people. I like to learn from others. For me, school is important, but I want to experience life, that is something no one can

take away. That is why any advice I get I see it as an advantage, something they are giving me, and I apply the lesson.]

Joaquin talked at length about how important study groups are to him. His responses include numerous examples where he enjoys being around people. He doesn't like to study alone and finds it strategic to work with his peers. Relative to academics it makes sense that he would cultivate a network of students and work together. He elaborated,

> *Por ejemplo, a mi no me gusta hacer la tarea solo. A mi no me gusta hacer la tarea solo. Porque ahorita en estas clases muchas personas se saben otros trucos, otras maneras de hacer los trabajos mas rápido. Entonces bueno, para que voy a hacer todo ese procedimiento si uno me puede sacar una formulita, me lo explica, porque. Entonces, y es lo que hice el domingo. Fui hacer tarea. Me levanté temprano con unos amigos y me dicen, es que lo estas haciendo diferente que yo. (haciendo caras como en respuesta a la pregunta) Hay Como? Pon esta formulita y en vez de hacer este procedimento. Y le dije porque no me dijiste. Pero son esas cosas que ya te das cuenta cuando las estas viendo y entonces se te quedan grabadas. ...Pero me gusta estar involucrado en todo.* [For example, I do not like doing homework alone. I do not like doing homework alone. Now in my classes there are people who know other techniques, other ways of doing things faster. So, I ask myself why would I go through all that work my way, when someone else can show me a different way and explain why. *(*making faces as if in reaction to comment from other*)* That's what I did on Sunday. I got up early. I went to do homework with friends and he tells me, you're doing it different than I am. What, I say? It's that you can use this formula instead of that process. I said, why didn't you tell me sooner? Those

are the things you learn when you are paying attention and then you learn new lessons...I like to be involved in everything.]

I asked how he first got started with study groups. He found it a little uncomfortable. The idea of approaching someone he didn't know well seemed strange. Yet, he didn't want to study alone. He shared the following:

Desde la pandemia. Empecé a hablarles, hey mi nombre es este. Te molesta si me ayudas en esto. Tengo este procedimiento. Y así me fui haciendo amigos. Y son los mismos amigos que hice y los nuevos que me hecho. En cada clase tengo uno o dos, tres amigos. Esa es mi meta siempre. Hacer amigos. Porque ya tengo con quien apoyarme en cada clase. No lo voy a hacer yo solo. Entonces por eso me gusta apoyarme de cada gente.

[Since the pandemic. I started talking, and saying hey, this is my name. Would you be willing to help me with this? I have this problem. That's how we started being friends. Those are the same friends I made and a few new ones we've added. In each class I have one, two, three friends. That is always my goal. To make friends. I now have someone to lean on for each class. I don't have to do it alone. That's why I like working with other people.]

Joaquin was keenly aware of how study groups have been instrumental to doing well in school. In his examples it is clear he sees it as a reciprocal relationship. There are times when he gets guidance and is shown a new way of doing things, yet has also been the one taking the lead. He has participated in study groups and has been instrumental in tutoring others. He is always willing to help others that want support. He gave this example of helping,

Todos. Todos. Todos. Me ayudaron. Mis maestros. Yo tenía maestros que me checaban mis essays. Tenia maestros que me checaban las tareas. Gracias a Dios, a mi me tocó ser

como el inteligente del equipo entonces me llegaban 3-4 hacer tarea. De sumar, restar y multiplicar. Y sacar un pizarrón. "Haber mis niños. Vamos hacer." Y allí los ponía a los que querían. [Everyone. Everyone. Everyone. They helped. My teachers. I had teachers who would check my essays. Thank God I am like the intelligent one of the group so I would get three or four to do homework. It was adding, subtracting and multiplication. And we would get out a chalkboard. "Ok, my children, let's get to it." I would do that with anyone that wanted help.]

Seeking help from peers can lessen the intimidation. His fellow baseball teammates knew him from the team. They knew what to expect from him in the field and could seek his help for academics. He was able to help others with their math homework. It was a mutually beneficial relationship.

Faculty

The respect he gives to faculty is evident. He values the learning and guidance given. I suspect he has also gained their respect. He values their time and appreciates the relationship as an opportunity to gain additional insight. I asked what he most gained from the faculty interaction. He said their undivided attention and mentioned that faculty are busy and get lots of emails and some don't respond. Those that respond and meet with you stand out.

He has been thinking about graduate school after graduation. The idea of going to another school is stressful since he has established relationships with some of the faculty and wouldn't know what to expect elsewhere. He elaborated on his personal experience working with faculty at other institutions,

Yo no sé como son los maestros. Me quede en una zona aquí que esto ya. Ya conozco los maestros. Claro que si quiero salirme de mi zona de confort. Crear nuevas amistades,

> *aprender nuevas cosas capaz que terminen al otro lado del mundo....Yo quiero trabajar con un maestro donde podamos llevar una relación de respeto de que cada quien haga sus cosas. Una relación sana donde que se puedan llevar bien. Eso es lo que yo busco. Trabajar feliz. Eso quiero yo.* [I don't know how faculty are. I am in a comfortable space now. I know the faculty. Of course, I want to step outside my comfort zone. I want to make new friends, learn new things and even the possibility of going around the world…I want to work with faculty where we can have a relationship built on mutual respect where each person does their job. A healthy relationship where we can get along. That is what I am seeking. Work and be happy. That's what I want.]

Support System

There is a strong connection to family, and he mentions that he talks daily with at least one of his parents. I asked about his sources of strength, and he immediately said family. They have helped all along the way. His dad has been there for him emotionally and academically and basically for everything. He is close with both parents and says they have been a huge source of support. He said he was raised right and taught to respect others and be humble. Joaquin says humility and respect are necessary leadership qualities that he learned from his family. He feels it is a first step in helping others. Athletics helped him learn the value of teamwork. He shares his thoughts on baseball,

> *El deporte me ayudó. A trabajar mas en equipo. A si a uno no le esta yendo mal, pues ánimo, ánimo. (levanta las manos) Levántate. Así es el béisbol. A mi me gusta mucho el béisbol. Yo vivo por el béisbol. Entonces yo vi mucha gente que le iba mal en un partido. No te preocupes. El siguiente día es otro. Entonces yo poder ayudar o cuando un compañero o amigo tuyo quiere hablar contigo de los problemas. Para mi eso es lo más*

bonito. [Sports helped me a lot. It showed me how to work in groups. This way if anyone is having a bad day, encouragement is what they need. (lifts his hands up) Get up. This is how baseball is. I really like baseball. I live for baseball. I saw how my teammates had a bad day. Don't worry. Tomorrow is another day. I can help another when they are having a bad day and talk about their problems. That is the best thing for me.]

Joaquin gained leadership skills starting in the military academy. He oversaw up to 200 people. He earned the rank of lead Captain. He elaborated on that time,

Como la militar tenemos posiciones de rango del liderazgo. Entonces yo dure cinco años, y entre mas dures subes de rango. Entonces yo estuve a cargo de 100-200 personas. Donde ellos, no todos venían, obvio. Los que querían, me pedían ayuda y yo les ayudaba. Y no les hacía mala cara. A la hora que necesitaban, vámonos hacer esto. Entonces fue muy bonito porque desde allí dije yo quiero hacer mi compañía, como ingeniero. Yo puedo hacer esto. Como un niño de 18-19 años le estoy dando órdenes de buena manera me están haciendo caso, pues no esta tan difícil, digo yo. [There are different military ranks for leadership. So I was in for five years and the longer you stay the higher your rank. I oversaw 100-200 people. Not all of them came to me for help obviously. Those that wanted my help got it. I didn't make any faces at them. I would help them any time they needed, ok, lets do this. Then it was a great thing because that's when I realized I wanted to have my own engineering company. I can do this. I thought to myself if an 18–19-year-old can give orders in a way that everyone listens, it must not be so difficult.]

Beyond your Comfort Zone

In talking with Joaquin, it was easy to see examples where he challenged himself to do things outside his comfort zone. He moved to a new country, talked to students and faculty he didn't know and took the time to extend his network. He shared more,

> *Si hay una oportunidad yo me voy. Si me mandan a China, yo me voy a China. Siento que salirse de la zona de conforte es bueno, tiene sus consecuencias y desventajas, pero las ventajas es conocer a mas gente (big smile). Yo tengo una filosofía que nos vamos a morir, entonces porque no conocemos mucha gente que te recuerden como eres. Una persona que hizo un buen trabajo. Que digan, él fue un buen trabajador. Eso es lo que mas busco.* [If there is an opportunity, I will take it. If I get sent to China, I will go to China. I think stepping outside your comfort zone is good. There are advantages and disadvantages, but the advantage is getting to know more people. I have a philosophy that we are all going to die, in that case we should get to know more people, so they remember you as you are. A person who did a good job. So, they say, he was a good worker. That is what I seek.]

No Regrets

Joaquin is confident in his decisions. He believes in moving forward and not looking back. He continued, *no me arrepiento. Son mis decisiones, y no me arrepiento.* [I have no regrets. They are my decisions and I have no regrets.] He continues to create the life he sees ahead of him and works towards that goal. He has cultivated a support system that will help him along the way. The strong family bond has continued to sustain him as well as his strong relationships with friends and in the study groups. He has gained support in the community he has built around him.

He talked about the type of engineer he wants to be. He has dreams of being an entrepreneur or owning a business and building something others would admire. He knows that comes with a big responsibility of giving back to the community and gaining the respect of his future employees. He shares more,

> *Quiero ser un ingeniero donde sepa que está pasando. ¿Por qué se está cayendo la estructura? Donde se puedan comunicar conmigo. Ojalá en unos 5-10 años, yo puedo tener una compañía estable, ojalá, pero esos cinco, seis, siete, años. Quiero trabajar. Quiero aprender… Quiero dejar como un legado, que mi hijo o hija o primo o tío quiere agarrarlo un día pero que siga.* [I want to be the type of engineer that knows what's happening. Why is that building falling? I want others to talk to me. Hopefully in 5-10 years I can have a stable company, hopefully, may in those five, six, seven years. I want to work. I want to learn…I want to leave a legacy so that my son or daughter or cousin or uncle would want to take over and keep it going.]

Chapter VIII

Obie-Wan Kenobi Portrait

"Yeah, it's been, it's been a lot of work and a lot of sacrifice.

I don't think some people understand some of the STEM degrees.

They take a lot of sacrifice, a lot of time."

– Obie Wan Kenobi 2021

Introduction

Obie-Wan Kenobi joined me in the Zoom room. He had short brown hair with a light complexion and was wearing a button up shirt. He is a senior nearing graduation and double majoring in mechanical and aerospace engineering. As I listened to his responses, they all centered around a strong identity grounded in family and driven by a desire to succeed. He was quick to respond and confident in his answers. Early in the interview I asked about a choice of pseudonym, and he quickly asked if he could choose. The question was unexpected, but I said yes. While I was surprised by the request, his choice of name, Obie-Wan Kenobi (OWK), made perfect sense. During our interview his Zoom background was a celestial sky as if illuminating the path that he is soon to choose as he nears graduation. The name reflected his interest in Star Wars. It was easy to see the connection to science and why he would choose the name. It seemed connected to his identity and interest in STEM. I would later learn more about what was behind the screen.

Academic Pathways

I asked OWK about school. He was able to excel and thrive in an environment that allowed him to focus on his interests and cultivate his strengths. In elementary and middle

school, he participated in the gifted and talented program. He took honors classes and all the math that was offered. As he talks, it is apparent those classes were not challenging to him. He was thriving on the pace and rigor from the additional courses and shared,

> I'm also extremely passionate, I guess about science and nature…engineering, kind of, is like the understanding and manipulation of nature and the natural sciences, so that's kind of why I'm interested in engineering.

The idea of engineering sparked in high school as he kept taking classes. He mentioned a specific teacher that taught classes that really got his interest. Here he elaborates,

> I've known I was interested in engineering since I was in high school. My high school is really lucky. There's a teacher there who would do like just part time. She just would come part time and she did engineering courses there, electives. I took all the engineering left through high school. So, I knew that I wanted to do engineering at some point.

In high school he kept taking math which led him to take Advanced Placement (AP) classes. He liked taking the AP classes and the idea of being ahead. I asked him how he found out about these classes. He smiled and looked straight at the camera, “my mom” he says, which I would later see as a recurring theme. He thinks it was his mom “pushing for that kind of stuff.” He elaborated further:

> I was definitely pushed by my mother to take AP classes; you know, take these more difficult classes. Push, push, push, get good grades, right. For me it was never a focus like hey I'm going to focus on doing this. I kind of just had a natural aptitude. I was in the honors courses and that was just kind of where my base level effort was, like I didn't have to put in any extra effort necessarily to complete those classes at a decent level.

His mom helped him figure out what classes to take and provided guidance. He explained it as a give and take. There were classes he preferred over others. He would negotiate with his mom. He shared,

> I guess there's a compromise, you know, cuz at the time I was so involved in sports like you know, like 'it doesn't matter mom, I want to be a superstar baseball player' or something. I don't need to take these AP and she's like 'No, you need to take them.' So, there was a compromise. Okay, I'll take all the AP and science ones that they offer. I'll take them all, right? Don't make me take the English and history ones, I don't want to take those.

He did not find the academics in high school challenging yet described the journey to college difficult. He was interested in baseball and was heavily focused on athletics. He attended a junior college out of high school on a baseball scholarship. His interest in playing sports and pursuing baseball was a strong motivator and he was very focused on that goal. The idea of getting a degree from college came later.

I asked him about his path to college. He shared,

> Difficult. I think it was really difficult. Like I said, in high school I was really hyper-focused on sports, and not focused on academics, even though I had a natural aptitude for academics. So then when the opportunity came …I got offered you know, the Dean's scholarship, where they pay for all your all your school, and you were able to get paid a certain stipend a month. Right? And then I also got offered, you know, an athletic scholarship to the junior college. Right? My mind is…'I'm going to play baseball, I'm gonna go do that…and my mom was like 'Well take a second, think about this.' I said NOPE. I'm doing it. So, I, you know, made kind of like a rash decision and went and did

> that. And so, it was difficult to kind of gear back up and get back into an academic focused mindset, you know, after, you know, collegiate baseball and all that. So, you know, it's taken me a lot longer than it's needed to right so I'm a little bit older now… a little bit.

OWK's academic journey included community college. He now thinks it was a rushed decision acting on emotion. He was given two scholarships and chose the route that included baseball, it was his passion at the time. The choice was not drive by lack of academic aptitude. He was following a dream of playing baseball. It sounded more fun. Once enrolled and taking classes along with baseball he began to see other options ahead of him. It was then he realized there were other possibilities.

Engineering as Challenging

OWK has been interested in engineering since high school. His identity as an engineer is strong and he holds himself to high standards. He has found his fellow peers to be "like minded." He puts in the work needed to do well. He shares his thoughts, "I could get the 90, and be okay on an exam but I'm, I want that 96." He elaborated on the rigor:

> Okay, so when I say difficult, I mean difficult for my standards, I set myself at extremely high standards just kind of in everything that I do and I kind of have an obsessive mindset or personality I guess. I want to be the best engineer I could possibly be. Right? And so, you know, what does that mean? Well, you should look straight at a GPA. I mean, you can get all A's. Right? And so, maybe my natural aptitude could give me the B, B pluses, but no I wanted the A, A pluses. Right? And so, I put in a lot of time and effort and sacrifices to kind of put me into that position to reach that goal.

OWK sees his peers as similar regarding the high standards they set for themselves. His peer group seems to have the same goals.

> So, so I hold myself to a high standard in engineering as a student. I think most students from what I've seen, you know, that are in the engineering department kind of hold themselves to those highest standards…and it's been it's been a really good experience. You know I found a lot of people that are like minded in the engineering department…

He has surrounded himself with a group of students that have a similar approach and expectations as he does. He has found a supportive community that aligns with his goals.

Family

The college journey can be difficult. Students find a support system to thrive. In some cases, they can rely on family. I asked OWK to tell me his sources of strength. Without hesitation he responded "Family." He elaborated,

> Yes. Um, yeah probably just family. You know. I was raised in a very traditional household, in that the man needs to go out and be, you know, provide for the family. So, that's just kind of the way I was raised again it's a blue-collar attitude, you know, get out there and get your hands dirty. Go out there and make some money, so you can provide for the family. So, I'd say, you know, that kind of mentality, you know, being raised in that mentality that I got to get out there and, you know, work, and, you know, keep pressing on just generated from my family.

His thoughts on going to college were driven by positive family pressure. He elaborates on the process and the support from both parents, in particular his mom. He says it wasn't, "You have to go do it just because I say. It was more of like, here's WHY you should go do it."

He credits his mom for helping him learn about resources. He says, “She knew how to leverage the University and schools’ resources. So, she would look up and be like hey there's tutoring Center, and tutors in this course. Here's the contact information. Go there.” His family was very influential in his choice of major. He thinks his interests were supported early on as the family got together for activities. His dad emphasized and taught a lot of the outdoor activities. His mom supplemented their interests with movies and academic interests. He shares,

> My mom was a big movie buff. So, for fun we were, you know, sit down and have movie nights, and you know I was introduced to like Star Wars and I kind of fell into like in love with like sci-fi and stuff like that so it was kind of this mixture of, you know, working outside with my dad and kind of seeing that, you know, mechanical type of function, and then the wonder of the sci-fi, so that's kind of how I fell into mechanical and aerospace engineering it's kind of a combination.

He talked about the differences in his family that bring them all together, parts of the whole. His parents each have distinctive features. Here is how he described his family.

> I'm lucky. You know…My dad is from Mexico, very, very dark complected. You know, he considers himself Mexican. My mom, blond hair, blue-eyed, very, very light complected. Right? and uh, so you know very Caucasian, very White… My dad, lineage of Mexican. Dark color, dark complected, dark, dark hair, brown eyes, and so it never… skin color in my family never played a part in who we were. It was, you know, what are you doing on a day-to-day basis, it didn't matter… I have three siblings; my sister and I both have freckles and are light complected. My brother is dark skinned… I mean he looks just like my dad…It almost looks like we're a separate family that have come together.

He describes how the visible differences bind them together and how the family works as a unit. As he elaborates, I also hear about the other ways the family works together. His father guides much of the outdoor activities or outdoor household chores that have helped shape who he is today. Saturday mornings were not for sleeping in. He and his siblings would wake up early to fix fences and could usually be found working on projects using different tools. As he worked with the tools his mind would start wondering about the tools and where they come from and who designed them and if he could design one in college. In retrospect it was all part of the process to think about his future and build curiosity for things around him.

Study Groups

I asked him what he would tell freshman college students about how to succeed as an engineering student. He credits the study groups. He gives different examples where he relies on other students to better learn the material. He shares more,

> A hundred percent study groups and trying to use each other as support systems. Unbelievable. I'm telling you right now I could not be in a position I am today at like, you know, maintain the higher the higher, high GPA that I have, you know, have all these opportunities. If it wasn't for study groups.

It was his mom that told him about group help.

> Hey, you need to get a part of study group. Study groups, even, you know, they don't know anything, the collaboration between study groups is going to help you. And I remember, it’s so funny I remember fighting her on study groups. I’m like, so what you're want me to just walk up to somebody and say, ‘Hey, hey, you want to study later?’

I liked his description of the study group dynamics as he shared:

> So, it's, it's like the collaboration. It's kind of just like a puzzle piece, right, there's things that you're understanding and not understanding, and then that person has things that they're understanding and not understanding. Right? and so when you get together, you know, you kind of fill those gaps between, between and you kind of work out, you know, maybe I understand this part of the assignment or topic… right? and that person had no idea what was going on, so I was able to help them and then there's a part where I'm like, I'm totally lost I don't get it. And they're like, 'Oh, it's simple". And it's like, Dang, that would have taken me three days to figure that out I figured out in 10 minutes, because you're here. You know, you know it's crazy like, I don't know, it's just, yeah.

His example clearly showed the value gained by working with others. The give and take and techniques shared with one another were invaluable. He could spend time with a peer and reinforce or better understand a concept from class. He saw his mom was right in her advice.

I wanted to know more about the study groups and how long they had been meeting. He shared,

> No, absolutely, it's been the same group. For the past two years I, you know, there's one guy. We both sat in the front row, and you know, one thing leads to another and 'Hey you want to study later? man kind of thing and it just so happened we've been on the same track so we, when it comes to like registration, we get all the same classes. And then, you know, the next semester, one other guy joined our group, and the next semester you know another girl joined our group and the next semester and other guy joined. Right? It's just, you know now there is a group of like 8 of us. Now we are going through all these courses together for the past two years.

OWK was uncomfortable asking for help. He was absolutely appalled that his mother suggested working with others, yet discovered it was the best advice. The study group has guided his studying and provided a support network for things beyond class. I asked what they discussed,

> Oh, yeah, we talked about jobs, careers, you know, funny stuff… just light-hearted conversations, a lot of the time and, yeah, it's really good. I mean, it also keeps you, you know if there's a timer, where 'man I don't want to study right now, man I do not want to finish this assignment. I'll just take the 50% on it. You know? Then you're like, you know, you get a message, like "Hey we're meeting up, in 30 minutes." Dang it, I gotta go. You know, it's kind of like, you don't have to, but it's kind of like that push, you know, which is good.

Beyond your Comfort Zone

OWK is a senior and will be graduating in May. He has been interviewing with different companies and received numerous job offers in different states. He is unsure what to do and is comparing his options such as cost of living, salary and benefits, town and how far away from family he would be. He's also determining if he should continue with a graduate degree instead of taking a full-time job. I asked how he was going to decide. He smiled and said he would show me, and he turned off the zoom background. I was then able to see what was behind him. There was a white board with all the options listed out and their pros and cons. He was keeping it up on a board so he could visualize all the options in order to make a better decision. After the explanation ultimately you could hear the confusion, doubt, and excitement in his voice. He shared,

> I don't know, I don't know. So, I've been going through that kind of process of trying to figure out. And right now, the biggest thing is, for me, the type of work I'm doing, and then close to…closeness to family. You know I'm in a position right now, kind of in a weird position where I have a lot of opportunities to go and do different things, and I'm just…I'm not sure what I want to do so.

No Regrets

He is happy with how things turned out saying, “I don't regret it, because there's a lot of opportunities that are “opening up now, that may have not been opened up, if I was younger...”

The path to college for OWK started in junior college. He loved baseball and took a scholarship. He feels it’s taken him a longer to get to where he is today as a senior nearly graduating. In the end he is happy with the path he took. Things worked out like they were supposed to. He has no regrets as he shares,

> If I had to do something differently? Hmm. I don't know if I would do anything differently, because I think my experiences have kind of shaped me into the person I am now, even though they weren't like the best direct path to being the most successful, it's kind of been a detour, you know, to get to this point of, now I'm going to be, you know, you know I’ll have a Bachelor's of Science and two different mechanic, or two different engineering disciplines. But going and doing that little detour has given me the ability, and I think, where we are with all to, uh,…I think….I think it kind of adds to my, my leadership aptitude to be honest with you, kind of understanding where other people come from not being so pigeonholed into engineering going and, you know, working with people that you know I say working I mean we're on a team together of just a totally different wide variety of people… people from Canada people from Puerto Rico people

> from all over the country, you know, and it's kind of giving me this, you know, I don't know, ability to, to work with, with people that maybe I wouldn't have generated as strong of a skill set if I wouldn't have done that.

OWK experienced confusion and the state of *nepantla* as the process from high school to community college evolved. He decided to pursue education beyond the community college. He emerged from that process with a renewed confidence in his decision as Anzaldúa (1987) points out is the true strength from *nepantla*. The detour he took, like *nepantla* was part of his journey. Through reflection he determines the detour enhanced the experience and helped him learn something new in the process.

Chapter IX

Program Administrator

Introduction

My first interview was with Carol over Zoom. It was an ideal way to start since she and I had communicated several times via emails and over the phone as we worked out the details related to the participants and the interview process. We started the conversation with small talk, exchanging comments about the weather. While we live in different states, we compared notes about the drop in the temperature. She seemed a bit nervous, but so was I so the feeling was mutual. Hopefully, I was able to set her at ease. There are several process questions needed regarding consent which seems to stifle conversation. I proceeded with getting those questions out of the way. To maintain anonymity, I provided several name options for pseudonyms, and she chose Carol. She identifies as a Caucasian female over 50. I found her very easy to talk with.

The conversation flowed easily. As an administrator myself I reassured her my goal was to find out more about their organization and how they meet their student's needs. My goal as a doctoral student is different from that of an investigative reporter looking for a sensational story. My objective was not to find a problem, rather to answer my proposed questions. I wanted to illuminate the organization successes and possible areas of improvement. I also shared that she would be given an opportunity to review my transcript and drafts. That seemed to put her at ease which helped set the tone for the rest of the conversation.

College of Engineering

Carol works for a large state institution that is the Lead Institution. Carol serves as the organization's Director for the statewide alliance of 14 institutions (7 universities and 7 community colleges). She has been in several roles on college campuses, including adjunct

instructor and writing coordinator, but has worked specifically with her current program since 2002, nearing twenty years. She tells me she loves working with the students and it is evident from her answers.

The pandemic came up in each student interview even though I didn't ask about it specifically. It was the same for Carol. At the time of the interview, it had been a year and a half since she had been working remotely. She had been sent home like many others back in March of 2019 and was still working from home in the Fall of 2021. She felt more productive at home and there had not been a push to send staff back to the office. She appreciated the ability to do her job while in the safety of her own home.

It was easy for me to see that she is passionate about her work. She was enthusiastic in her answers, and I can easily see that she is good at what she does. As the researcher with a shared identity with the student participants she serves, I felt like one of her students. I felt very supported by her during the process of finding students and working with the rest of the staff as if I was part of their cohort. I felt like one of her grad students and found it very comforting. It was easy for me to see why the students speak highly of the program. I had similar feelings as the students of identifying her as an incredible resource that I would certainly reach out to. There were other areas identified as possible weaknesses by the students including the poor advising by their department, but nothing in relation to the organization Carol administers.

I asked Carol to tell me about her institution, the Lead Institution for the Alliance. She shared that it is a land grant institution that "serves a majority of Hispanic students, and a minority of other students." She tells me they have a very good engineering program, and her program is housed in engineering. However, the program targets underrepresented students in all STEM fields, not just engineering. The organization she works is an alliance of 13 other

institutions, including 7 universities and 7 community colleges. They have been funded by the National Science Foundation (NSF) since the early 90's and their program is nearing the end of their 28th year. The federal stipulations include serving underrepresented students from the designated populations: Hispanic, African American, Pacific Islander, Native American and Alaska Natives. One of their partner institutions has more Native American students.

Student Programs

Carole shared more details about the different programs in the organization that support both the second-semester freshman and first and second-semester sophomore students and those for juniors and seniors, as well as the community college programs. The idea behind the first-year programs is to give students experience and preparation early on regarding the research positions they could apply for later. Once students participate in the preparation programs, they are then more competitive when applying for research positions with faculty. The programs also help students gain the skills needed and confidence to work with faculty. The program staff will do what it takes to make students comfortable. She shared that in one program, students who have never conducted research learn what to expect in the actual research program to which they are assigned to apply; the coordinators will even help students make the call to professors/possible research mentors to help set up appointments. She continued, "It kind of seems like hand-holding, but we want them to be successful. If it is hand-holding, we let go of their hand as soon as the students feels comfortable." The students can find approaching faculty intimidating, and even more daunting to think of working with faculty. The research preparation program started last year and was created to fill the skills gap students needed prior to the research positions in their junior or senior year.

Carole talked about the importance of connecting students to mentors and other students. She shared, “We have found that students succeed better when they have a place to go to where they feel accepted, and they belong.” For example, the research preparation program is facilitating the interaction with other students and the faculty. They are asking the students to meet, get to know each other and even help reach out to faculty to the extent the student needs the help.

They served 303 students in the preparation program during the 2020-21 school year. All the programs of the organization include mentoring with the program coordinators or with faculty. The students benefit from the added support.

When I asked about a program in which student success was evident, she talked about their flagship program that supports statewide students who conduct research with a faculty mentor, who help the students learn research strategies and techniques of the specific research project and also help them prepare for a conference presentation. The organization hosts an annual student research conference with around 250-300 attendees. They have attendees come from all over the state. At midday there is a legislative speaker who talks about the state economy encourages students to continue to the B.S. degree and beyond and to seek STEM jobs in the state after graduation. The state is rich with opportunities to work at national labs and industry. A win-win situation for both the organization and the legislator, he/she gets the opportunity to view student presentations and to understand more fully what the organization’s purposes and goals are. In addition, the legislator gets to learn about the programs, activities, and events and becomes more familiar with the students. Since the organization relies on some funding from the state, the legislator plays a key role in communicating with other legislators about the organization and its research focus. This leveraging of funding from the state is valued

immensely by NSF, as it reflects support of our state legislature, which helps with approval of our NSF proposals.

The organization has created a program for community college students that takes place the day before and after the research conference. Students are given guidance to help them navigate going to a conference, so they know what to expect. They work together so the students have a plan when they arrive, so they are not lost. They are asked to write their thoughts in a booklet after watching the speakers. That process allows them to respond and engage with the speakers. The booklets give them an opportunity to clarify areas of confusion without putting the students on the spot. They get together the day after the conference on Saturday to discuss what they learned and respond to additional questions. That is also how they are eligible to receive a stipend. Carole says they are asked, 1. How will this impact your academic future? and 2. How will this impact your professional future? She adds,

> it's kind of life changing for some of these students. They come from teeny, little towns…and they don't think they can get into college, much less go to graduate school or do research.

Students can get a transfer stipend if they attend an in-state institution after attending the conference. The Transfer Stipend program does not require students to transfer to the organization's Lead Institution. They support them going on and continuing at any statewide university.

The organization works their college partners to host a four-week residential on campus summer program, where students attend and live on campus. The program is called SCCORE an acronym for Summer Community College Opportunity for Research Experience. The community college students identify their first or second choice of institution and are placed,

based on institution availability. Students get to live on campus and eat in campus dining. They have an opportunity to experience what it is like to attend college. They have class in the morning and a credit-bearing professional development course in the afternoon. They are given exposure to different groups, such as panels comprised of transfer students and graduate school students. Everything is focused on getting them interested in attending college.

Language Services

I asked if there were any services or programs available in Spanish. Carol says they don't have any. She indicated students are bilingual and speak English. In some cases, students have shared with her that their parents want them to learn English. She says it has not been requested to have anything in Spanish. They have never really thought about it. She told me about one of the state schools with more Latinx students that hosts programs in Spanish and have been very effective.

Future Programs

I asked Carol if there was something else, she would like to be doing for students that they haven't been able to do. She had several ideas and immediately answered. First on the list is to develop more community college programs. The SCCORE outcomes of good STEM retention and transfer rate of participants encourage the organization to plan more programs for community college students that will attract them to university life and the culture of research. They want to partner students with mentors in clubs. She would also like a senior seminar that would help students prepare for graduate school. They have talked about having a more structured program to apply for internships. There is a small component in one of the programs that they would like to expand. Carole shared some of the NSF goals include helping students transfer to a university, progress to graduate school and participation in internships at off-campus

locations to get students prepared for life after college. The programs they have in mind fit into those categories.

Funding

The statewide NSF organization Carol directs is now in the category of alliances that have been in existence for longer than ten years, called the STEM Pathways for Research Alliances (SPRA). She says,

> Our money every year keeps getting reduced, and our alliance is getting less and less money because NSF wants to see that we're sustainable and that our programs have left an impact and influence institutionalization. We are grateful for leveraged funding we have applied for and that our faculty leverages funding for their research student assistants. Our state has also invested funding although the funding has been reduced some. State funding reflects support of our statewide students and programs.

I asked Carol about performance-based funding and meeting certain metrics. She was not familiar with that term but was familiar with performance measures. Our alliance is required to do reporting annually for the State and for NSF, both of which combine qualitative and quantitative data. The State also requires an oral presentation. She says, "the state has been very generous with us."

Chapter X

Discussion

Introduction

The lure of the American Dream has the potential to propel students forward, towards institutions of higher learning where they hope to get a degree and have a better life. Students are the client and choose an institution with the anticipation of getting a degree. They affirm their decision through institution enrollment and hope they can access student services and academic support to get to graduation. That's how the implicit contract should function. Multiple interests are at play. Institutions who once counted on federal and state financial support have seen the funding decline over the past two decades.

Performance-based funding has gained popularity across the country and has been used to incentive institutions to gain funding in exchange for meeting student's needs. The results have been mixed. To compete for funding, unintended consequences including examples such as limiting access to students with financial need and raising admissions standards have occurred. Positive results have been seen in performance-based funding models with a STEM metric. This study intended to learn more about some of the students in that type of model. Using a qualitative study, a narrative of one of the student populations evolved.

The research questions in this study are as follows:

1. What strategies do Latinx engineering students make use of to navigate their postsecondary STEM academic program?
2. How do those strategies align with the critical elements in PBF with a STEM incentive?

Nepantla, the term brought to life by the late scholar Gloria Anzaldúa was used as the theoretical framework. It captures the in-between state and discomfort that many times goes

along with it. *Nepantla* is not a place as much as a journey. It is the *conocimiento* [understanding] which can be gained through reflection afterwards that is the true gift. Not all people experience the process and consider *nepantla* as a positive experience. They do not have the *conocimiento* and potential growth that can be gained afterwards. Those that do find the understanding can utilize it as a source of strength. The concept evolved from Anzaldúa's work on the borderlands focusing on the literal boundaries between places, in her case Mexico and the United States. She coined the term to capture the struggle from being in between worlds and the re-birth and wisdom gained from the experience. *Nepantla* was not included among the questions asked during the interviews. The concept of *nepantla* was used when analyzing the responses.

The participants were all Latinx, college students majoring in engineering. They were attending a large public university operating under a model that is eligible to receive performance-based funding with a STEM metric. The participants were asked questions related to their student experience and how they find strength during difficult times. They shared examples from their personal life with their family and at school with friends and study groups. They talked about challenging moments. While the idea of *nepantla* was not discussed, examples of their own *nepantla* journey and how it has impacted their experience was evident with each participant.

I was nervous to interview the students. It is likely common for new researchers. I reflected on my feelings and determined that my anxiety was attributed to the new experience, not so much the students or visiting with them that was making me nervous. I needed a pep talk. I reminded myself that I talk to engineering college students every day. I even talk to strangers regularly and have great conversations. It was helpful to remind myself of examples where even one interaction amounted to an excellent conversation. That reflection was very helpful. I

realized I was over thinking it. I embraced the discomfort. I acknowledged the new skill I needed to master and approached the interviews with that in mind. My *nepantla* experience helped me approach the interview phase.

Reflections

OWK shared the importance of study groups. His mom has been very influential in his personal and academic career. He is close with his family and seeks their input. He talked about how awkward it seemed to participate or initiate a study group when his mother first suggested the idea. Despite his reluctance, he followed her advice. He reached out to others, formed study groups, and realized it was a huge help. He gained a new appreciation from the experience and reflection of the process and outcome as found in *nepantla*. Here is OWK's reflection on the formation of the study group,

> So, it's, it's like the collaboration. It's kind of just like a puzzle piece, right, there's things that you're understanding and not understanding, and then that person has things that they're understanding and not understanding… and so when you get together, you know, you kind of fill those gaps in-between, and you kind of work out, you know, maybe I understand this part of the assignment or topic… right? and that person had no idea what was going on, so I was able to help them and then there's a part where I'm like, I'm totally lost I don't get it. And they're like, 'Oh, it's simple," and it's like, Dang, that would have taken me three days to figure that out. I figured it out in 10 minutes, because you're here. You know, you know, it's crazy like, I don't know, it's just, yeah.

OWK knew something about the study group was working. The study group helped improve his understanding of the course material and saved time. He was going through *nepantla* as he reluctantly sought out a study group despite his initial hesitation. It felt strange to ask

others for help. The outcome and reflection of the study group gave him a new understanding and appreciation. He emerged from the process convinced study groups help with academics and that the idea as a strategy is worth sharing with others. He commented, “If anybody asks me, ‘Like, hey, how do I succeed in college?’ Study groups.”

The collaboration made sense even though the process of getting together was not always clear. The outcome was a gained understanding of the homework and better grades. Joaquin, the other male participant also in his last year had a similar experience. He shared the following realization after a study group interaction, “*A mi no me gusta hacer la tarea solo. Pon esta formulita y en vez de hacer este procedimiento. ¿Y le dije, por qué no me dijiste?”* [I don’t like to do homework alone. Use this formula, instead of those steps. I asked, why didn’t you tell me?] Like OWK, Joaquin learned a different formula; a quicker way to get the results from his study partner. He was able to better understand the material with help from others. It solidified his idea of working with others. He also shared examples where he took the lead helping others, such as when he helped his baseball teammates. It was a reciprocal process for him.

Three of the participants indicated a strong connection to family. Their family has been a support system for them. In some cases, they are in touch on a regular basis. Julia makes the three-hour drive with her sister once or twice a month to visit her family. She adjusts her schedule so that she gets her homework done in advance to better focus on the family time while with them. Visiting with family and doing something outside of school were strategies Julia identified as helpful to keep stress to a minimum. Visiting with family was a strategy used to stay motivated for school.

Olivia shared about her family dynamics and not currently being in touch with them. Her responses to other questions indicated her mom played a large role in her academics up through

high school. The relationship is now non-existent. When I asked if she would do things differently, she adamantly said no. She shared, “I think it’s harder from a culture standpoint because Mexicans are very, you know, close and you’re, you’re supposed to do what your parents say…it just wasn’t what I wanted.” There were challenges as she shared,

> So, it's been. Yeah, it's been ups and downs. I think it's important; it was important for me to follow what I wanted to do, and not live the life that they wanted me to live.

Leading the life she chose has had emotional consequences, but she wouldn’t have it any other way and is confident in her path. She went to Germany all by herself and was ready to stay longer and pursue an additional degree before the pandemic changed things. The independence and self-assurance have helped her pursue her own agenda. The *nepantla* journey for Olivia included interactions with family to the point of no longer communicating and the realization that following her dreams was the best way to stay true to herself.

Julia and Olivia both discussed how creativity can break up the monotony of school and provide an escape. Olivia expanded the definition of creativity by including anything outside your comfort zone, and a way to try something new. Julia watched movies or met with friends or clients for manicures. Olivia enjoyed art and sculpture classes. The challenging coursework could be momentarily put aside while they did something entirely different. It was a diversion from classes. It was an intentional disruption of the normal routine, its own forced *nepantla* while navigating academics.

Summary of the Results

The participants shared their thoughts on their experiences as college students in various stages of their academic trajectory. The participants included a student in their second year, one in their third year, and two in their last year of college nearing graduation. All of the students

mentioned leaning on others for support, often family, friends, study groups or even faculty. They shared the process of getting to the current point of their academic journey. Only one student had attended their current institution the entire time. One student already had a degree and was a second-degree seeking student after dissatisfaction the first time around. Two of the four students attended a community college before on sports scholarships prior to attending this institution. Their different paths to the engineering degree are examples of the many route's students take and the need for institutions to recognize and provide support with those different pathways in mind. Here is a list of the main codes and themes that developed in this study.

People	**Process**
Support Structure	*Process and Path Forward*

Creating a Space to Belong

The participants navigated their educational journey by creating a support system when one was not in place. Referring to Strayhorn's (2018) idea of belongingness where students' sense of belonging refers to students perceived social support on campus, a feeling or sensation of connectedness, the experiences of mattering or feeling cared about, accepted, respected, valued by, and important to the group (e.g., campus community) or others on campus (e.g., faculty, peers; p. 17).

They created the space where they belonged and where they mattered through the study groups. It was a place where they were respected by their peers and could share equally in the process. They were encouraged to pursue study groups by faculty and in one case their mom.

Having a strong interest in engineering for Latinas is a stronger predictor of belongingness (Verdín, 2021b). Olivia and Julia both have a strong connection to their chemical

engineering major. Olivia spent some time thinking about a major after not being happy with her first degree. Spending time in Germany and exploring different ways engineering can be executed made her more confident in her decision. As a student she has spent time thinking about how to make new materials. She even added a brewery concentration to open other job possibilities. The process for Olivia was rocky after getting the first degree, the inability to study in (person) Germany and even returning to the United States. She is now connected to her major and feels relaxed about the process noticing that she is not as stressed as her peers since she understands it is a journey that can't be rushed.

Julia talked about learning about fertilizers. She had been exploring ideas in case she decided to return to Mexico. The strong agricultural base in her hometown she feels, needs sustainable agricultural practices. She has been thinking this is an ideal area for her to consider if she were to return. This connection to the major makes her more focused. It supports her idea of being an engineer that solves problems as she shared was her motivation.

Recommendations

In retrospect there are a few things I would do differently. There are a few additional things I would like to know and could easily ask ahead of time. I think adding a pre-questionnaire would be helpful. It could address some of the questions easily answered such as age, ethnicity, number of siblings and their GPA. I would have those answers prior to the interview and could modify the interview questions accordingly. It would save time when we meet which in turn could be used for icebreakers or introductions.

I did not have a specific question about their GPA. I would like to know more about their strengths academically. The responses given referenced comments by friends and the frequency of studying. I am inclined to think they are all strong academically. It would be interesting to see

if there are differences and how the responses vary accordingly. I wonder if we would see lower GPAs among the group of students that do not have a consistent study group or find value in meeting with others to study.

The university support structures in place can intentionally put students together and facilitate the connections and study groups. It could be a requirement. Some of the discomfort in forming the groups could be removed by creating the groups and requiring attendance. Sharing student *testimonios* supporting the use of study groups can be persuasive for other students. Identifying students who can lead the groups could assist in the process.

I prepared for the possibility of interviews in Spanish. I could have specific questions related to language acquisition and cultural experiences. The dominant Spanish speakers may benefit from additional support. Understanding what mechanisms could be put in place to help emerging language learners could be beneficial as educators consider the changing demographics.

Implications for Professional Practice

Engineering students have challenging course loads. Engineering colleges need to understand all their students' needs and offer services accordingly, each fitting the population being served. The need to increase the number of engineers has been discussed and referred to as the leaky pipeline for two decades. The idea of engineers as problem solvers, haven't solved that problem. We need to apply new approaches. The one approach for all is not working. It is time we disaggregate the data and look at the results.

Conclusion

Academics at a university are involved with three areas: teaching, research, and service. Faculty are recognized as they excel in those areas. They can gain recognition by excelling in

one of those areas, especially if done exceptionally well. It could add up to tenure. Student affairs professionals on the other hand do not get that type of recognition. We are staff and typically do not teach. We will not reach tenure or gain accolades for our service to the campus or students or be listed or even thought of as the primary investigator on grants. That is a role typically reserved for the esteemed faculty. There may be an occasional recognition in the form of a plaque or award.

In academic terms professional staff fall in the hard to define, third space category, as third space professionals. The research led me there, yet it was there all along. My entire career in higher education, third space has been my home. I didn't have the words to describe it prior to my doctoral journey. I was a realization that I have been in *nepantla* throughout my life. This doctoral journey has been a constant state of discomfort. I hope to soon see the other side, where I can be gifted with a title, yet earned with years of hard work.

The journey reflects my professional career, considering that I am a proud first-generation scholar, soon to reach doctoral status. One step forward, one step sideways, reflection and pause. This time I will know to expect the discomfort. I will anticipate the reflection as the sweetest reward that can be gained from chaos, as I anticipate *nepantla* on *el otro lado* [the other side.]

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Appendix A

Testimonios Interview Guide

Diana Garza doctoral study titled

EMBRACING *NEPANTLA* IN LATINX STUDENTS ENGINEERING IDENTITY: A QUALITATIVE CASE STUDY EXAMINING THE ASSET BUILDING MECHANISMS AT PERFORMANCE-BASED FUNDING INSTITUTIONS WITH A STEM INCENTIVE

Introductory Statement: My doctoral study is about your experiences as a Latinx student enrolled in an engineering degree program. You have been given a CONSENT form regarding participation in the study. After you have read the CONSENT form, I will answer any question you may have. Please keep in mind that your participation is voluntary and confidential and that you can, at any time stop this interview and opt out of the study. If you decide to complete the interview, I will send you a copy of my transcribed notes for your review and approval before I use them in my findings. For the purposes of the study, I will assign you, and the university, a CODE NAME that will be used in my findings.

Date/Time/Setting: (Completed by researcher)

Participant Code Name: (Give by researcher for the participant)

What is your Degree Objective? For example, do you hope to complete a Bachelor of Science Degree?

Demographic data:

Please give me your age in a five-year age span. For example, if you are 23, your five year age span would be 20-25.

What is your ethnicity? How would you describe yourself?

Family Order: If you have siblings, please tell me your birth order. For example, were you the first child among four?

Language Preference for the Interview: Please tell me your first language. In other words, is Spanish your first language? If so, do you want me to speak Spanish or English during the interview.

Interview Guide

The Student

Let's begin with you – how would you generally describe yourself?

More specifically—describe yourself as a Latinx engineering student.

What about your friends? – how would they generally describe you?

More specifically—how do your friends describe you as a Latinx engineering student?

1) The Family

   Let's talk about family – please generally describe your family.

   Specifically, please describe your family's reaction to you attending college.

   Have other family members attended college? Did that make it harder/easier for you?

2) Your Academic Journey

   I'm interested in your academic journey, from the beginning through high school.

What comes to mind when I say, “How was your elementary school experience?”

What comes to mind when I say, “How was your junior high or middle school experience?”

What comes to mind when I say, “How was your high school experience?”

When you look back on those years, did you have to change yourself in any way in order to “survive” in the school environment?

Now let’s talk about your college journey—

How did you decide which college was a match for your goals?

What comes to mind when I say, “How was your college experience?”

When you look back on those years, did you have to change yourself in any way in order to “survive” in the college environment?

“What was you most difficult class and how did you get through it?

“Was there help available when you were struggling? Tell me about that?”

3) Your Personal Obstacles

Let’s talk about personal obstacles in your academic journey. For example, did you have surgery? Did you have to move often? Did you have to work full time?

Please describe one or more personal obstacle in your academic journey that really stands out—what was it and how did you cope with it and learn from it?

4) Your Academic Challenges

Let’s talk about academic obstacles in your academic journey. For example, did you have difficulty with a particular course?

Please describe one or more academic challenge in your academic journey that really stands out—what was it and how did you cope with it and learn from it?

5) Your Experiences with Faculty

The teaching faculty is so important to a college student. Let's talk about the way some college teachers made it difficult and made it rewarding. For example, does a particular teacher stand out as someone who inspired or depressed you? If so, how?

6) Your Experiences with Other Students

Interacting with other students is always memorable for a college student. Tell me about your experiences with other students. For example, did a student harass you? Or, did a student become a close friend and mentor?

7) Your Sources of Strength

I'm interested in your sources of strength, as a Latinx. Describe one to three sources of strength that kept you going during college.

8) Your Successes

Your journey has had moments of celebration for successes. Describe one or more celebrations or successes that filled you with hope and energy to continue college.

9) Your Future Plans

What's next for you? I'm interest in your plans and goals for the next year, and, perhaps beyond…

10) Free Flowing

We've talked about many things, but I don't want to miss anything.

Let's talk about what I *haven't asked you*—is there anything—an event, a person, a word—anything else that is important to your academic journey?

Appendix B

INFORMED CONSENT FORM - Julia

A. PURPOSE AND BACKGROUND

Diana Garza a**, doctoral,** student in the Department of Educational Leadership at Northwest Nazarene University is conducting a research study related to **the cultural asset building mechanism in Latinx engineering students**.

You are being asked to participate in this study because you are a healthy volunteer, over the age of 18.

B. PROCEDURES

If you agree to be in the study, the following will occur:

1. You will be asked to sign an Informed Consent Form, volunteering to participate in the study.

2. You will be asked to answer a set of interview questions and engage in a discussion on your perception of the support mechanisms for engineering students. This discussion will be audio taped and is expected to last approximately 60 minutes.

3. You will be asked to read a debriefing statement at the conclusion of the interview.

4. You will be asked to reply to an email at the conclusion of the study asking you to confirm the data that was gathered during the research process.

These procedures will be competed at a location mutually decided upon by the participant and principal investigator and will take a total time of about 120 minutes.

C. RISKS/DISCOMFORTS

1. Some of the discussion questions may make you uncomfortable or upset, but you are free to decline to answer any questions you do not wish to answer or to stop participation at any time.

2. For this research project, the researchers are requesting demographic information. The researchers will make every effort to protect your confidentiality. However, if you are uncomfortable answering any of these questions, you may leave them blank.

3. Confidentiality: Participation in research may involve a loss of privacy; however, your records will be handled as confidentially as possible. No individual identities will be used in any reports or publications that may result from this study. All data from notes, audio tapes, and disks will be kept in a locked file cabinet, password protected computer or in

password protected files. In compliance with the Federalwide Assurance Code, data from this study will be kept for three years, after which all data from the study will be destroyed (45 CFR 46.117).

4. Only the primary researcher and the research supervisor will be privy to data from this study. As researchers, both parties are bound to keep data as secure and confidential as possible.

D. BENEFITS
There will be no direct benefit to you from participating in this study. However, the information you provide may help educators to better understand the factors that enhance the student experience and retention and benefit students.

E. PAYMENTS
There are no payments for participating in this study.

F. QUESTIONS
If you have questions or concerns about participation in this study, you should first talk with the investigator. **Diana Garza** can be contacted via email at **dgarza@nnu.edu** via telephone at **208.991.4054**. If for some reason you do not wish to do this you may contact Dr. Studebaker**,** Director of Doctoral Programs in Educational Leadership at Northwest Nazarene University, via email at **bstudebaker@nnu.edu** via telephone at **208.467.8802** or by writing 623 S. University Blvd, Nampa, Idaho 83686.

Should you feel distressed due to participation in this, you should contact your own health care provider.

G. CONSENT
You will be given a copy of this consent form to keep.

PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline to be in this study, or to withdraw from it at any point. Your decision as to whether or not to participate in this study will have no influence on your present or future status as a student at Northwest Nazarene University.

I give my consent to participate in this study:

Signature of Study Participant **Date12/06/2021**

I give my consent for the interview and discussion to be audio taped in this study:

[redacted] 12/06/2021

Signature of Study Participant **Date**

I give my consent for direct quotes to be used in this study:

[redacted] 12/06/2021

Signature of Study Participant **Date**

[redacted] 12/06/2021

Signature of Person Obtaining Consent **Date**

THE NORTHWEST NAZARENE UNIVERSITY INSTITUTIONAL REVIEW BOARD HAS REVIEWED THIS PROJECT FOR THE PROTECTION OF HUMAN PARTICIPANTS IN RESEARCH.

Appendix C

INFORMED CONSENT FORM - Joaquin

A. PURPOSE AND BACKGROUND

Diana Garza a**, doctoral,** student in the Department of Educational Leadership at Northwest Nazarene University is conducting a research study related to **the cultural asset building mechanism in Latinx engineering students**.

You are being asked to participate in this study because you are a healthy volunteer, over the age of 18.

B. PROCEDURES

If you agree to be in the study, the following will occur:

5. You will be asked to sign an Informed Consent Form, volunteering to participate in the study.

6. You will be asked to answer a set of interview questions and engage in a discussion on your perception of the support mechanisms for engineering students. This discussion will be audio taped and is expected to last approximately 60 minutes.

7. You will be asked to read a debriefing statement at the conclusion of the interview.

8. You will be asked to reply to an email at the conclusion of the study asking you to confirm the data that was gathered during the research process.

These procedures will be competed at a location mutually decided upon by the participant and principal investigator and will take a total time of about 120 minutes.

C. RISKS/DISCOMFORTS

5. Some of the discussion questions may make you uncomfortable or upset, but you are free to decline to answer any questions you do not wish to answer or to stop participation at any time.

6. For this research project, the researchers are requesting demographic information. The researchers will make every effort to protect your confidentiality. However, if you are uncomfortable answering any of these questions, you may leave them blank.

7. Confidentiality: Participation in research may involve a loss of privacy; however, your records will be handled as confidentially as possible. No individual identities will be used in any reports or publications that may result from this study. All data from notes, audio tapes, and disks will be kept in a locked file cabinet, password protected computer or in

password protected files. In compliance with the Federalwide Assurance Code, data from this study will be kept for three years, after which all data from the study will be destroyed (45 CFR 46.117).

8. Only the primary researcher and the research supervisor will be privy to data from this study. As researchers, both parties are bound to keep data as secure and confidential as possible.

D. BENEFITS

There will be no direct benefit to you from participating in this study. However, the information you provide may help educators to better understand the factors that enhance the student experience and retention and benefit students.

E. PAYMENTS

There are no payments for participating in this study.

F. QUESTIONS

If you have questions or concerns about participation in this study, you should first talk with the investigator. **Diana Garza** can be contacted via email at **dgarza@nnu.edu** via telephone at **208.991.4054**. If for some reason you do not wish to do this you may contact Dr. Studebaker**,** Director of Doctoral Programs in Educational Leadership at Northwest Nazarene University, via email at **bstudebaker@nnu.edu** via telephone at **208.467.8802** or by writing 623 S. University Blvd, Nampa, Idaho 83686.

Should you feel distressed due to participation in this, you should contact your own health care provider.

G. CONSENT

You will be given a copy of this consent form to keep.

PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline to be in this study, or to withdraw from it at any point. Your decision as to whether or not to participate in this study will have no influence on your present or future status as a student at Northwest Nazarene University.

I give my consent to participate in this study:

Signature of Study Participant **Date: 9/Nov/21**

I give my consent for the interview and discussion to be audio taped in this study:

[redacted]

Signature of Study Participant **Date: 9/Nov/21**

I give my consent for direct quotes to be used in this study:

[redacted]

Signature of Study Participant **Date: 9/Nov/21**

[redacted]

Signature of Person Obtaining Consent **Date: 9/Nov/21**

THE NORTHWEST NAZARENE UNIVERSITY INSTITUTIONAL REVIEW BOARD HAS REVIEWED THIS PROJECT FOR THE PROTECTION OF HUMAN PARTICIPANTS IN RESEARCH.

Appendix D

INFORMED CONSENT FORM – Obie-Wan Kenobi

A. PURPOSE AND BACKGROUND

Diana Garza a**, doctoral,** student in the Department of Educational Leadership at Northwest Nazarene University is conducting a research study related to **the cultural asset building mechanism in Latinx engineering students**.

You are being asked to participate in this study because you are a healthy volunteer, over the age of 18.

B. PROCEDURES

If you agree to be in the study, the following will occur:

9. You will be asked to sign an Informed Consent Form, volunteering to participate in the study.

10. You will be asked to answer a set of interview questions and engage in a discussion on your perception of the support mechanisms for engineering students. This discussion will be audio taped and is expected to last approximately 60 minutes.

11. You will be asked to read a debriefing statement at the conclusion of the interview.

12. You will be asked to reply to an email at the conclusion of the study asking you to confirm the data that was gathered during the research process.

These procedures will be competed at a location mutually decided upon by the participant and principal investigator and will take a total time of about 120 minutes.

C. RISKS/DISCOMFORTS

9. Some of the discussion questions may make you uncomfortable or upset, but you are free to decline to answer any questions you do not wish to answer or to stop participation at any time.

10. For this research project, the researchers are requesting demographic information. The researchers will make every effort to protect your confidentiality. However, if you are uncomfortable answering any of these questions, you may leave them blank.

11. Confidentiality: Participation in research may involve a loss of privacy; however, your records will be handled as confidentially as possible. No individual identities will be used in any reports or publications that may result from this study. All data from notes, audio

tapes, and disks will be kept in a locked file cabinet, password protected computer or in password protected files. In compliance with the Federalwide Assurance Code, data from this study will be kept for three years, after which all data from the study will be destroyed (45 CFR 46.117).

12. Only the primary researcher and the research supervisor will be privy to data from this study. As researchers, both parties are bound to keep data as secure and confidential as possible.

D. BENEFITS

There will be no direct benefit to you from participating in this study. However, the information you provide may help educators to better understand the factors that enhance the student experience and retention and benefit students.

E. PAYMENTS

There are no payments for participating in this study.

F. QUESTIONS

If you have questions or concerns about participation in this study, you should first talk with the investigator. **Diana Garza** can be contacted via email at **dgarza@nnu.edu** via telephone at **208.991.4054**. If for some reason you do not wish to do this you may contact Dr. Studebaker**,** Director of Doctoral Programs in Educational Leadership at Northwest Nazarene University, via email at **bstudebaker@nnu.edu** via telephone at **208.467.8802** or by writing 623 S. University Blvd, Nampa, Idaho 83686.

Should you feel distressed due to participation in this, you should contact your own health care provider.

G. CONSENT

You will be given a copy of this consent form to keep.

PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline to be in this study, or to withdraw from it at any point. Your decision as to whether or not to participate in this study will have no influence on your present or future status as a student at Northwest Nazarene University.

I give my consent to participate in this study:

[redacted]

_____ 11/11/21

Signature of Study Participant **Date**

I give my consent for the interview and discussion to be audio taped in this study:

[redacted] 11/11/21

Signature of Study Participant **Date**

I give my consent for direct quotes to be used in this study:

[redacted] 11/11/21

Signature of Study Participant **Date**

[redacted] 11/11/21

Signature of Person Obtaining Consent **Date**

THE NORTHWEST NAZARENE UNIVERSITY INSTITUTIONAL REVIEW BOARD HAS REVIEWED THIS PROJECT FOR THE PROTECTION OF HUMAN PARTICIPANTS IN RESEARCH.

Appendix E

INFORMED CONSENT FORM - Olivia

A. PURPOSE AND BACKGROUND

Diana Garza a**, doctoral,** student in the Department of Educational Leadership at Northwest Nazarene University is conducting a research study related to **the cultural asset building mechanism in Latinx engineering students**.

You are being asked to participate in this study because you are a healthy volunteer, over the age of 18.

B. PROCEDURES

If you agree to be in the study, the following will occur:

13. You will be asked to sign an Informed Consent Form, volunteering to participate in the study.

14. You will be asked to answer a set of interview questions and engage in a discussion on your perception of the support mechanisms for engineering students. This discussion will be audio taped and is expected to last approximately 60 minutes.

15. You will be asked to read a debriefing statement at the conclusion of the interview.

16. You will be asked to reply to an email at the conclusion of the study asking you to confirm the data that was gathered during the research process.

These procedures will be competed at a location mutually decided upon by the participant and principal investigator and will take a total time of about 120 minutes.

C. RISKS/DISCOMFORTS

13. Some of the discussion questions may make you uncomfortable or upset, but you are free to decline to answer any questions you do not wish to answer or to stop participation at any time.

14. For this research project, the researchers are requesting demographic information. The researchers will make every effort to protect your confidentiality. However, if you are uncomfortable answering any of these questions, you may leave them blank.

15. Confidentiality: Participation in research may involve a loss of privacy; however, your records will be handled as confidentially as possible. No individual identities will be used in any reports or publications that may result from this study. All data from notes, audio tapes, and disks will be kept in a locked file cabinet, password protected computer or in

password protected files. In compliance with the Federalwide Assurance Code, data from this study will be kept for three years, after which all data from the study will be destroyed (45 CFR 46.117).

16. Only the primary researcher and the research supervisor will be privy to data from this study. As researchers, both parties are bound to keep data as secure and confidential as possible.

D. BENEFITS

There will be no direct benefit to you from participating in this study. However, the information you provide may help educators to better understand the factors that enhance the student experience and retention and benefit students.

E. PAYMENTS

There are no payments for participating in this study.

F. QUESTIONS

If you have questions or concerns about participation in this study, you should first talk with the investigator. **Diana Garza** can be contacted via email at **dgarza@nnu.edu** via telephone at **208.991.4054**. If for some reason you do not wish to do this you may contact Dr. Studebaker**,** Director of Doctoral Programs in Educational Leadership at Northwest Nazarene University, via email at **bstudebaker@nnu.edu** via telephone at **208.467.8802** or by writing 623 S. University Blvd, Nampa, Idaho 83686.

Should you feel distressed due to participation in this, you should contact your own health care provider.

G. CONSENT

You will be given a copy of this consent form to keep.

PARTICIPATION IN RESEARCH IS VOLUNTARY. You are free to decline to be in this study, or to withdraw from it at any point. Your decision as to whether or not to participate in this study will have no influence on your present or future status as a student at Northwest Nazarene University.

I give my consent to participate in this study:

_____ _____

Signature of Study Participant **Date**

I give my consent for the interview and discussion to be audio taped in this study:

Signature of Study Participant	**Date**

I give my consent for direct quotes to be used in this study:

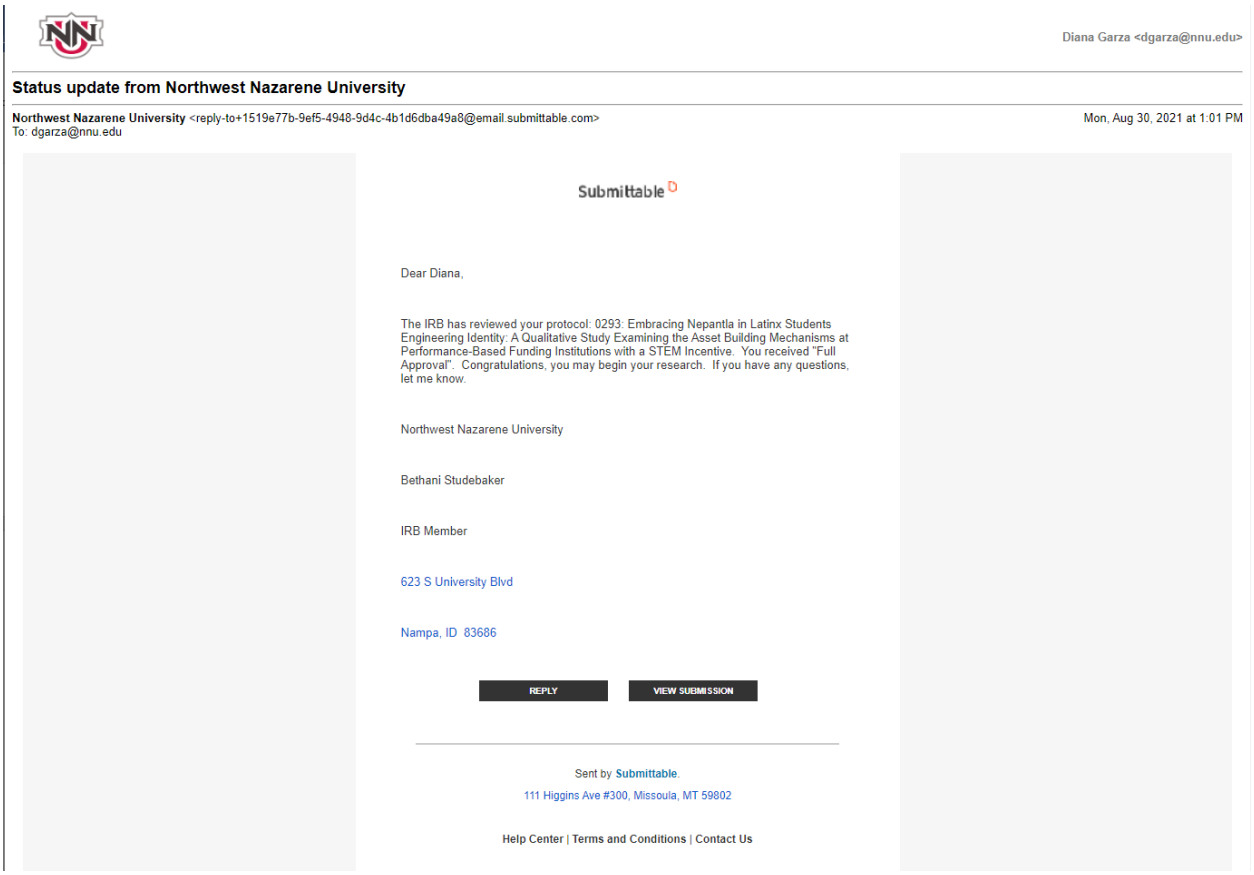
Signature of Study Participant	**Date**

Signature of Person Obtaining Consent	**Date**

THE NORTHWEST NAZARENE UNIVERSITY INSTITUTIONAL REVIEW BOARD HAS REVIEWED THIS PROJECT FOR THE PROTECTION OF HUMAN PARTICIPANTS IN RESEARCH.

Appendix F

NNU IRB Approval Form



Diana Garza <dgarza@nnu.edu>

Status update from Northwest Nazarene University

Northwest Nazarene University <reply-to+1519e77b-9ef5-4948-9d4c-4b1d6dba49a8@email.submittable.com>
To: dgarza@nnu.edu

Mon, Aug 30, 2021 at 1:01 PM

Submittable

Dear Diana,

The IRB has reviewed your protocol: 0293: Embracing Nepantla in Latinx Students Engineering Identity: A Qualitative Study Examining the Asset Building Mechanisms at Performance-Based Funding Institutions with a STEM Incentive. You received "Full Approval". Congratulations, you may begin your research. If you have any questions, let me know.

Northwest Nazarene University

Bethani Studebaker

IRB Member

623 S University Blvd

Nampa, ID 83686

REPLY VIEW SUBMISSION

Sent by **Submittable**.
111 Higgins Ave #300, Missoula, MT 59802

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Appendix G

NM STATE UNIVERSITY

Office of the Vice President for Research

INSTITUTIONAL REVIEW BOARD (IRB)
Dr. Merranda Romero Marin, Chair
MSC 3 RES
New Mexico State University
P.O. Box 3001
Las Cruces, NM 88003-8001
Phone: 575-646-7177 Fax: 575-646-2480
Email: ovpr@nmsu.edu

DATE: October 5th, 2021

FROM: The Office of Research Integrity and Compliance

TO: Diana Garza
Liaison:Jeanne Garland
Department Head:Antonio Garcia

SUBJECT: **IRB Determination Memo for Submission #22161**

Project Title:	Embracing Nepantla in Latinx Students Engineering Identity: A Qualitative Study Examining the Asset Building Mechanisms at Performance-Based Funding Institutions with a STEM Incentive
Application Type:	Determination
Review Type:	Expedited
Review Category:	0

The NMSU Institutional Review Board Chair, Dr. Merranda Romero Marin has reviewed your application for the conduct of research involving human subjects. This application has been reviewed and approved by the Northwest Nazarene University's IRB as Expedited, category 6, 7. NMSU's IRB concurs with the research review and approval. Hence, NMSU's IRB has completed an IRB Authorized Agreement (IAA) and are relying on Northwest Nazarene University to serve as the IRB of record for this project.

If there are any changes/modifications or adverse events/protocol deviations with the currently approved application, these will need to be communicated/documented with NMSU's IRB. The research must be conducted according to the proposal/protocol that was approved by the IRB. Any changes in the research, instruments, or the consent document(s) must be submitted to the IRB prior to implementation. Additionally, any unexpected hazards or adverse events involving risk to subjects or others must be reported immediately to the IRB of record.

Given the current COVID-19 outbreak, investigators should consider whether at any point their research procedures should be revised to limit personal contacts, for example by reducing or eliminating in-person visits or replacing in-person interviews with telephone or internet contacts. Researchers must ensure that they are not endangering the safety of participants in the current pandemic.

If you should have any questions, please do not hesitate to contact the Office of Research Integrity and Compliance at 646-7177 or via e-mail at ovpr@nmsu.edu.

Appendix H

Association of Clinical Research Professionals

CERTIFIES THAT

Diana Garza

Has Successfully Completed

Ethics and Human Subject Protection (No CEU)

Certification Date:
January 27, 2019