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Out on a STEM: Gender wage gap and factors that impact salary in science, technology, engineering, and mathematics careers

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OUT ON A STEM: GENDER WAGE GAP AND FACTORS THAT IMPACT SALARY IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS CAREERS

BY

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DEDICATION

To my parents, Kelly, Leo, Olivia, Landon, Lucy, Jessica, family and friends.

What began in my family who have shaped my life.

To our larger human family; through each encounter we grow.

May we accompany each other, stand in solidarity, leverage our humanity and the strength of our diversity, to build an equitable and just world.

ABSTRACT

OUT ON A STEM: THE GENDER WAGE GAP AND FACTORS THAT IMPACT A PERSON'S SALARY IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS CAREERS

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This study explores data of newly graduated students hired into the workforce. It uses data from the National Survey of College Graduates (NSCG), a longitudinal study started in 1993 by the National Science Foundation (NSF). The NSCG uses a questionnaire to collect data on demographic, education, employment, and occupation attributes from all graduating students and emphasizes those working in science and engineering fields. In addition, this study sought to identify any wage gap that may exist between STEM and non-STEM fields in the last decade. The study found average salaries of standard occupational codes were affected by race/ethnicity, gender, and degree type. Wage gaps due to all analyzed factors (e.g. gender, race/ethnicity, discipline, and degree level) were found to exist in the data between 2010-2019. The quantitative data analysis of this archival data employed statistical methods using various software tools:(MATLAB, SPSS, Tableau, and Excel).

Keywords: engineering, gender, gender gap, latinx, math, race/ethnicity, science, STEM, technology, wage gap.

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CHAPTER 1: INTRODUCTION

People are bombarded by all kinds of values, ideas, and images from everyone around them, parents and other relatives, peers and classmates, friends, even society at large through pop culture and the media. While the individual "grows up," these inputs can eventually lead them to pursue and attain employment in a particular field (Blickenstaff, 2005; Connelly et al., 2014). What an individual's purpose could be is a topic many people reflect on throughout their lives. This purpose becomes the source of a whole host of other questions that, as one develops and matures, can be a foundation of stability for their values, identity, and what actions are performed in this world.

Science, technology, engineering, and mathematics, also known as STEM, is a collection of disciplines and fields that has marked and continues to mark potential growth areas with significant potential impact on our world and our shared humanity. The impact can be seen in examples from developing a new life saving vaccine, writing software to combat global warming, or even designing equipment that could quickly and safely transport people from one place on this world and one day to other planets. STEM can serve humanity from both technical and social perspectives. There are undoubtedly other non-STEM fields where people are employed and needed in the world, but the question that many people ask early in life is, "What do I want to be?" The question of getting a job in STEM versus non-STEM fields is a common question that students face today because of the increasing rate this is being discussed, debated, and responded as our society becomes more industrialized (Blickenstaff, 2005; Shapiro et al., 2015, Smith et al., 2015). What occupation a student undertakes offers insight into whether they can support themself or a family. A natural lens of analysis coming from this inquiry is: which field is best for the individual? Objective data on standardized occupations and earnings can be used to help a student mitigate the environmental factors in their life — their story of origin, upbringing, worldview, and values — to help them discern which path to start their professional life (Blickenstaff, 2005; Crombie et al, 2005; Shapiro et al., 2015, Smith et al., 2015; Watt et al., 2006).

This study narrowed the question to what fields have growth potential and represent the equitable treatment for people of color, especially Latinas (Latinx women), compared to other races/ethnicities and men. More specifically, are Latinx women equally valued as males in the same fields? Are salaries for all communities of people in the workplace equal, or are some valued more than others? This study looked at archival data from the longitudinal National Survey of College Gradutate (NSCG) conducted by the National Science Foundation (NSF) to determine if there was a wage gap between STEM and non-STEM careers and if the parity was affected by gender, race/ethnicity, degree type, or a combination of those factors.

The remaining sections of Chapter 1 continue with a statement of the problem, followed by the purpose of the study. Successive content includes questions that guided the research and hypotheses investigated by the study, followed by the theoretical frameworks and specifics (context, methodology, and significance) of how it was completed. The remaining areas include a dictionary of terms commonly used in the literature, and the limitations/delimitations of the study. The chapter concludes with a summary, which highlights and frames the rest of the research.

Statement of the Problem

The injustice of gender and racial inequality still exists in our society (Aisenbrey & Brückner, 2008; Cha & Weeden, 2014; Michelmore & Sassler, 2016; Optow et at., 2005; Spencer Stuart, 2019, 2020). Race-based hate crimes, including attacking an elderly woman simply because she is Asian, seeing a person behind a wheel and pulling them over because they are Black, or going into a temple or synagogue and shooting the people inside because of their faith, are all examples of the inequities and atrocities within our society. Examples exist in the workplace despite changes to our laws and corporate structures; for example, males make more in salary than women, along with those from other races and ethnicities (U.S. Department of Labor, 1997-2018). This undervaluation of a person's worth as an employee reflects negative impacts of gender biases and stereotypes that persist in our society (Aisenbrey & Brückner, 2008; Cha & Weeden, 2014; Fluhr et al., 2017; Goldin et al., 2006; Major et al., 2002; Michelmore & Sassler, 2016). These impacts are still seen in corporate culture today. In 1997, starting salaries showed the wage gap existed for women and men entering comparable scientific jobs (National Center for Education Statistics, 1997). Nineteen years later, women still earned less than men, earning $0.82 for every dollar men earn in the physical sciences (Michelmore & Sassler, 2016). The earnings differential variation is between 25%–35%, with STEM majors earning on average 25% more than non-STEM students (Melguizo &

Wolniak, 2012; Pascarella & Terenzini, 2005). Furthermore, this disparity resulted in the promulgation of systemic oppression that has: a) hindered youth from identifying and following in a profession best suited for their intellect; and b) prevented them from realizing those dreams of a particular occupation. All people of different genders and races/ethnicities need to be valued not because of how their talents are perceived or whom they know, but rather because they are human. This is especially important for the Latinx community and women. This neutral and universally powerful concept can break down the walls that pit people against each other even when equally educated, talented, and qualified (Adams, 1993; Adams, 2011; Adams & Kirchmaier, 2016). These undervaluation paradigms have even prevented individuals from serving in leadership roles due to their gender or skin color. It is imperative that leadership opportunities across all professions, STEM and non-STEM, are pursued in such a manner that latent biases and stereotypes lose their power and are replaced with a thoughtfulness that sees all human beings equally. Corporate boards often lack diversity because of cultural biases or lack of intentionality for a variation based on thought, gender, and experience, resulting in a lack of explicit requirements when doing new member searches. Even today, corporate board membership continues to both change and remain stagnant (Adams & Kirchmaier, 2016; Spencer Stuart, 2019, 2020). Despite signs of growth in board diversity for women and minority board members (increases of 40%-59% for women, minorities, and under 50yrs of age), they only reflect a small number of board positions (8% of all board seats) due to low turnover (Jones, 2006; Spencer Stuart, 2019, 2020).

Changes in executive and board recruitment strategies continue to struggle. Recruitment firms are not provided with precise requirements focused on diversity. This often resulted in a tokenized need in place of an intentional and thoughtful process that could benefit the organization long-term. The benefits of having various thoughts, experiences, perspectives, gender, race, and ethnicity enable companies to adapt, grow, and better serve their communities (Gardyn, 2003; Harris, 2008). Hiring all people in a given role for a consistent salary regardless of gender, race/ethnicity, or belief can begin a substantial transformation of equality from a system that propagates a reality where only one can win while others lose (Connelly et al., 2014). The inequity behind this idea transcends pay because it changes how we see and treat each other.

In this current era of gender and racial injustice, it is crucial now more than ever to embrace the ideals of Lyndon Johnson when he spoke in 1965 about having equality as **both theory and result** (Franklin & Starr, 1967; Johnson, n.d.; Jones, 1997, 2006):

> Thus it is not enough just to open the gates of opportunity. All our citizens must have the ability to walk through those gates.
>
> This is the next and the more profound stage of the battle for civil rights. We seek not just freedom but opportunity. *We seek not just legal equity but human ability, not just equality as a right and a theory but equality as a fact and equality as a result* [emphasis added].

A key tenant of having a just world full of equality is creating the reality we seek. This can be accomplished by establishing equal employment opportunities and creating policies supporting equality such that all people can be valued, seen, and fully engaged in society (Jones, 2006). According to Jones (2006), wages earned by the workforce over the last 50 years have experienced disparity based on race, ethnicity, and gender. Predominantly, men have and are being paid more money than females. The wage gap reflects various factors, including the gender of the employee, career field/occupation, and degree type. Other environmental factors that contribute to this gender wage gap are organizational culture, biases, stereotypes, and social mores (Aisenbrey & Brückner, 2008; Cha & Weeden, 2014; Diekman et al., 2010; Fluhr et al., 2017; Goldin et al., 2006; Michelmore & Sassler, 2016). Do these factors persist? Does earning a degree and gaining employment in a STEM field mitigate this gap? Answers to these questions can help identify areas where the wage gap can be reduced if not eliminated.

Research shows existing biases based on the gender of the student results in differing expectations for them (Quin & Cooc, 2015; Riegle-Crumb et al., 2012; Tai et al., 2006; Wang, 2013; Watt et al., 2006), despite consistent evidence of no difference between the genders in learning and excelling in math or science (Eccles, 2009; Friedman, 1989; Hyde et al., 1990; National Center for Education Statistics, 1997; Watt et al., 2006). The parity in the representation between men and women in STEM fields has grown over time. Definitively identifying external factors that affect people internally during their formative adolescent years can establish a healthier perspective to change world views of educators, administrators, families, and society to destroy stereotypes and build paradigms that will help all people, not just women, to become stronger (Bouffard, 2015; Crombie et al., 2005; Quinn & Cooc, 2015; Ryan & Deci, 2000). These factors can also be internalized by businesses to be then expressed in better workplace culture, benefits, and fair treatment to all employees as a basis of being a human and not because of gender, race, or ethnicity (Ryan & Deci, 2000). This study assesses if the gender pay gap exists, the magnitude, and who are affected to update the conversation on worker equality and fair trade/treatment to influence "professional" culture toward a more helpful, responsible, and active change.

Purpose of the Study

This study explores the impact on salary from various factors over the last decade to determine their significance for graduating students who entered the workforce in science, engineering, technology, math, or an alternate field. It emphasizes Latinx women while analyzing genders across all races/ethnicities within the dataset for comparison and context. In addition, the study evaluates archival data between 2010-2019 to correlate salary with occupation, degree level, gender, and race/ethnicity in determining if a wage gap exists between STEM and non-STEM fields. It also examines the magnitude of gaps between the various racial/ethnic communities.

Research Questions

The following research questions guided this dissertation study.

RQ1. Is there a wage gap between STEM and non-STEM positions post-graduation?

RQ2. Is there a difference in the wage gap based on gender, race/ethnicity, discipline, and education level for the Latinx community?

a. What are the main effects that discipline, gender, and race/ethnicity have on salary?
b. What effect does each of the two-way interactions (STEM and Gender; STEM and Race/ethnicity; STEM and Level; Gender and Race/ethnicity; Gender and Level) have on salary?
c. What effect does the three-way interaction of STEM by Gender by Race/ethnicity have on salary?

Theoretical Frameworks

This study used three theoretical frameworks to explore the equity of the wage gaps: self-determination theory (SDT), the expectancy-value model (EVM), and gender performance (GP). SDT explores how values, expectations, biases, and other environmental factors affect students' identity, performance, and academic decisions. EVM addresses self-image from a perspective of the student's interactions leading to a valuation of those experiences and what they will value; this affects their future – classes, programs of study, and career choices. GP focuses on the negative impacts of social mores and gender stereotypes on expectations and performance. The three taken together provide a foundation for analyzing the equity of the salary awarded when the student graduates and gains employment. They also provide a foundational perspective to evaluate the impact the salary wage gap has on students' ability to visualize a career in

STEM. The study also offers opportunities to support an active conversation to identify future actions for equitable compensation in the workplace.

Context of the Study

This study combined NSCG survey cohort responses between 2010 and 2019 to create a unified sample of graduates. An essential set of attributes present in all surveys from which to conduct a quantitative analysis include: (a) demographics, (b) educational history, (c) employment status, (d) field of degree, and (e) occupation. In addition, the population of the surveys included individuals who met the following criteria: (a) earned a bachelor’s degree or higher before January 1 of the year before the survey year, (b) are not institutionalized and resided in the United States as of February 1 of the year of the survey, and (c) were younger than 76 years as of February 1 of the survey year. The 2010-2019 cohort’s population was approximately 174,400,000 graduates, from which 449,000 respondents were included based on the preceding eligibility requirements and the integrity of each survey returned.

This study assessed the wage gap between STEM and non-STEM disciplines and how it was affected by gender, race/ethnicity, or degree type; it focused on Latinx women compared to women and men of other races and ethnicities.

Significance of the Study

The wage gap in recognition and compensation between the sexes in the workforce has existed for decades. The significance of this study was to evaluate if the wage gap exists between STEM and non-STEM fields and if and how factors such as gender, race/ethnicity, degree type, or a combination thereof impacted the gap. This research could combat the leaky pipeline where female students abandon the pursuit of math and science careers by facilitating dialogue based on facts and data to resolve unfair treatment/pay. Assessing the wage gap by various factors could identify biases and stereotypes that persist in today’s workplace. The presence and conditions in which gaps exist within a given corporate environment provide the foundation for an honest discussion and examination of policies, practices, and philosophies that enable an organization to grow into a more just and inclusive workplace. This growth could provide hope to students by showing examples of how companies can be proactive in developing parity amongst all workers. It can also become a sustainable competitive advantage for those corporations that embark on this path of equity and justice to attract talented people to safe and inclusive cultures.

The practical application of the results include but are not limited to: 1) the elimination of pay based on gender and race/ethnicity in the public and private sectors, 2) to eliminate social and gender stereotype biases, 3) change how the media depicts careers and who are shown in those professions, 4) change the composition of curricula to be more inclusive through a diversity of people and situations that are not based on stereotypes nor favor segments of our population, and 5) to help establish a more equitable environment where all employees are valued for being human and not from a utilitarian purpose. Educators, counselors, and administrators may utilize this to explore existing indicators to disrupt and transform them into cultures and environments where all students thrive and are actively engaged.

Definition of Terms

Ethnicity. "[OMB defines ethnicity] as either 'Hispanic or Latino' or 'Not Hispanic or Latino.' OMB defines 'Hispanic or Latino' as a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race. People who identify as Hispanic, Latino, or Spanish may be any race" (Population Division, 2020).

Gender. "Although some scholars view gender on a continuum (e.g., Eagly, 2013), this variable was used synonymous[ly] with biological sex in this study." (Fluhr et al., 2017). I coded this variable 1 for female and 0 for male students. I predominantly used "gender" instead of "sex," for male or female, as defined by the U.S. Census Bureau.

Latinx. Merriam-Webster.com defines Latinx as "of, relating to, or marked by Latin American heritage—used as a gender-neutral alternative to *Latino* or *Latina*."

Motivation. According to Ryan and Deci (2000), motivation "concerns energy, direction, persistence, and equifinality-all aspects of activation and intention. ... [I]n the real world, motivation is highly valued because of its consequences: Motivation produces." Motivation can be explained as either intrinsic or extrinsic. Extrinsic motivation "refers to the performance of an activity in order to attain some separable outcome and, thus, contrasts with intrinsic motivation, which refers to doing an activity for the inherent satisfaction of the activity itself.” (Ryan & Deci, 2000)

Race. “The racial categories included in the census questionnaire generally reflect a social definition of race recognized in this country and not an attempt to define race biologically, anthropologically, or genetically. In addition, it is recognized that the categories of the race item include racial and national origin or sociocultural groups. People may choose to report more than one race to indicate their racial mixture. People who identify their origin as Hispanic, Latino, or Spanish may be of any race” (Population Division, 2020).

Race/Ethnicity. “The revised standards will have five minimum categories for data on race: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White. There will be two categories for data on ethnicity: ‘Hispanic or Latino’ and ‘Not Hispanic or Latino’” (Authenticated U.S. Government Information GPO, 1997). The combination of these two attributes as created by the U.S. Census Bureau was used in this study.

Racialism. Racialism is the “mechanism by which race is perpetuated because it suggests that race is a relevant standard for explaining human variation.” (Jones, 2006).

Role congruity. According to Diekman and Eagly (2008), role congruity is the “align[ment of] behavior with the demands of roles.”

Salary. The reported annual salary of the respondent’s principal job, before deductions, as of February 1st of the survey year.It does not include bonuses, overtime,additional summertime teaching/research compensation, or business expenses (National Center for Science and Engineering Statistics, 2010, 2013, 2015, 2017a, 2019).

Self-efficacy. Self-efficacy is the belief a person has concerning their ability to perform tasks and behaviors. In relation to mathematics, it includes confidence, which is reinforced by performance (Bandura, 1977; Tyler-Wood et al., 2012).

STEM fields. These disciplines include mathematics, physical sciences, biological/life sciences, computer and information sciences, engineering and engineering technologies, and science technologies (National Center for Education Statistics, 2014).

Assumptions

This study assumes the NSCG survey is a reliable and valid instrument for measuring salary and the factors that affect it. Also, students participating in the study were correctly identified, and they answered each of the NSCG questions truthfully.

Limitations and Delimitations

The limitations of this study included the following:

1. Wage gap-centric questions served as a baseline and beginning of future analyses of environmental factors.
2. Though the study sample was large, the archival data emphasized those in the science and engineering workforce. Though this workforce comprises workers who primarily earned a STEM degree, it was not required.

The delimitations of this study included the following:

1. STEM degrees had a large detailed subgroup structure, whereas the non-STEM categories had fewer aggregated subgroups. The types supported the comparison of STEM versus non-STEM disciplines while enabling a detailed comparison of the fields within STEM.
2. The overlap from earlier years (2008–2017) in the NSCG, originating from the American Community Survey (ACS), enabled a longitudinal analysis of a subset of data using the reference identifier (REFID) unique variable.

Summary

The wage gap exists in our history, and this study seeks to determine if it persists in the last decade. Examining salary with respect to gender, race/ethnicity, discipline, and degree level data can facilitate a thoughtful discussion of what exists, affects it, and provides a foundation to eliminate it. A strength of this study is based on the longitudinal survey from which it was derived. The data, which emphasizes STEM fields, showed the distribution of the workforce related to both the private and public sectors.

Overview of the Remainder of the Study

Chapter 2 reviews an overview of the literature relevant to the wage gap, STEM gender gap, and how environmental factors influence students' persistence. Chapter 3 describes the methodology and the research design used to conduct this study. Chapter 4 presents the study's results and findings. Chapter 5 discusses the study's findings, recommendations, and future research for what can be done to enculturate the significant environmental factors to reduce the STEM wage and gender gaps.

CHAPTER 2: REVIEW OF THE LITERATURE

This chapter focuses on the literature through three frameworks of SDT, EVM, and GP. It reviews previous wage gap data focused on STEM fields, including non-STEM disciplines as a category, regarding degrees awarded, the number of jobs in each area, and salaries for those employees. It also includes details on the “glass ceiling” experienced by women. The chapter concludes with an overall summary of the preceding sections.

Restatement of Purpose of the Study

This research aims to examine if the gender wage gap exists in the last decade and what factors impact salary upon completing a program of study. The study focuses on STEM versus non-STEM careers, emphasizing Latinx women compared with men and women of other races/ethnicities. The study explores which factors could explain the perceived treatment of people, using historical employment data, which in turn can impact students’ plans to pursue programs of study and employment in STEM fields. Although this study focused on the end of the academic journey, at the intersection between graduation and beginning a vocation, it is rooted early in the student’s academic career, where they start visualizing what field they want to pursue. For that, we turn to the theoretical frameworks.

Self-Determination Theory

Research demonstrated that in the U.S., beginning in primary school and intensifying in middle through postsecondary school, student identity is impacted by their environment. This identity development starts with the values, expectations, roles, and freedom they are raised with in their home (Eccles, 2009). In addition, a student's development is also impacted at school throughout their academic career through their classroom space; if it was safe, encouraging, equal, along with any biases of their teachers and administrators they encountered on their way (Blickenstaff, 2005; Wang, 2013). Curriculum and experience, especially with professionals in STEM fields, are particularly formative through grounding material and discussion so that topics become relevant to the student, enabling them to see themselves in any given career (Tyler-Wood, et al., 2012). The way students internalize all these expectations, gender stereotypes, and biases from other community members, including their peers and friends, contribute to their self-identity and belief in their ability (Diekman et al., 2010). The effect of this internalization is most visible in high school, as young women are often seen dropping advanced math and science courses given the opportunity because they are either not going to college or those classes are not required for college admission (Eccles, 2009; Watt et al., 2006). This, in turn, affects gender differences on competence beliefs that contribute to lowering enrollment in advanced math courses and pursuing math-related careers (Crombie et al., 2005; Eccles, 1994; Farmer et al., 1999). Having a complete understanding of all these factors is crucial because they either enable or hinder the student's belief, performance, and persistence.

SDT is an approach that examines environmental factors, human motivation, and personal attributes, which identify the nature of an individual's developmental tendencies that highlight essential inner resources and behavioral self-regulation (Ryan & Deci, 2000; Ryan et al., 1997). This theory grounds the examination of self-identity relative to career exploration. As exemplified by Ryan and Deci, "[t]he fullest representations of humanity show people to be curious, vital, and self-motivated. At their best, they are agentic and inspired, strive to learn; extend themselves; master new skills; and apply their talents responsibly" (Ryan & Deci, 2000). Individuals need to harness their curiosity. Their motivation propels them into contiguous and deep learning, fueling persistence against adversity, which assists the student in developing perceptions of themselves and their capabilities.

Ryan and Deci (2000) continued by stating that "motivation concerns energy, direction, persistence, and equifinality-all aspects of activation and intention." In essence, it is the key to developing motivation. Intrinsic motivation is the prototypic manifestation of the human tendency toward creativity and learning (Ryan & Deci, 2000). External social factors explain whether people stand behind a particular behavior if it is significant to the culture. These environmental factors help explain how people determine the meaning of their and others' behavior. (Ryan & Connell, 1989; Ryan & Deci, 2000). People whose motivation is self-authored or endorsed contain more interest, excitement, and confidence than those that are merely externally controlled, which enhance performance, persistence, creativity, heightened vitality, self-esteem, and general well-being (Deci & Ryan, 1995; Nix et al., 1999; Ryan & Deci, 2000; Ryan et al., 1995; Sheldon et al., 1997).

SDT becomes entirely part of the person's nature where the factors foster growth, well-being, healthy development, and effective participation as self, in groups and communities. Their image and well-being can be disrupted by a lack of connectedness, nonoptimal challenges, and excessive controls, resulting in a lack of initiative, responsibility, and increased distress (Ryan & Deci, 2000). Hence, Latinx students need to critically and consistently review what spaces are created to encourage and enrich them, while simultaneously destroying the harmful stereotypes, and replacing them with supportive paradigms. Their experience during their academic career prepares them to identify healthy workplace environments where inclusivity and fairness are present. The goal is a clear, innovative, relevant, and unbiased curriculum embedded with experiences that ignites the student's imagination and prepares them for a fulfilling career equal in compensation to all others in the discipline. Therefore, SDT enables this research to explore the motivations that lead to completing a program of study and beginning employment after graduation, starting with compensation. Although the motivation of SDT can be mainly focused on external environmental factors, also known as extrinsic motivation, it is used to explain how they affect the student's development of their self-identity.

SDT, EVM, and GP explore the foundational implications for a student's self-identity development and performance. For example, we can predict how a student in their early academic career will be impacted when seeing a wage gap and other unfair practices in the workplace. New paths to explore for those anticipated impacts are found in how the student values specific tasks, roles, or even careers. For this, we explore the expectancy-value model.

Expectancy–Value Model

People are all faced with questions of "what do I want to do when I grow up?" especially during their formative years as a youth. What an individual accomplishes in life is contingent on many factors, including their self-image, expectations from family, friends, community, and the larger world. Each person's personality forms a disposition of whether they are open to new and unfamiliar tasks or experiences, either reinforced or diminished by past experience (Eccles et al., 1984; Reyes & Domina, 2017; Updegraff et al., 1996). The gender-linked socialization process influences ability self-concepts, aka self-confidence for ability/task performance (Steffens et al., 2010). Jacquelynne Eccles (2009) found a critical key to success was present when individuals select occupations congruent with their values and a strong held belief. Environmental factors such as family environment, cultural norms, classroom culture/structure, and gender stereotype roles are also impactful to envision future careers (Diekman et al., 2010; Eccles, 2007; Quinn & Cooc, 2015). A student's educational/occupational interests and choices are directly influenced by their perceived immediate success and valued tasks (Eccles, 2009; Wang, 2012).

The EVM model of achievement-related choices is rooted in a framework where one's identity is conceptualized on two self-perceptions: related to personal values/goals and those related to skills, characteristics, and competencies (Eccles, 2009). When the individual and collective identities combine with motivation for specific tasks and activity expectations, EVM explains choices based on one's abilities. For example, when a student enters college and contemplates majoring in engineering, EVM predicts how they would do if they were both confident in their ability to do well in the courses and placed a high value on engineering over another major (Eccles, 2009).

Therefore, how a community provides an environment and set of experiences that transcend a student's current social mores and gender stereotypes to support an unbiased trajectory of growth leading to a STEM career is vital. EVM is central to this study in assessing how adversity can be overcome to earn their degree and get a job. Long-term, EVM provides the basis for an environmental analysis that supports growth in the same occupation or causes a change to an entirely different field. Both EVM and SDT provide a framework that establishes an environment where social gender norms and biases can be neutralized, supporting an overall healthy learning environment that fosters equal learning and performance.

Gender Performance: Learning Differences and Academic Achievement

At the heart of SDT is a relationship between behavior and motivation; the environment and people external to the student can affect their identity, choices, and performance. Substantial motivation translates into types of action or inaction. Performance in science and mathematics is often at the heart of perceived expectations and actual performance. The social mores and gender stereotypes have and will continue to affect students of all ages, negatively impacting self-efficacy and performance (Diekman et al., 2010). The literature shows girls' math performance is equivalent to boys, if not better, yet competency beliefs of boys were frequently reported more favorably (Crombie et al., 2005; Fennema & Hart, 1994; Kimball, 1989; Marsh & Yeung, 1998).

The effect of gender difference on competency beliefs can contribute to lowering enrollment in advanced math courses and pursuing math-related careers (Crombie et al., 2005; Eccles, 1994; Farmer et al., 1999). Girls' math performance and the number of courses taken are very similar to boys (Hyde et al., 2008; Legewie & DiPrete, 2014). Gender stereotyping begins in early childhood relative to their ability {self-efficacy}, performance, and task value {benefit} (Arbona, 2000; Crombie et al., 2005; Eccles, 1994; Wigfield & Eccles, 2000). Gender stereotypes affect women's math self-confidence and performance (Crombie et al., 2005; Nosek et al., 2002; Spencer et al., 1999). Furthermore, the research on math ability shows the gap in performance and course enrollment had narrowed; the data shows girls took as many classes in high school and performed similarly to boys on tests (Lee et al., 2007; Legewie & DiPrete, 2014). Performance and enrollment in sciences and mathematics can be attributed to bias within their school environment.

Optimal classroom environments (factors) in earlier grades can increase student expectancies, subjective task values, and future math educational courses/career aspirations (Carrell et al., 2010; Wang, 2012). Female students who report lower math expectancies and are less likely to consider math careers than boys (Wigfield et al., 2006) despite taking, performing, and valuing subjective math tasks equally as male peers (Wang, 2012). From the students' perspective, teacher expectations are the strongest predictor in math performance and personal task values. Studies suggest teachers held lower expectations for girls than boys (Wang, 2012). Perception, not reality, of teacher gender bias, affects student motivational beliefs and achievement behavior. Female students, even those with the highest math ability and subjective task values, are affected by the belief that their teachers support and have high expectations for them. Those with positive perceptions are most likely to consider a math-related occupation (Carrell et al., 2010; Wang, 2012). Having a mentor provides a student mentee with an opportunity to find relevance to a field, emboldened interest/participation, and help develop their current/future self-concept. A student’s belief that they can successfully perform an action is known as self-efficacy. Classroom culture (environment) creates opportunities for students to engage (Carrell et al., 2010; Eccles, 1994; Estrada et al., 2018).

Kenny et al. (1998) found competency beliefs and utility value mediate the correlation of prior grades and enrollment intentions. No difference in math performance between genders in 9th grade was found even though girls outperformed at the 8th-grade level. The utility value of the task predicted enrollment intentions, but the intrinsic value was not a significant predictor for enrollment for both genders (Combie et al., 2005). Therefore, task importance and prior performance were essential factors in predicting future math enrollment (Crombie et al., 2005; Eccles, 1984; Meece et al., 1990). The perceived cost value of a high utility valued task can negatively affect future enrollment in advanced math courses (Crombie et al., 2005). Wang's (2012) model found that students' seventh-grade motivational beliefs are linked to 12th-grade choices and interests. Further research is needed to identify the link between enrolling in optional math courses and students' competence (Crombie et al., 2005).

Research has shown that men and women generally perform equally in high school math (Friedman, 1989; Hyde et al., 1990; Watt et al., 2006). Skill relevance (intrinsic applicability) along with one's self-confidence (ability) and task enjoyment are significant predictors toward enrollment and participation in math (Benbow & Minor, 1986; Updegraff et al., 1996; Watt, 2005; Watt et al., 2006). How are students' motivation concerning enrollment and performance in math influenced by culture? College-bound students are determined to take four years of math to be competitive; this appeared to provide minimal choice in this context. Math classes are required throughout all primary school years and in at least two years in secondary school in the US, with a solid recommendation to take more to be prepared for postsecondary. All students performed similarly in math in Grades 9 and 11. Boys rated themselves significantly higher than girls on self-perceptions. The most substantial influence on a student's enrollment, for both sexes, was if they like and are interested in math. This is followed by their self-perception about their ability and success expectation (Watt et al., 2006). Girls in the United States have similarly substantial impacts from ability/expectancy beliefs, relevance (intrinsic value), and importance when looking at enrollment. Social gender bias, occupational stereotypes, and how a student values a scientific field influence an individual's decision to pursue a scientific career (Eccles, 2007; Quin & Cooc, 2015; Wang, 2013).

Research shows a link between if a student will choose a STEM career based on their scientific, academic background, performance, and attitude (Quin & Cooc, 2015). Their achievement in high school and preparation explains large portions of the racial/ethnic gaps in the persistence of STEM majors in college (Glass et al., 2013; Quin & Cooc, 2015). Students' prior achievement and skills explain science test score gaps when factoring in SES and race/ethnicity. Many disparities in math and reading develop early on, so those students are at a disadvantage in class (Quin & Cooc, 2015). Studies identify a link between a student's performance in high school with what major they will declare, if they will persist in a STEM degree, along with explaining racial gaps in college (Quin & Cooc, 2015).

According to Frome et al. (2006), “A long-term longitudinal study in the US has shown that many young women opt out of the choice of math- and other STEM-related careers largely because of their desire for a family-flexible career.” Therefore, more exploration is needed to understand the trends of young students graduating in STEM-related fields and the relationship of the jobs acquired based on their program of study and stated job intentions.

Distribution of Jobs Earned

A student’s self-perceptions and how relevant they view math significantly impact enrollment. These disparities are substantial and appear at a very young age (Watt et al., 2006). Watt, Eccles, and Durik (2006) found that differences between genders in how they perceive their ability and success expectations begin early in primary school and need to be addressed from childhood. Transforming primary and secondary instruction and curricula into practical, collaborative, and problem-focused environments help connect the still to the real-world application (Meece & Scantlebury, 2006; Watt et al., 2006). Making math relevant to female students’ lives is helpful to make math skills and their social uses meaningful and vital (Watt et al., 2006). Again, having a mentor provides a protégé with an opportunity to find relevance to a field, embolden interest/participation, and help develop their current/future self-concept.

These mentorships fight the social disparities in our understanding of science and achievement in our high-tech global economy. The large body of research shows women focus on occupations that emphasize intrinsic, altruistic, social rewards, and social interactions, whereas men seek careers involving abstract concepts, physical objects, power, money, and other extrinsic rewards (Beutel & Marini 1995; Davies & Guppy 1997; Eccles 2007; Johnson 2002; Konrad et al. 2000; Legewie & DiPrete, 2014). Career selection and persistence are directly correlated with a woman's self-confidence, whereas those with lower esteem are less likely to choose and persist in male-dominated professions. Research has shifted the focus from self-evaluation of career-relevant skills (Cech et al., 2011) to more role-based confidence reflected by competencies (Legewie & DiPrete, 2014). Concrete experiences, based on strong high school math and science curriculum, encourage girls' interest in STEM fields, reduce the effect of gender stereotyping, along with helping reduce the STEM gender gap (Legewie & DiPrete, 2014). The gap present in achievement is a leading indicator of barriers where students seek to enter these fields (Drew, 2011; Muller et al., 2001; Quin & Cooc, 2015; Wang, 2013). Research shows the likelihood of women declaring STEM majors in college over the past 50 years has made little progress (Quin & Cooc, 2015; Riegle-Crumb & King, 2010). According to Legewie and DePrete, (2014), "Occupational orientations develop during early childhood differently between genders (Tai et al. 2006). Secondary education performance and experience are more important, than college years, in determining the gender gap size in STEM degrees" (Legewie and DiPrete 2014).

The STEM Wage Gap

While differences in performance in mathematics between genders that favor men, typically appear in advanced math courses in secondary school and higher education (Crombie et al., 2005), looking at data at the end of the academic journey whenstudents begin working provides context for this concept's endurance. The 1997–2018 U.S. Department of Labor and Statistics data shows a reduction in the gap.

Between 1997-2012, the number of bachelor's degrees awarded in the United States rose approximately 52.56% for all genders and races/ethnicities, from 1,186,589 degrees conferred in 1997 to 1,810,647 in 2012. Master's degrees increased at a higher rate of 79.9%, from 420,954 in 1997 to 757,387 in 2012. Doctorate degrees had the smallest overall rate increase, rising 19.9%, from 42,539 in 1997 to 51,008 in 2012. The next environmental factor shifts the focus from degrees awarded to the number of people employed in those fields.

Jobs Attained by Discipline

A pre-study of occupational employment statistics data from the U.S. Bureau of Labor Statistics between 1997 and 2018 show that occupations relating to a program of study related to the conferred degree by an institution of higher education found significance in the trend where jobs found in the STEM category over those from other types. The movement for total employees in STEM-related Standard Occupation Codes (SOC) in the United States started at 10,565,740 in 1997 and rose to 16,248,810 in 2018. This represents an overall increase of 53.79%, and the trend explained over 94.4% of the data with a $p<0.0001$ for the period. Shifting the focus to the "Other" category, for education, humanities, and professional degrees (e.g., JD, LLB, MD, DDS, DVM), the revealed total employees began at 7,552,700 in 1997 and increased over 37.4% to

10,458,600 in 2018. In contrast, the Other trendline had a $p<0.001$, only fitting approximately 54% of the data. Overall, the data indicated substantial growth was expected in the upcoming future across all SOCs. However, further analysis is required to see where the percentage distribution, total counts of degree conferrals, and total employees ended up between men and women for the Latinx community compared to White race/ethnicities as defined by the U.S. Government.

Degree Attainment

Revisiting the pre-study analysis of data from 1997-2012 reveals Latinx women consistently received more bachelor’s and master’s degrees than their male counterparts by 45.3%, 53.0% respectively in 1997 and 55.6%, 80.4% respectively in 2012. Women went from earning 44,388 bachelor’s degrees in 1997 to earning 107,568 in 2012, while their increase from master’s degrees began from 9,894 in 1997 to 32,279 in 2012. Doctoral degrees were closer in totals between Latinx men and women over the entire period beginning at 625 and 574 respectively in 1997, rising to 948 and 1,193 respectively in 2012, where women started at the beginning of the period with -8.2% and ended at 25.8% in 2012.

The same data from 1997-2012 shows White women consistently received more bachelor’s and master’s degrees than their male counterparts by 23.61%, 44.49% respectively in 1997 and by 27.94%, 59.26% respectively in 2012. Women went from earning 485,218 bachelor’s degrees in 1997 to earning 635,766 in 2012, while their change in master’s degrees began from 170,411 in 1997, ending up at 138,843 in 2012.

Doctorate degrees were much closer in totals between White men and women over the entire period, having started at 12,966 and 10,966 respectively in 1997 and rose to 12,282 and 11,927 respectively in 2012, with women being at -15.62% difference at the beginning to virtually eliminating the differential ending the period at -2.89%.

The Job Gender Gap (a.k.a. "the Glass Ceiling")

The scientific occupations still have inequities in pay and prestige based on race/ethnicity and gender. Improving the workplace disparity begins with increasing the number of employees to be more balanced through a combination of eliminating science test scores gaps, increasing entry into STEM fields, and persistence in programs of study (Glass et al., 2013; Hill et al., 2010; Quin & Cooc, 2015). Evaluating the gender gap for median earnings for both sexes found a consistent upward trend of median weekly earnings, which began at $721.90/week for men and $593.40/week for women in 2008 and ended at $880.80 and $733.00 respectively in 2018. The trends were relatively close in 2008, converging at some point in late 2019, with the men's slope being higher from that point on through 2018. Overall, women were paid on average 16.9% less than their male counterparts over these ten years.

This gender gap affects the salary between the STEM and non-STEM fields and impacts how we value each occupation and, by extension, each other. This gap has had a harmful effect in dividing humankind by an essentially arbitrary set of paradigms and characteristics. The closure of the gender pay gap reflects and impacts a fundamental shift toward an equitable and just society, beginning in the microcosms that are our various public and private organizations.

Conceptual Framework

This chapter seeks to provide insight into the literature through an examination of the scholarship related to two research questions:

RQ1. Is there a wage gap between STEM and non-STEM positions post-graduation?

RQ2. Is there a difference in the wage gap based on gender, race/ethnicity, discipline, and education level for the Latinx community?

This study uses the motivational components of SDT, extrinsic and intrinsic, as the basis to establish the two major categories of environmental factors, external and internal, respectively. This foundation is expressed in this study as persistence. EVM's predictive nature of how individuals value a task and whether they will engage it in the future expands the foundation to include visualization. It provides a lens to discern when looking back from the end of a student's academic career. The GP framework emphasizes the cost versus value an activity, skill, or goal could provide for a student to succeed. This study begins at the end of the pipeline, at the intersection of graduation and gaining employment, making it unique. It evaluates a national data set to determine which factors are significant across multiple fields, whether the graduating student experiences parity in all forms of compensation across the genders, races/ethnicities, occupations, and degree types upon employment.

Chapter Summary

Chapter 2 began by exploring SDT, EVM, and GP. It continued with a review of the progress of the wage gap focused on science, STEM fields in terms of degrees awarded, the number of jobs in each area, salaries for those employees, and finished with details on the "glass ceiling" experienced by women.

Chapter 3 of this study discusses the methodology, the study design, the sample, the total population, and the corresponding sampling approach. It continues with data collection, data analysis, and review reliability and validity requirements. The chapter concludes with ethical considerations.

CHAPTER 3: METHODOLOGY

Introduction

This study utilized data from the NSF's NSCG between 2010-2019. The data was analyzed based on the race/ethnicity attribute created by the US Census Department, along with attributes for sex (termed gender), highest degree earned (termed degree level), and job category/job code. The data was structured individually and in combinations to explore the research questions using various statistical analysis techniques.

Overview of Purpose

This research study seeks to identify if a wage gap exists between STEM and non-STEM career fields. It also explores whether gender, race/ethnicity, degree type, or a combination therein impacts the wage gap. The purpose of this research is to participate in the ongoing discussion of the STEM wage and gender gaps and their effects on gaining employment or pursuing a program of study in a field in the sciences, technology, engineering, or mathematics postsecondary secondary education using the SDT, EVM, and GP conceptual frameworks.

This chapter continues with a restatement of the research questions and then proceeds with the study's proposed methods. It follows with an explanation of how the archival data was collected and analyzed. Finally, it concludes with an overall summary of the chapter.

National Science Foundation Survey Designs

The National Survey of College Graduates (NSCG) is a study sponsored by the National Science Foundation (NSF) that began in 1993. The NSCG is a rotating panel design, which includes new samples from the American Community Survey (ACS) and returning samples from prior NSCG years. It is collected every 2 to 3 years by the U.S. Census Bureau in one of three manners: an online survey, mail questionnaire, or telephone interview. This study focuses on individuals with education in or who are employed in science and engineering fields and provides data on the number and characteristics of individuals graduating with a bachelor’s degree or higher. The NSF uses this data to prepare congressionally required biennial reports (e.g., *Science and Engineering Indicators* and *Women, Minorities, and Persons with Disabilities in Science and Engineering*) to present information on the science and engineering workforce. The NSCG also provides employers in all sectors an opportunity to see, understand, and evaluate employment opportunities and salaries trends, including the effectiveness of equal opportunity efforts. The NSCG’s key variables are shown in Table 1.

Table 1

National Survey of College Graduates: Key Variables

Key Variable	Key Variable
• Age	• Labor force status
• Certification attainment	• Marital status
• Citizenship status	• Number of children
• Community college enrollment	• Occupation information
• Country of birth	• Primary work activity
• Disability status	• Race and ethnicity
• Educational history	• Salary
• Employer information	• School enrollment status
• Employment sector	• Sex
• Immigration information	• Student loan debt
• Job satisfaction	• Work-related training

Source: U.S. Census 2020

Research Questions and Hypotheses

As stated in Chapter 1, the following research questions guided this study:

Research Question #1

Is there a wage gap between STEM and non-STEM positions post-graduation?

Hypothesis #1

STEM career has no significant impact on the Salary of each respondent.

Research Question #2

Is there a difference in the wage gap based on gender, race/ethnicity, discipline, and education level for the Latinx community?

Hypothesis #2

Gender has no statistically significant impact on respondents' Salary.

Hypothesis #3

The race/ethnicity of the respondent has no significant impact on the Salary.

Hypothesis #4

The degree level of the respondent has no significant impact on the Salary.

Hypothesis #5

The two-way interaction effect of race/ethnicity and Gender on the Salary is not statistically significant.

Hypothesis #6

The two-way interaction effect of Gender and STEM on Salary is not statistically significant.

Hypothesis #7

The two-way interaction effect of race/ethnicity and STEM on Salary is not statistically significant.

Hypothesis #8

*There is no significant Three-Way interaction effect of race/ethnicity * Gender * STEM on the Salary.*

Methods

This investigation assembles existing NSCG cohort responses between 2010 and 2019 that surveyed job earned and the associated characteristics of entering that career. The analysis of this longitudinal and multi-institutional dataset explores the determinants of wages and explanations for the wage gap among college graduates with STEM degrees while highlighting the role of college education in the pay gap.

Three types of quantitative analysis were used to answer the research questions. First, descriptive analysis was employed on critical variables, including demographics (e.g., age, gender, race/ethnicity, and citizenship), education history, employment status, the field of degree, and occupation. Second, two multiple regression analyses were conducted to explore the determinants of income, separately for women and men, and used to identify the extent to which the determinants were similar or different between STEM and non-STEM fields. Third, a factor analysis was performed to understand how the determinants contributed to the significance of each of the variables.

Study Design

This study examined the data set collected between 2010-2019 from the NSCG. The target population of the NSCG included those who had earned a bachelor’s degree or higher in the year before the earliest cohort sample year, were not institutionalized, resided in the United States during each year of the sample, and were younger than 76 years of age. The NSCG used a stratified sampling design to select its sample from the eligible sampling frame.

This quantitative comparative design analyzed the relationship between job earned after graduation and its corresponding salary at the intersection of various independent variables such as participant’s gender, race/ethnicity, and degree earned (including type). The comparative design was intended to identify significant factors that impact the wage earned upon graduation.

Variables

This section describes the outcome measures and the independent variables that were used to predict the outcome. The independent variables in the study are as follows:

- Degree Level: bachelor's, master's, doctorate, or professional
- Degree Category: STEM or non-STEM based on degree conferred
- Job Category: STEM or non-STEM based on and including primary job code
- Gender: female and male
- Race/Ethnicity: Latinx, White, Black, Asian, American Indian/Alaska Native, Hawaiian Native or Pacific Islander, and multiple races.

The dependent variables in the study are as follows:

- Salary: Annual earnings from primary job code

The NSCG data is structured by cohort year, all of which include salary, and utilizes all the listed variables to analyze the research questions. The STEM category (D3stem) for education degree and job was calculated based on the primary job code listed for each respondent. The two categories, STEM and non-STEM, were aggregated as follows: STEM – Biological, agricultural, and other life sciences/scientists; Computer and mathematical sciences/scientists; Engineering/engineers; Physical and related sciences/scientists; Science and Engineering (S&E) related fields/occupations; Social and related sciences/scientists; and Non-STEM – Non-Science and Engineering fields/occupations. This primary job code standard enabled data to span the period for analysis. The other demographic attributes such as gender, race/ethnicity, degree level were fields within the data.

Study Sample

The archival data provided by the National Survey of College Graduates (NSCG) questionnaire responses between 2010-2019 reached out to a population of more than 174.4 million graduates, of which the National Science Foundation (NSF) received more than 448,996 responses. All the data fields included in this study existed in all the survey years incorporated. The NSF used a stratified sampling design to select the participants from the eligible sampling frame. The NSCG used random sampling techniques, probability proportional to size, to choose the sample of participants (National Center for Science and Engineering Statistics, 2017b).

Quantitative Method Data Collection and Data Analysis

This research project used archival data provided by the National Science Foundation. Each NSCG questionnaire contained data fields that could vary by survey year. A key factor for inclusion in the study is that each data field appeared on all survey questionnaires. For example, if a question was either new or retired in a given year, the corresponding data field was excluded from the unified dataset.

Steps for Quantitative Data Collection

The following is a high-level protocol to guide the assembly and analysis of the archival NSGC dataset.

1. Analyzed each NSCG survey year's list of data fields.
2. Consolidated all field analyses into a unified workbook and assessed patterns and persistence across all survey years to determine if each field could be included in the final unified dataset.
3. Applied inclusion criteria for each data field in the final dataset.
    a. Data field existed in all survey years.
    b. If not, the data field was deemed significant when it existed in most surveys.
4. Built a unified dataset based on the selected set of data fields
    a. Created Standard Query Language (SQL) query to pull the desired variables from each survey.
    b. Scrubbed the inclusion field list by database
        i. Cleaned all leading/trailing spaces
        ii. Added calculated fields to standardize field name, using the "D3" prefix, for analysis across the data set period.
    c. Created union queries to assemble each year into a single aggregated data source.
5. Published the dataset source for analysis and visualization by the various software tools.

Data Analysis

The quantitative method of analyzing the dataset was based on standard statistical methods using accepted software tools such as, but not limited to, SPSS, Tableau, and Microsoft Excel. The base dataset determined if a wage gap existed between STEM and non-STEM workers. Data were combined with demographic data to support each research question in their comparative analysis.

1. Data analysis used statistical methods for quantitative research, descriptive statistics, and advanced statistical modeling, including ANOVA, regression, and other techniques.
2. Data were visualized using various software packages such as Microsoft Excel, Tableau, SPSS, and MindManager.
3. Results were compared against questions and other applicable results before being incorporated into Chapter 4.

Testing data for the goodness of fit, using statistical analysis methods including chi-squared statistic (X^2), the Comparative Fit Index (CFI), the standardized root-mean-squared-residual (SRMR), and the root-mean-square error of approximation (RMSEA), are essential to assess both the measurement and structural model integrity (Byrne, 2001; Kline, 2015; M. Wang, 2012; Price, et al., 2017; X. Wang, 2013). Researchers have used ordinary least squares regression (OLS) to analyze the gender gap in the STEM field, noting how the difference changed over time. Controlled OLS regression can also be broken down into categories and run independently against race/ethnicity to explain the correlation of the wage gap between descriptive data and field characteristics (Michelmore & Sassler, 2016). A factorial analysis of variance (ANOVA) can be used to test for the significance of main and interaction effects and more precise estimates of error variance (Fluhr et al., 2017). This study explores relationships between gender, race/ethnicity, STEM/nonSTEM career category, primary job code, and degree level on salary, requiring various statistical methods, including simple correlation, factor analysis, and multidimensional scaling (Kline, 2015). Regression methods are also used to test this study's hypotheses (Kline, 2015).

Reliability and Validity for Quantitative Method

A core foundation to validate all data collected and analyzed as part of the quantitative method of this study is that all data is thematized and weighted based on the frequency of repetition. This is imperative to the integrity of the information because reliability over time, across the sample of respondents represented by field, institution, and primary job code, in conjunction with collection method, could render results of this study, along with the reports generated by the NSCG invalid (Price, et al., 2017). The test-retest reliability factor found in this dataset was assessed by using a split-half correlation, i.e., via the Cronbach's α (the Greek letter alpha), to determine if the coefficient of each of the internal consistency of each item was significant, which is generally +0.80 or greater (Price, et al., 2017).

Chapter Summary

The analysis on the NSF's NSCG data between 2010-2019, comprising 448,996 participants, employs a quantitative research approach to explore whether there is a wage gap between genders, race/ethnicity, STEM categories, job code, and degree level. Each of the survey years included in the study were compiled using their respective variable names and normalized so that a unified dataset could be created for analysis. The statistical methods to explore the relationships between the independent variables and salary include ANOVA, X^2, descriptive statistics, and regression analysis. Results of the study are presented in Chapter 4, followed by discussion and conclusions in Chapter 5.

CHAPTER 4: FINDINGS

Introduction

This chapter illustrates this study results and provides answers to whether there is a wage gap from multiple perspectives: 1) disciplinary field (a.k.a. STEM category and job code), 2) gender, 3) race/ethnicity, 4) degree level, and 5) a combination of the forementioned attributes. The chapter starts with an analysis of the participants of the composite cohort spanning 2010-2019 surveys. It looks at the demographic characteristics of the participants across seven race/ethnicity communities by gender and degree level. Next, it presents the results through the research questions and associated hypotheses, then concludes with a chapter summary.

Demographics of Participants

There are 448,996 respondents to the NSCG survey between 2010-2019, where the total annual responses varied between 77,188 to nearly 104,600 at its peak. The gender distribution across the race/ethnicities for each survey year, displayed in Table 2, showed an almost even split between the genders at 46% female to 54% Male. A surge in respondents appeared in 2013, indicating high enrollment in 2009-2010 caused by the financial crisis that began in 2008, followed by a steady decline in 2015 and 2017 until leveling off in 2019 almost to match the mean across the analysis period.

Table 2

NSCG 2010-2019 Respondents by Gender

Gender	2010	2013	2015	2017	2019	Period
Female	33,849	49,188	42,604	38,202	42,012	205,855
Male	43,339	55,411	48,396	45,470	50,525	243,141
Total	77,188	104,599	91,000	83,672	92,537	448,996

Breaking down the participants according to race/ethnicity, presented in Table 3, show the sample distribution represents on average seven communities: American Indian/Alaska Native 0.43%, Asian 16.39%. Black 7.78%, Latinx 10.10%, Multiple Races 2.51%, Native Hawaiian/Pacific Islander 0.35%, and White 62.43% across the five survey years.

Table 3

NSCG Survey Respondents by Year and Race/Ethnicity

Race/Ethnicity	2010	2013	2015	2017	2019	Period
American Indian/Alaska Native	317	450	389	368	406	1,930
Asian	12,378	16,139	14,076	14,248	16,765	73,606
Black	7,080	8,476	7,016	6,042	6,330	34,944
Latinx	7,533	10,857	9,256	8,060	9,644	45,350
Multiple Race	1,561	2,474	2,317	2,207	2,719	11,278
Native Hawaiian/Pacific Islander	307	368	317	295	271	1,558
White	48,012	65,835	57,629	52,452	56,402	280,330
Total	77,188	104,599	91,000	83,672	92,537	448,996

Looking at the gender composition of participants by race/ethnicity over the study period, shown in Table 4, to determine if the gender distribution maintains its balance across each of the communities.

Table 4

NSCG Survey Respondents by Year, Gender and Race/Ethnicity

Race/Ethnicity	2010		2013		2015		2017		2019	
	M	F	M	F	M	F	M	F	M	F
American Indian/ Alaska Native	161	156	218	232	194	195	187	181	192	214
Asian	7,171	5,207	8,930	7,209	7,786	6,290	7,933	6,315	9,497	7,268
Black	3,193	3,887	3,482	4,994	2,811	4,205	2,591	3,451	2,664	3,666
Latinx	3,890	3,643	5,228	5,629	4,457	4,799	3,925	4,135	4,702	4,942
Multiple Race	777	784	1,130	1,344	1,033	1,284	1,039	1,168	1,279	1,440
Native Hawaiian/ Pacific Islander	179	128	189	179	157	160	149	146	134	137
White	27,968	20,044	36,234	29,601	31,958	25,671	29,646	22,806	32,057	24,345
Total	43,339	33,849	55,411	49,188	48,396	42,604	45,470	38,202	50,525	42,012

The differential in gender distribution for each community for each year in the period, shown in Table 5, revealed a trend in which females in Asian and White communities had significantly fewer participants than male respondents. In contrast, females in Black, Latinx, and multiple race communities consistently surpassed their male counterparts. AIAN and NHPI communities had the closest number of participants between genders.

Table 5

NSCG 2010-2019 Difference between F-M by Survey Year

Race/Ethnicity	2010	2013	2015	2017	2019
	M F	M F	M F	M F	M F
American Indian/ Alaska Native	-3.11%	6.42%	0.52%	-3.21%	11.46%
Asian	-27.39%	-19.27%	-19.21%	-20.40%	-23.47%
Black	21.74%	43.42%	49.59%	33.19%	37.61%
Latinx	-6.35%	7.67%	7.67%	5.35%	5.10%
Multiple Race	0.90%	18.94%	24.30%	12.42%	12.59%
Native Hawaiian/ Pacific Islander	-28.49%	-5.29%	1.91%	-2.01%	2.24%
White	-28.33%	-18.31%	-19.67%	-23.07%	-24.06%
Total	-21.90%	-11.23%	-11.97%	-15.98%	-16.85%

This study’s data utilizes the aforementioned seven race/ethnicity framework and is leveraged to explore the research questions and their associated hypotheses.

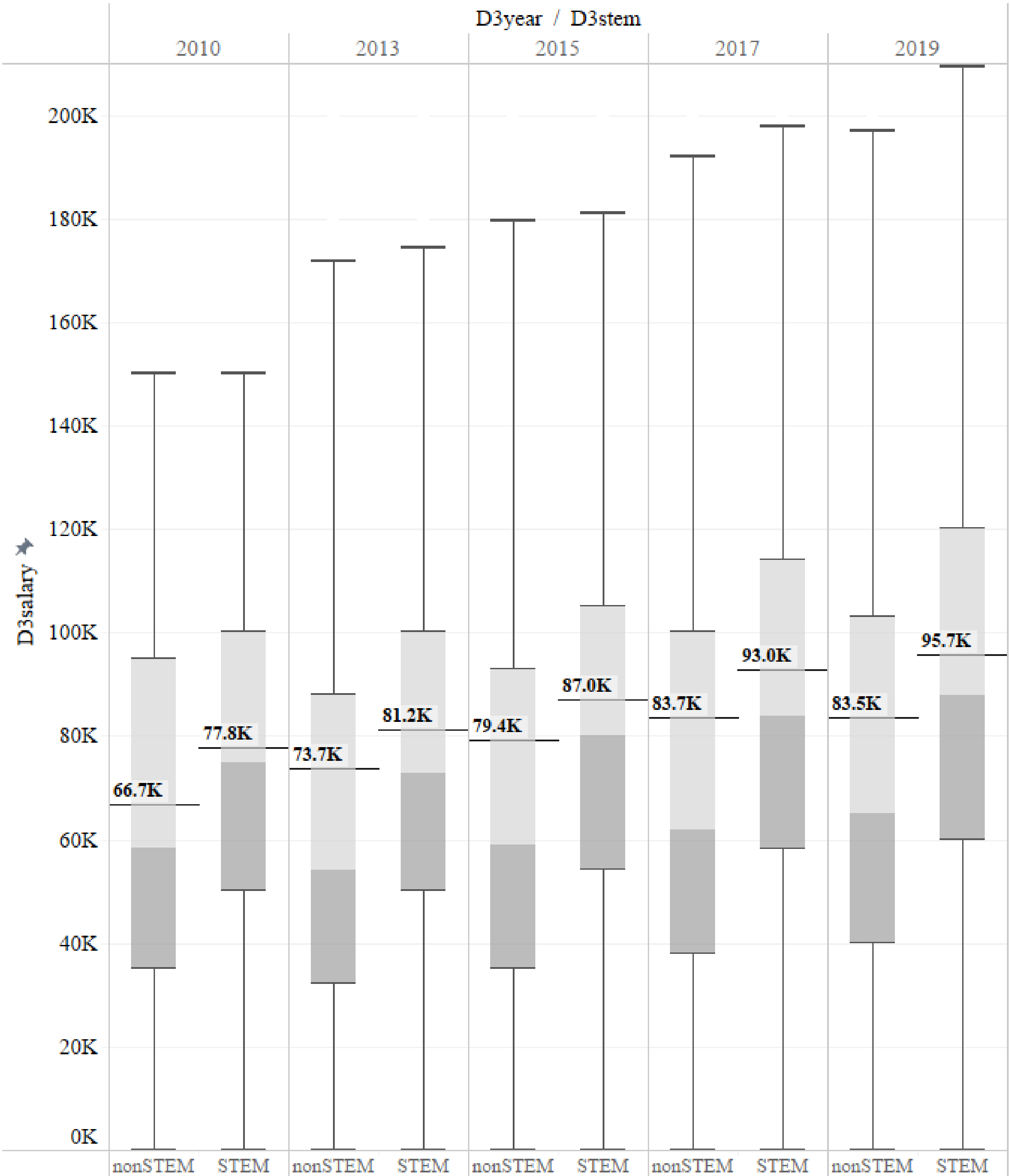
Research Question #1

Is there a wage gap between STEM and non-STEM positions post-graduation? This is an essential beginning question because it takes objective criteria, disciplinary category, and specific job code to analyze the average salary to measure parity. The answer can establish the floor between careers in which a person looking at which job would be more prosperous based on a minimum number of factors – discipline and salary. This becomes the baseline from which other attributes can be added and whose impacts are quantified.

Starting with the unified 2010-2019 NSCG dataset, aggregating it into the two categories by the job codes, and plotting it over time shows that the average STEM salary is consistently higher than the non-STEM category during the entire period. Consolidating the annual wages into a single average value for the period shows that STEM earned $87,074 to the non-STEM period average of $77,542; in other words, non-STEM fields earned on average $9,532 (or 10.95%) less income than STEM disciplines for the same period. A box-plot visualizing the difference between the STEM categories over time, depicted in Figure 1, shows the average salary for each category as the line within the quartile box. It reveals a slight differential increase over the period. The second quartile salaries are relatively consistent with a mild slope for both categories. The third quartile salaries slopes are more distinct with the non-STEM pitch similar to those of the second quartile, while the STEM slope is steepest. Lastly, the median salary difference between non-STEM and STEM categories increases across the period.

Figure 1

Box-Plot of average salaries by year and STEM category



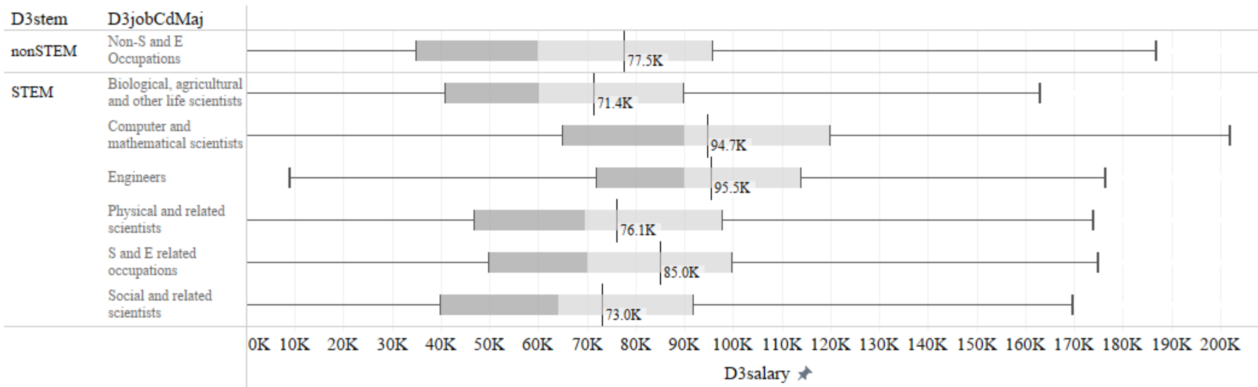
To assess the validity of this first null hypothesis, which states that STEM career has no significant impact on the Salary of each respondent, the analysis began with the two overall discipline categories. Then, the average salary was calculated over the entire survey range of 2010-2019 and showed STEM salaries were nearly 11% over the average salary for the non-STEM category. This is consistent with previous research indicating that STEM disciplines earn more than non-STEM fields. Each category's average salary compared by survey year revealed the differential was consistent over the nine-year duration, with STEM fields making on average more than 10% in higher pay over non-STEM disciplines.

The seven primary job codes are split between two STEM categories and are used throughout this study. The disciplines within STEM are: 1) Biological, agricultural, and other life sciences; 2) Computer and mathematical sciences; 3) Engineering; 4) Physical and related sciences; 5) S&E related fields; and 6) Social and related sciences. The non-STEM category contains a single job code - Non-S&E fields. Please note that the Science and Engineering acronym (S&E) does not combine any job codes but enables reference to general supporting STEM fields defined by the U.S. Census Bureau.

Expanding the analysis by these detailed major job codes to create Figure 2 shows the average salary variation was congruent with current research, with Computer and Engineering fields at approximately 22% higher than the non-STEM fields. Exceptions to the research were the life, physical, and social sciences, which computed just below the non-STEM average salary, ranging from approximately -2% to -8%, for the same period.

Figure 2

Box-Plot of average salaries by STEM category - primary job code for the period

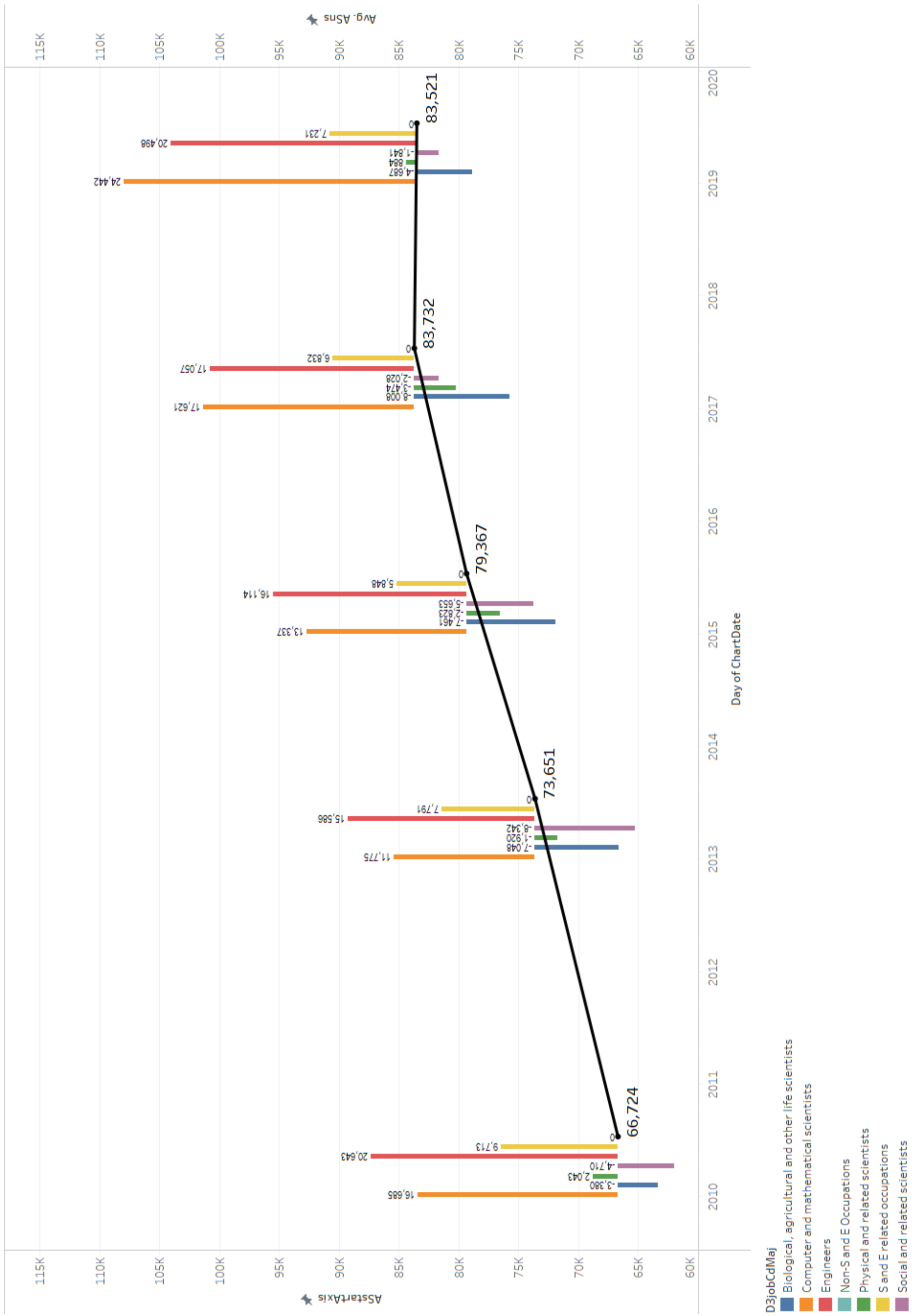


Plotting the expanded data by year according to the various major principal job codes based on the non-STEM category for non-science and engineering occupations, titled "Non-S and E Occupations," to produce average salary differences yields found in Figure 3. This chart computed the average salary for a given year for the non-STEM job code (the line plot with bold, large font) and then presented the variances compared to the other STEM job codes. For example, the vertical bars above or below the line indicated higher or lower average wages than the baseline salary. Two of the highest fields were computers and engineering, which are congruent with research.

Figure 3 shows how the average salaries differ across the period against the non-STEM job category. For example, it indicates that non-STEM fields typically earn less than most STEM fields, which is congruent with the literature. The main exceptions during this period were that it exceeded biology, agriculture, other life, and social sciences.

Figure 3

STEM Average Salaries Compared to Non-STEM Job Code



The ANOVA analysis revealed the STEM category variable (D3stemV) was highly significant upon salary ($p = 0.000$). For comparison, the same ANOVA was run on the entire 1993-2019 data set and revealed significance throughout the nearly 30-year span ($p = 0.000$). Therefore, the STEM category has a significant impact on salary. This comparison was completed because the variables included were continuous and not reliant on race/ethnicity, which was explored in our next research question.

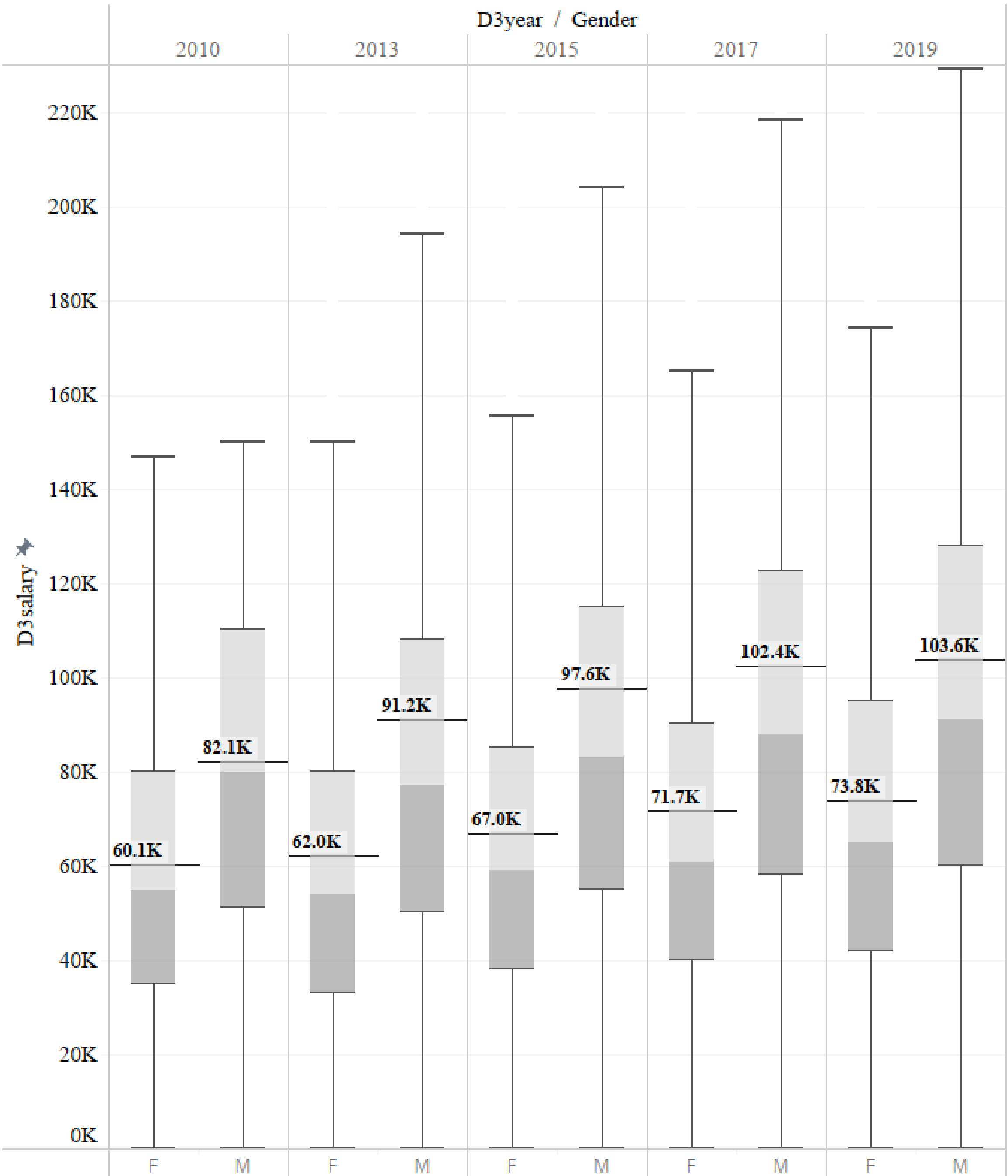
Research Question #2

Taking the baseline analysis of the wage gap compared across STEM and non-STEM fields and applying the gender of the graduate to it, are there any noticeable changes or trends that appear at this intersection?

To assess the validity of this second null hypothesis (H_2), gender has no statistically significant impact on respondent's salary, the analysis started with the two genders, female and male, as reported by the participants on their NSCG questionnaires. The average salary was calculated over the entire survey range of 2010-2019 and revealed STEM salaries were nearly 11% over the non-STEM category. As a single value over the range, the overall average salary between the genders showed a nearly 30% discrepancy in pay between men and women, favoring men as depicted in Figure 4. Comparing the individual values within the period indicates that the gender wage gap was 30% or more in three of the five survey years, with the remaining two greater than 26%, reinforcing this current inequity.

Figure 4

Box-Plot of average salaries by year and gender



An ANOVA was computed to identify if there was an effect by gender on salary, which confirmed gender was highly significant ($p = 0.000$). Therefore, gender had a significant impact on salary. I also ran an identical ANOVA calculation on the full NSCG 1993-2019 data set because race/ethnicity was isolated and found Gender was highly significant ($p = 0.000$) on salary over the 26 years. The impact of race/ethnicity was the focus of the following hypothesis.

To assess the validity of this third null hypothesis (H_3), the race/ethnicity of the respondent had no significant impact on the salary, the analysis began with the race/ethnicity standard categories derived by the U.S. Census Bureau and the National Science Foundation on this survey. The values in this variable were captured in Table 6, which included: American Indian/Alaska Native; Asian; Black; Latinx; Multiple races; Native Hawaiian/Other Pacific Islander; and White.

Table 6

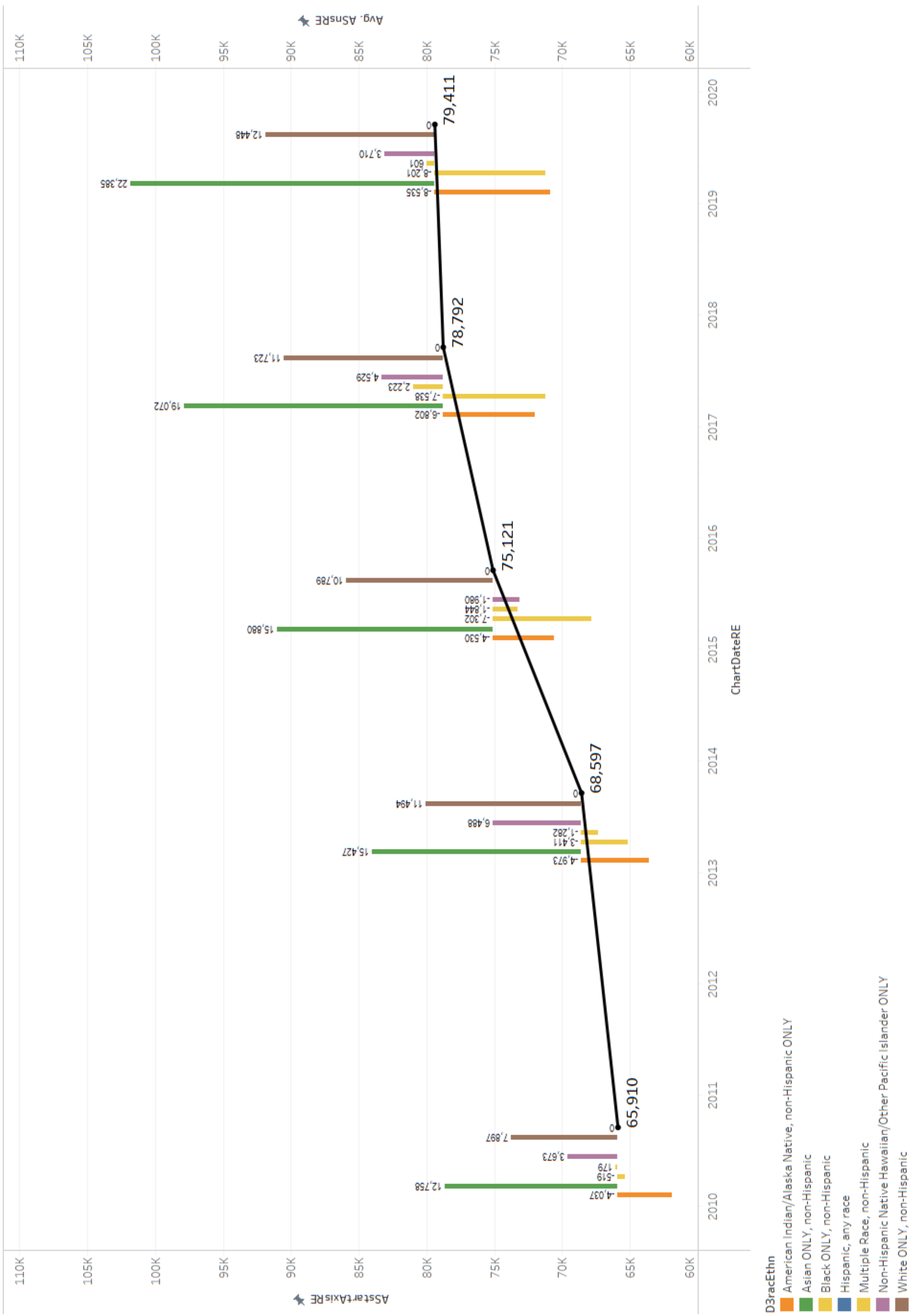
Average salary by Race/Ethnicity

Race/Ethnicity	2010	2013	2015	2017	2019
American Indian/Alaska Native	61.9 K	63.6 K	70.6 K	72.0 K	70.9 K
Asian	78.7 K	84.0 K	91.0 K	97.9 K	101.8 K
Black	65.4 K	65.2 K	67.8 K	71.3 K	71.2 K
Latinx	65.9 K	68.6 K	75.1 K	78.8 K	79.4 K
Multiple Race	66.1 K	67.3 K	73.3 K	81.0 K	80.0 K
Native Hawaiian/Pacific Islander	69.6 K	75.1 K	73.1 K	83.3 K	83.1 K
White	73.8 K	80.1 K	85.9 K	90.5 K	91.9 K

Figure 5 shows average salaries for all seven racial/ethnicity communities by year, using the Latinx community as the datum to visualize the annual average salary differences. This chart calculated the average salary for a given year for the Latinx community (the line plot with bold, large font) and then presented the variances relative to the other races/ethnicities. Those vertical bars moving above or below the line made relatively higher or lower average wages. The two highest compensated communities, Asians (the green bar) and White (the purple bar), are congruent with the literature.

Figure 5

Average Salary Race/Ethnicity Differentials compared to Latinx community



The average salary differential for each race/ethnicity compared to the White community, including the annual average salary, is computed. The results and their total impact relative to the baseline community can be reviewed in Table 7. An ANOVA testing if race/ethnicity did not affect salary is performed and finds race is highly significant (p = 0.000).

The data also shows the Asian community earned higher pay than the White community, which appears to be a recent change and departure from the literature. The magnitude of the wage gap between the race/ethnicities compared to the White community revealed the wage gap maintained the direction but nearly doubled over the nine years, as seen in Table 7. The Black community experiences the most significant wage gap growth, based on the NSCG data, of 145%, from -$8,416.63 in 2010 to -$20,648.86 in 2019.

Table 7

Average Salary Wage Gap by Race/Ethnicity

Race/Ethnicity	2010	2013	2015	2017	2019
American Indian/Alaska Native	-11.9 K	-16.5 K	-15.3 K	-18.5 K	-21.0 K
Asian	4.9 K	3.9 K	5.1 K	7.3 K	9.9 K
Black	-8.4 K	-14.9 K	-18.1 K	-19.3 K	-20.6 K
Latinx	-7.9 K	-11.5 K	-10.8 K	-11.7 K	-12.4 K
Multiple Race	-7.7 K	-12.8 K	-12.6 K	-9.5 K	-11.8 K
Native Hawaiian/Pacific Islander	-4.2 K	-5.0 K	-12.8 K	-7.2 K	-8.7 K
White	0.0 K	0.0 K	0.0 K	0.0 K	0.0 K

Therefore, race/ethnicity significantly impacts salary, and its direction depends on which race/ethnicity is. For example, the data in Table 7 shows that the White community, serving as the datum for the analysis, holds a sizeable average salary for each year over the other communities. However, this data does not show how each participant determined what to report for their particular race/ethnicity, which can skew the numbers between the seven communities. The results also indicate the salary gap increased for all except the Asian community. Except for the Asian community, the data shows that identification with a non-White race/ethnicity would expect a lower annual salary. This race/ethnicity wage gap can cause students to be concerned and look for ways to mitigate this injustice. Finally, how does the degree level affect the pay earned by a graduating student?

The fourth null hypothesis (H_4), stating that the degree level of the respondent had no significant impact on the salary, analysis begins with the type of degree conferred—bachelor's, master's, doctorate, or professional—as reported by the participants on their NSCG questionnaires. The average salary was calculated over the entire survey range of 2010-2019. It showed wages progressively increased as the student went further down the degree level, with virtually steady increases over the nine years, as shown in Table 8. Master's degrees averaged 13.5% more salary over bachelor's degree holders for the period. Doctorate recipients averaged 36.6% more than bachelor's degree holders between 2010-2019. Those with Professional degrees averaged 85.2% more salary than bachelor's degree holders over this same nine-year span. Much like the higher wages in

2013 related to the increasing demand for laborers due to economic recovery after the financial crisis in 2008-2009, the number of degrees earned and the subsequent impact on the pay gap by degree level. The professional gap more than doubled between 2013 (109.3%) and 2010 (52.1%) and then settled down closer to the mean increase pay gap by level.

Table 8

Average Salary by Degree Level

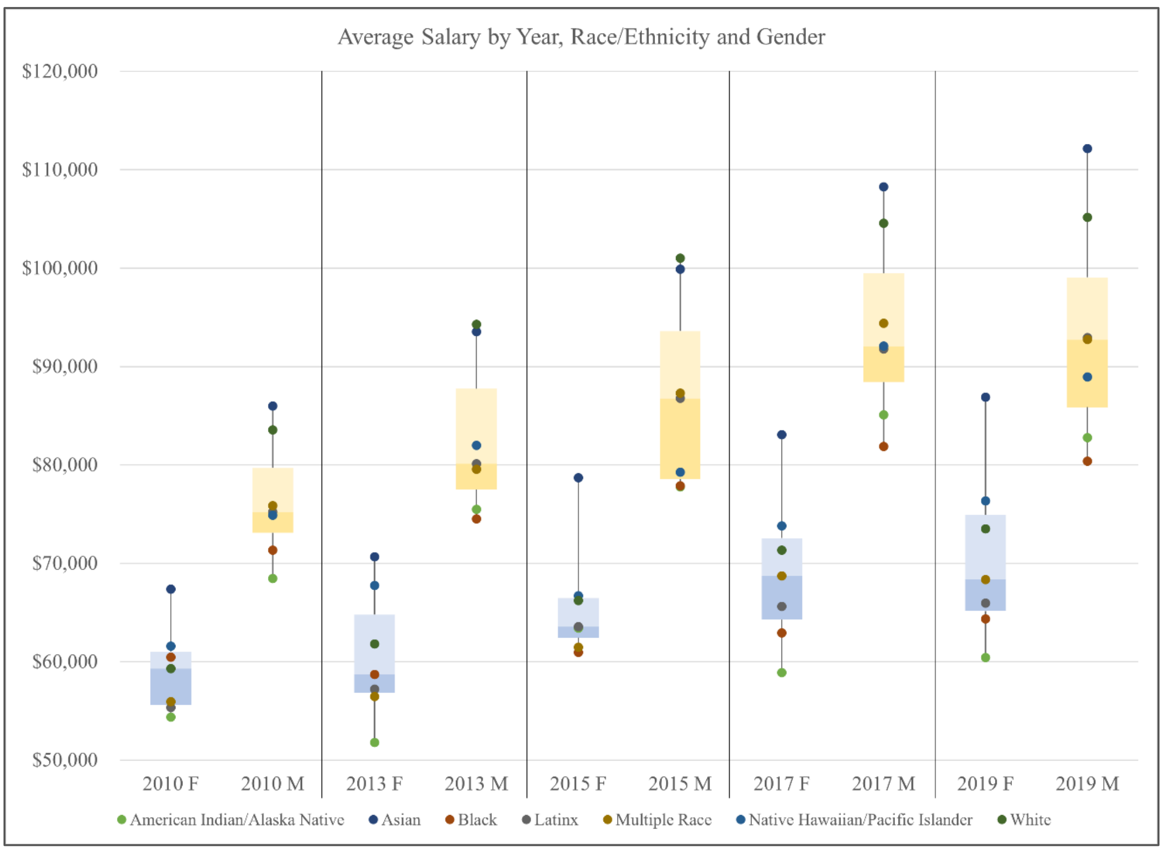
Degree Level	2010	2013	2015	2017	2019	Period
Bachelor's	$ 66,470	$ 68,928	$ 74,716	$ 79,543	$ 80,928	$ 74,117
Master's	$ 74,593	$ 78,277	$ 84,445	$ 89,663	$ 92,220	$ 83,840
Doctorate	$ 85,474	$ 95,976	$ 101,306	$ 106,276	$ 110,794	$ 99,965
Professional	$ 101,129	$ 144,272	$ 147,615	$ 154,248	$ 149,090	$ 139,271

An ANOVA test is conducted to determine whether a degree level has no impact on salary and finds the effect on pay from the most recent degree conferred is highly significant ($p = 0.000$). Consistent with previous comparisons where race/ethnicity is excluded, we ran an identical ANOVA calculation on the full NSCG 1993-2019 data set and found degree level was highly significant ($p = 0.000$) on salary over the whole duration. Thus, the following hypothesis began to combine the impact of variables on salary.

The fifth hypothesis (H_5), the two-way interaction effect of race/ethnicity and gender on the salary is not statistically significant, began analyzing the impact of combining two variables on salary. For example, how did the interaction between race/ethnicity and gender affect salary? Modeling the three variables over the survey years for average salary showed similar pay discussed in hypothesis 3.

Figure 6

Box-Plot of average salaries by year, race/ethnicity, and gender



Plotting all of the average salaries for each gender and race/ethnicity by survey year, as shown in Figure 6, shows that males have higher wages than women, which increases over time. However, the slopes for the period show that male salaries grew at a higher rate than women's salaries. The side-by-side plots show the magnitude of the gender wage gap by year.

Table 9

Average Salary by Race/Ethnicity and Gender

Race/Ethnicity	Gender	2010	2013	2015	2017	2019
American Indian/Alaska Native	F	$54.4 K	$51.8 K	$63.4 K	$58.9 K	$60.4 K
	M	$68.4 K	$75.5 K	$77.7 K	$85.1 K	$82.8 K
Asian	F	$67.4 K	$70.7 K	$78.7 K	$83.1 K	$86.9 K
	M	$86.0 K	$93.5 K	$99.9 K	$108.3 K	$112.1 K
Black	F	$60.5 K	$58.7 K	$61.0 K	$62.9 K	$64.3 K
	M	$71.3 K	$74.5 K	$77.9 K	$81.9 K	$80.4 K
Latinx	F	$55.3 K	$57.2 K	$63.6 K	$65.6 K	$66.0 K
	M	$75.2 K	$80.1 K	$86.8 K	$91.8 K	$93.0 K
Multiple Race	F	$55.9 K	$56.4 K	$61.5 K	$68.7 K	$68.4 K
	M	$75.8 K	$79.6 K	$87.3 K	$94.4 K	$92.7 K
Native Hawaiian/Pacific Islander	F	$61.6 K	$67.7 K	$66.7 K	$73.8 K	$76.3 K
	M	$74.9 K	$82.0 K	$79.3 K	$92.1 K	$89.0 K
White	F	$59.3 K	$61.8 K	$66.2 K	$71.3 K	$73.5 K
	M	$83.5 K	$94.3 K	$101.0 K	$104.6 K	$105.1 K

Table 9 shows Asian males make the highest average salary among all the communities, followed closest by White males. Latinx women were ranked 12th, with Latinx males at 4th, of the 14 average gender-race/ethnicity salaries. As per the paradigm of determining all variances against a baseline of White males, the data showed men consistently were paid higher wages than females in their community.

Table 10

Average Salary by Race/Ethnicity and Gender Differentials

Race/Ethnicity	Gender	2010	2013	2015	2017	2019
American Indian/Alaska Native	F	-$29.2 K	-$42.5 K	-$37.6 K	-$45.7 K	-$44.7 K
	M	-$15.1 K	-$18.8 K	-$23.3 K	-$19.5 K	-$22.4 K
Asian	F	-$16.2 K	-$23.6 K	-$22.3 K	-$21.5 K	-$18.3 K
	M	$2.4 K	-$0.8 K	-$1.1 K	$3.7 K	$7.0 K
Black	F	-$23.1 K	-$35.6 K	-$40.0 K	-$41.6 K	-$40.8 K
	M	-$12.2 K	-$19.8 K	-$23.1 K	-$22.7 K	-$24.8 K
Latinx	F	-$28.2 K	-$37.1 K	-$37.5 K	-$38.9 K	-$39.2 K
	M	-$8.3 K	-$14.1 K	-$14.2 K	-$12.8 K	-$12.2 K
Multiple Race	F	-$27.6 K	-$37.8 K	-$39.5 K	-$35.9 K	-$36.8 K
	M	-$7.7 K	-$14.7 K	-$13.7 K	-$10.2 K	-$12.4 K
Native Hawaiian/Pacific Islander	F	-$22.0 K	-$26.5 K	-$34.3 K	-$30.8 K	-$28.8 K
	M	-$8.7 K	-$12.3 K	-$21.8 K	-$12.5 K	-$16.2 K
White	F	-$24.2 K	-$32.5 K	-$34.8 K	-$33.2 K	-$31.7 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K

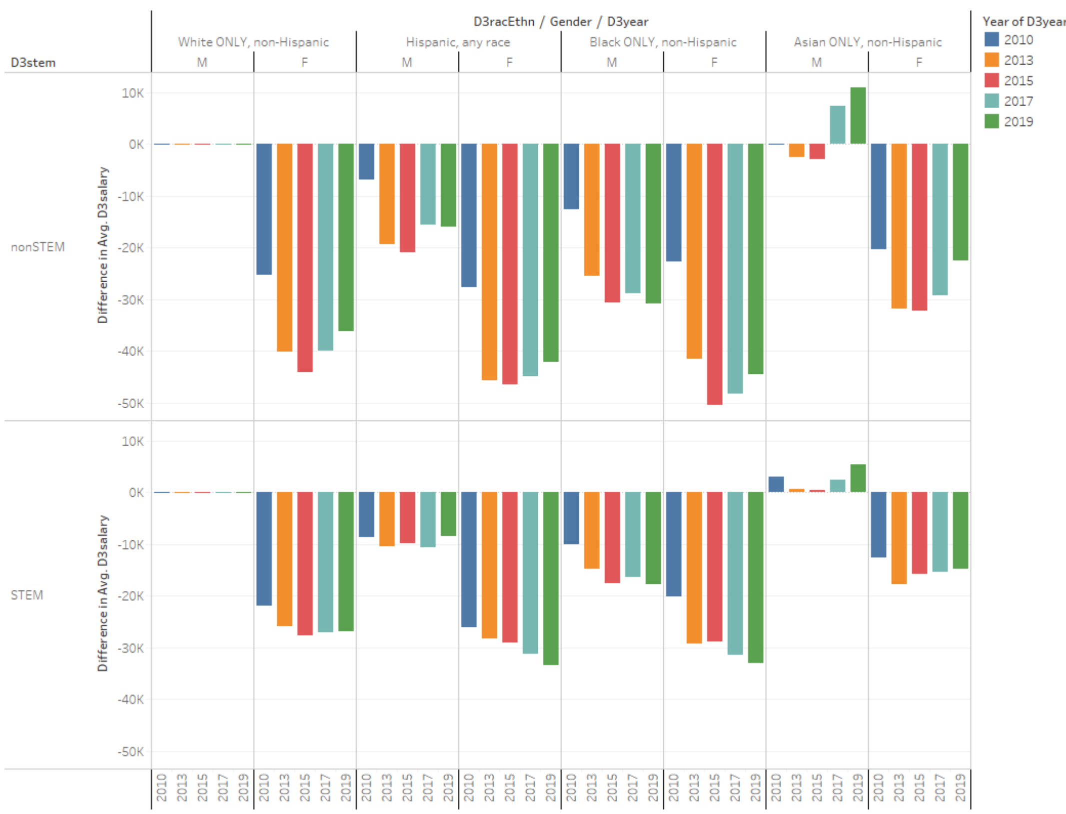
Table 10 shows the variances of average salaries of White males compared to the other communities, both men and women, for each year. Ranking the period average salary differentials from highest to lowest during the show: Asian men ($2,711.60), White men ($0.00), Multiple race/ethnicities males ($11,133.40), Latinx males ($12,479.46), Pacific Islander men ($14,905.74), Native American males ($19,896.14), Asian females ($20,040.83), Black males ($21,030.49), Pacific Islander females ($28,720.45), White women ($31,483.78), Multiple race/ethnicities women ($35,122.20), Latinx females ($36,274.80), Black females ($36,675.08), and Native American females ($40,124.94).

The combined average differentials found by using White males as the baseline and comparing all the other genders/communities revealed men and women had an average gap of ($12,788.94) and ($32,634.58), respectively, over the entire period. This differential represented either 155% more or 61% less when comparing men and women's average pay gap from their respective perspectives.

Figure 7 depicts the salary differences between race/ethnicities by gender over the five surveys in the period.

Figure 7

Salary Differences by Gender and Race/Ethnicity Compared to White Men



The gender pay gap within each racial/ethnic communities shown in Figure 7 is detailed in Table 11. It shows females made on average $21,672.64(or 24.73%) less in salary than males in their respective communities. Ranking the period average salary gender gap between females and men within their community shows: 1) White women have the most significant gap (-$31.3K); 2) Latinx & Multiple race women tied for second worse gap (-$23.8K); 3) Asian women had the third worse wage gap (-$22.6K); 4) AIAN women had the fourth worse wage gap (-$20.1K); 5) Black women had the fifth worse wage gap (-$15.7K); 6) NHPI women had the least wage gap within the NSCG data (-$14.2K). Only three (NHPI, Black, & AIAN) of the seven communities had gender gaps under the period average for all females in the sample.

Table 11

Average Salary by Race/Ethnicity and Gender Within the Community

Race/Ethnicity	Gender	2010	2013	2015	2017	2019
American Indian/Alaska Native	F	-$14.1 K	-$23.7 K	-$14.4 K	-$26.2 K	-$22.4 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
Asian	F	-$18.6 K	-$22.9 K	-$21.2 K	-$25.2 K	-$25.3 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
Black	F	-$10.9 K	-$15.8 K	-$16.9 K	-$18.9 K	-$16.0 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
Latinx	F	-$19.9 K	-$22.9 K	-$23.2 K	-$26.1 K	-$27.0 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
Multiple Race	F	-$19.9 K	-$23.1 K	-$25.8 K	-$25.7 K	-$24.4 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
Native Hawaiian/Pacific Islander	F	-$13.3 K	-$14.2 K	-$12.6 K	-$18.3 K	-$12.6 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
White	F	-$24.2 K	-$32.5 K	-$34.8 K	-$33.2 K	-$31.7 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K

A two-way ANOVA testing if race/ethnicity and gender had no impact on salary was performed. Both race/ethnicity (p = 0.000) and gender (p = 0.000) were found to be highly significant in their impact on salary. A regression analysis confirmed that race/ethnicity and gender are highly significant on salary with p=0.000, as shown in Table 12.

Table 12

Regression Analysis: Gender & Race/Ethnicity impact on Salary

H_5	Measure	Salary (DV)	Gender (IV)	Race/Ethnicity (IV)	Constant (Model)
Descriptive Statistics	Mean	82910.03	.44	6.85	
	Std. Dev	77712.381	.497	2.143	
	N	374094	374094	374094	
Coefficients	Unstd Coef B		-28643.231	-578.265	99590.529
	Unstd Coef Std. Err		251.396	58.282	434.335
	Std Coef Beta		-.183	-.016	
	t		-113.937	-9.922	229.294
	p		.000	.000	.000

The sixth hypothesis (H_6) used a two-way interaction effect of gender and STEM category to test their impact on salary. H_6 is important to determine if STEM as a discipline can mitigate the impact that gender has on pay and vice-versa or if they compound their effect. The null hypothesis is that the gender and STEM category effects do not impact the salary. The average wage is calculated at the intersection of gender and STEM categories over the entire survey range of 2010-2019 and is captured in Table 13.

Table 13

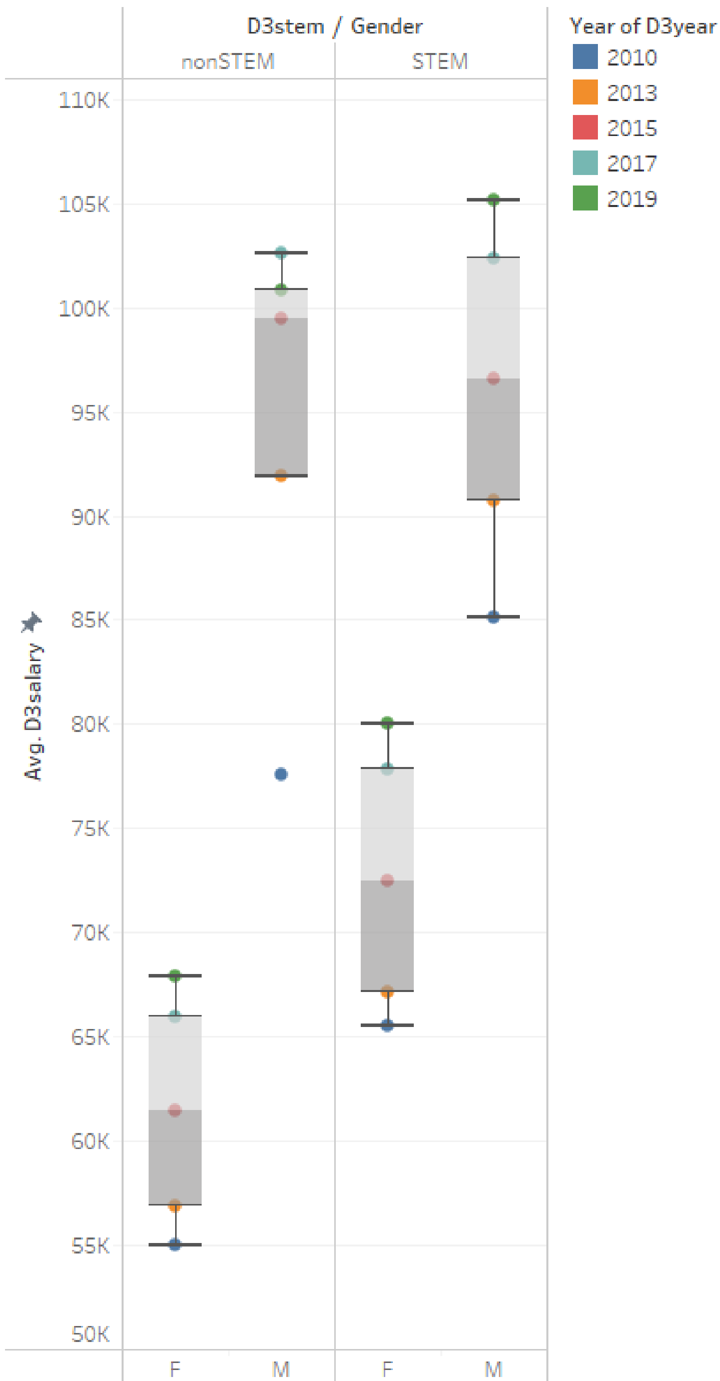
Average Salary by STEM Category and Gender

STEM Category	Gender	2010	2013	2015	2017	2019
Non-STEM	F	$55.0 K	$56.9 K	$61.4 K	$66.0 K	$67.9 K
	M	$77.6 K	$91.9 K	$99.4 K	$102.6 K	$100.9 K
STEM	F	$65.5 K	$67.2 K	$72.5 K	$77.9 K	$80.0 K
	M	$85.1 K	$90.7 K	$96.6 K	$102.3 K	$105.2 K

To better visualize the STEM wage gap between the categories, quartiles for the entire period were computed to visualize within a box plot. Figure 8 presents this box plot and each annual average salary within the period. It shows a larger STEM gender wage gap for the non-STEM category than the STEM category. It also shows that the average wages for men are closely aligned between the categories (non-STEM $94,561 and STEM $96,261). In contrast, the female salaries show that the STEM category ($72,620) is much higher than the non-STEM category ($61,548).

Figure 8

Box-Plot of average salaries by STEM category and gender



The average salary difference calculated against a baseline of STEM males averaged $20,018 (or 20.8%) less in pay for the other three categories for the entire period. The gender pay gap by STEM category, shown in Table 14, revealed women earned on average from $21,082 up to $31,069 less in pay over the nine years when STEM categories were combined and compared.

Table 14

Average Salary Gender Pay Gap by STEM Category

STEM Category	Gender	2010	2013	2015	2017	2019
Non-STEM	F	-$22.5 K	-$35.0 K	-$38.0 K	-$36.7 K	-$33.0 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K
STEM	F	-$19.6 K	-$23.6 K	-$24.2 K	-$24.4 K	-$25.1 K
	M	$0.0 K	$0.0 K	$0.0 K	$0.0 K	$0.0 K

A two-way ANOVA analysis is computed between STEM categories and gender and their effect on salary, which showed both variables were highly significant (p = 0.000). Consistent with previous comparisons where race/ethnicity was excluded, an identical ANOVA calculation was run on the full NSCG 1993-2019 data set. This analysis revealed the STEM category–gender intersection was highly significant (p = 0.000) on salary, in both the nine-year and 26-year perspectives, race/ethnicity and gender impacted pay.

The last two-way interactions assessed the effect of race/ethnicity and STEM categories on salary. The seventh null hypothesis (H_7) explores whether the two-way interaction between race/ethnicity and STEM categories does not affect salary. The average wage is calculated at the intersection of race/ethnicity and STEM categories over each year of the entire survey range of 2010-2019. The resulting table from modeling the variables for these data is immense, as shown in Table 15. It begins with the major job code, followed by the race/ethnicity category, and then displays average salaries by year. This presentation can be helpful to assess the earning potential over time across all the racial/ethnic communities. Selecting a particular year and scrolling down the table enables a comparison of the major job codes by racial/ethnic community. The table was then restructured with race/ethnicity as the primary grouping, followed by a major job code to display how salaries compare across the various primary occupations. As the null hypothesis stated, there should be no change in salary at the intersection of primary job code and race/ethnicity.

Analysis of this hypothesis begins with average salary descriptive statistics over the 2010-2019 period in biology, which shows an average salary for all communities and all years of $71,356. The corresponding average salary ranges between $61,387 to $93,104 across the racial/ethnic categories. The computer and math job code has an overall average salary of $94,702 for the period, ranging from $76,018 to $102,628 across the communities. The engineering category has an overall average salary of $95,542 during the nine-year sample, ranging from $87,359 to $98,396 across the communities. Non-S&E occupations have a period average salary of $77,542, with racial/ethnic community salaries ranging from $59,240 to $86,679.

Table 15

Average Salaries by STEM Category and Race/Ethnicity

Primary Job Code	Race/Ethnicity	2010	2013	2015	2017	2019
Biological, agricultural, and other life scientists	American Indian/Alaska Native	61.6 K	57.6 K	62.9 K	68.6 K	60.9 K
	Asian	65.8 K	68.6 K	76.6 K	75.5 K	83.1 K
	Black	61.7 K	57.8 K	64.1 K	73.5 K	78.4 K
	Latinx	57.4 K	62.7 K	64.6 K	70.4 K	65.5 K
	Multiple Race	52.8 K	54.2 K	64.6 K	71.3 K	73.4 K
	Native Hawaiian/Pacific Islander	70.9 K	127.6 K	66.1 K	87.4 K	76.6 K
	White	63.7 K	67.3 K	72.1 K	76.7 K	79.2 K
Computer and mathematical scientists	American Indian/Alaska Native	78.7 K	67.0 K	77.9 K	79.5 K	80.5 K
	Asian	89.8 K	92.3 K	100.8 K	107.5 K	115.8 K
	Black	72.3 K	72.8 K	77.0 K	87.1 K	87.9 K
	Latinx	71.0 K	73.8 K	83.2 K	85.7 K	94.7 K
	Multiple Race	75.0 K	75.2 K	89.5 K	96.3 K	101.2 K
	Native Hawaiian/Pacific Islander	74.9 K	79.6 K	87.2 K	78.2 K	98.1 K
	White	84.0 K	85.5 K	91.9 K	101.4 K	107.1 K
Engineers	American Indian/Alaska Native	91.1 K	87.6 K	96.4 K	85.7 K	90.6 K
	Asian	87.9 K	92.3 K	99.1 K	104.0 K	106.7 K
	Black	80.4 K	81.9 K	89.0 K	95.2 K	98.6 K
	Latinx	81.2 K	81.5 K	90.5 K	100.0 K	100.4 K
	Multiple Race	82.2 K	82.5 K	92.5 K	89.8 K	94.9 K
	Native Hawaiian/Pacific Islander	89.1 K	86.9 K	90.4 K	112.3 K	104.4 K
	White	88.8 K	90.5 K	95.9 K	100.6 K	104.2 K
Non-S&E Occupations	American Indian/Alaska Native	51.6 K	52.4 K	58.5 K	64.7 K	67.2 K
	Asian	70.2 K	79.7 K	87.3 K	94.8 K	97.8 K
	Black	61.2 K	61.6 K	62.2 K	65.5 K	64.8 K
	Latinx	62.0 K	63.1 K	70.1 K	74.0 K	73.2 K
	Multiple Race	61.6 K	61.4 K	67.9 K	77.8 K	72.6 K
	Native Hawaiian/Pacific Islander	65.5 K	71.1 K	68.1 K	78.3 K	77.0 K
	White	68.2 K	77.2 K	83.2 K	86.5 K	86.2 K
Physical and related scientists	American Indian/Alaska Native	68.1 K	66.1 K	62.6 K	64.9 K	70.7 K
	Asian	67.8 K	64.1 K	68.7 K	73.2 K	77.8 K
	Black	64.1 K	61.1 K	61.7 K	67.1 K	74.6 K
	Latinx	55.9 K	66.3 K	77.4 K	68.0 K	72.4 K
	Multiple Race	61.9 K	65.3 K	70.0 K	85.9 K	80.6 K

Primary Job Code	Race/Ethnicity	2010	2013	2015	2017	2019
	Native Hawaiian/Pacific Islander	64.7 K	72.8 K	91.3 K	90.3 K	76.4 K
	White	70.9 K	75.1 K	79.2 K	83.4 K	87.8 K
S&E related occupations	American Indian/Alaska Native	67.6 K	82.2 K	91.2 K	89.6 K	74.0 K
	Asian	85.2 K	88.0 K	90.5 K	98.6 K	101.1 K
	Black	69.4 K	67.5 K	72.0 K	74.0 K	73.9 K
	Latinx	70.6 K	75.7 K	76.9 K	80.8 K	81.9 K
	Multiple Race	72.8 K	75.9 K	73.1 K	78.2 K	81.5 K
	Native Hawaiian/Pacific Islander	65.9 K	68.2 K	70.8 K	85.9 K	88.4 K
	White	76.1 K	82.6 K	87.3 K	92.4 K	91.7 K
Social and related scientists	American Indian/Alaska Native	61.3 K	57.3 K	59.0 K	60.9 K	74.0 K
	Asian	61.5 K	64.5 K	77.0 K	94.4 K	83.4 K
	Black	57.2 K	55.8 K	62.6 K	71.7 K	68.1 K
	Latinx	59.3 K	59.1 K	69.1 K	75.7 K	82.1 K
	Multiple Race	51.3 K	53.5 K	59.5 K	81.7 K	71.7 K
	Native Hawaiian/Pacific Islander	79.8 K	61.5 K	62.1 K	67.8 K	74.6 K
	White	63.4 K	68.0 K	76.0 K	82.3 K	83.4 K

Physical and related scientists' overall average salary is $76,110, encompassing $65,032 to $79,114 for the communities. Science and engineering-related occupations have an average salary of $85,006, with community average salaries between $71,199 and $92,971. Finally, social and related scientists have an overall average salary of $72,984, with the lowest average salary of $61,837 to a high of $76,185. Thus, descriptive statistics established a foundation that begins to refute the null hypothesis.

Another way these data revealed trends in variations was by visualizing a combination of a specific racial/ethnic community to base all the calculations, in this case, Latinx, selecting a single STEM major job code and comparing the other occupations to identify salary variations.

Figure 9

STEM Job Salary Comparison: Latinx and Non-STEM

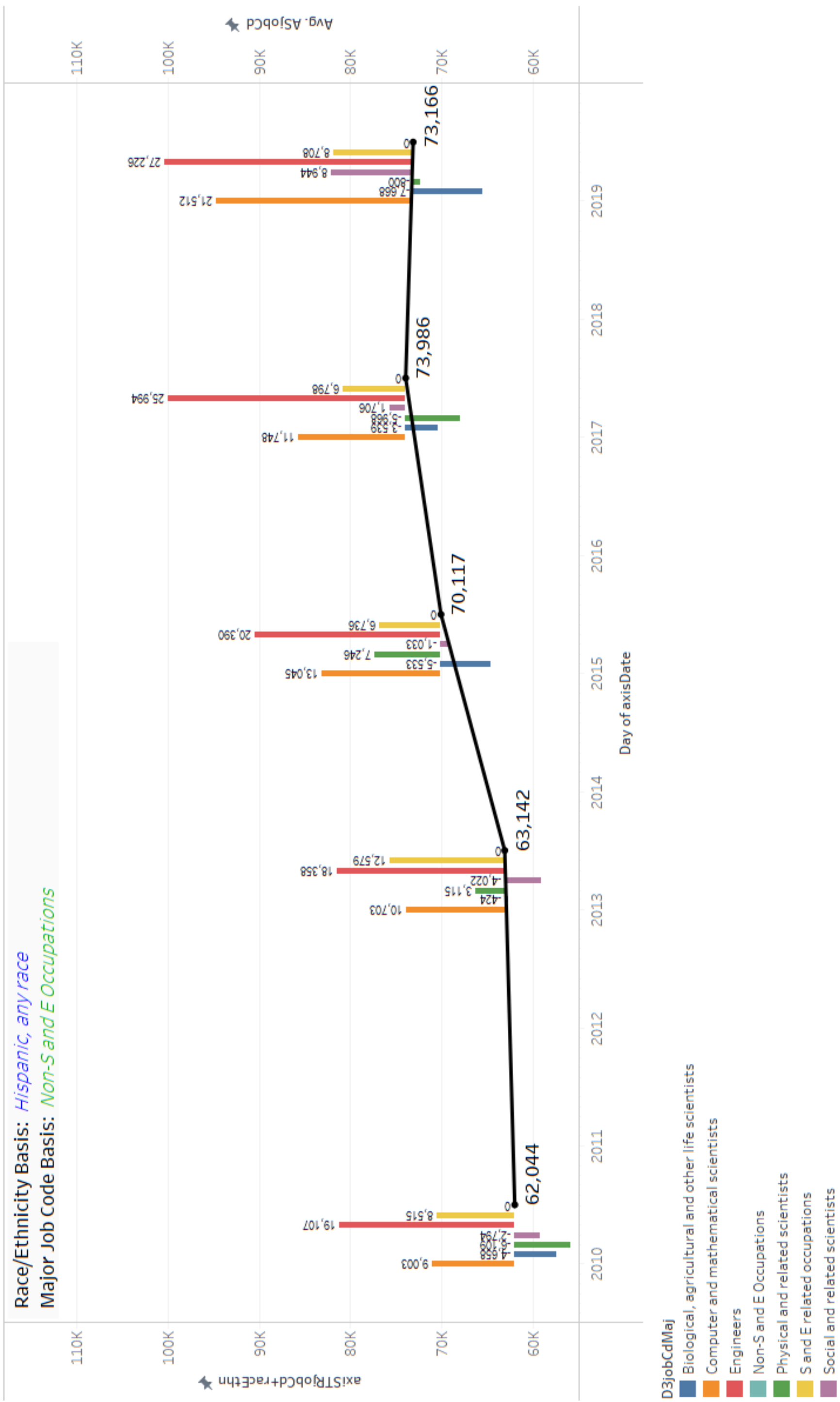
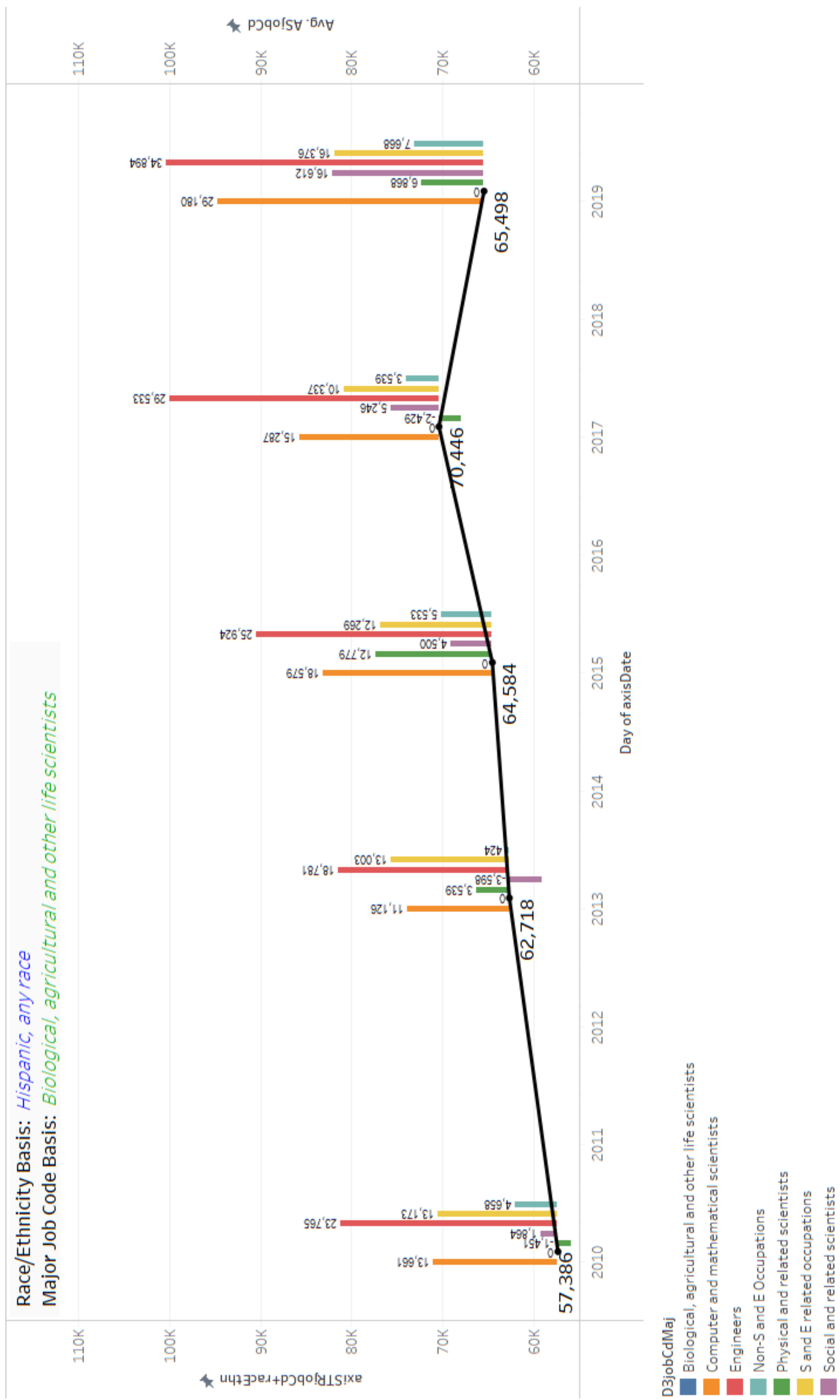


Figure 9 shows the average salary for the Latinx community by year and then compares the salary difference to the other communities represented by color-coded vertical bars. Non-STEM salary data also showed a modest growth trend over this period, with an average differential of 9.6% over the other occupations for 2010-2019. Though it lagged behind four of the other job categories at 18.52%, it only led by 5.54% more than the remaining two occupations.

Figure 10

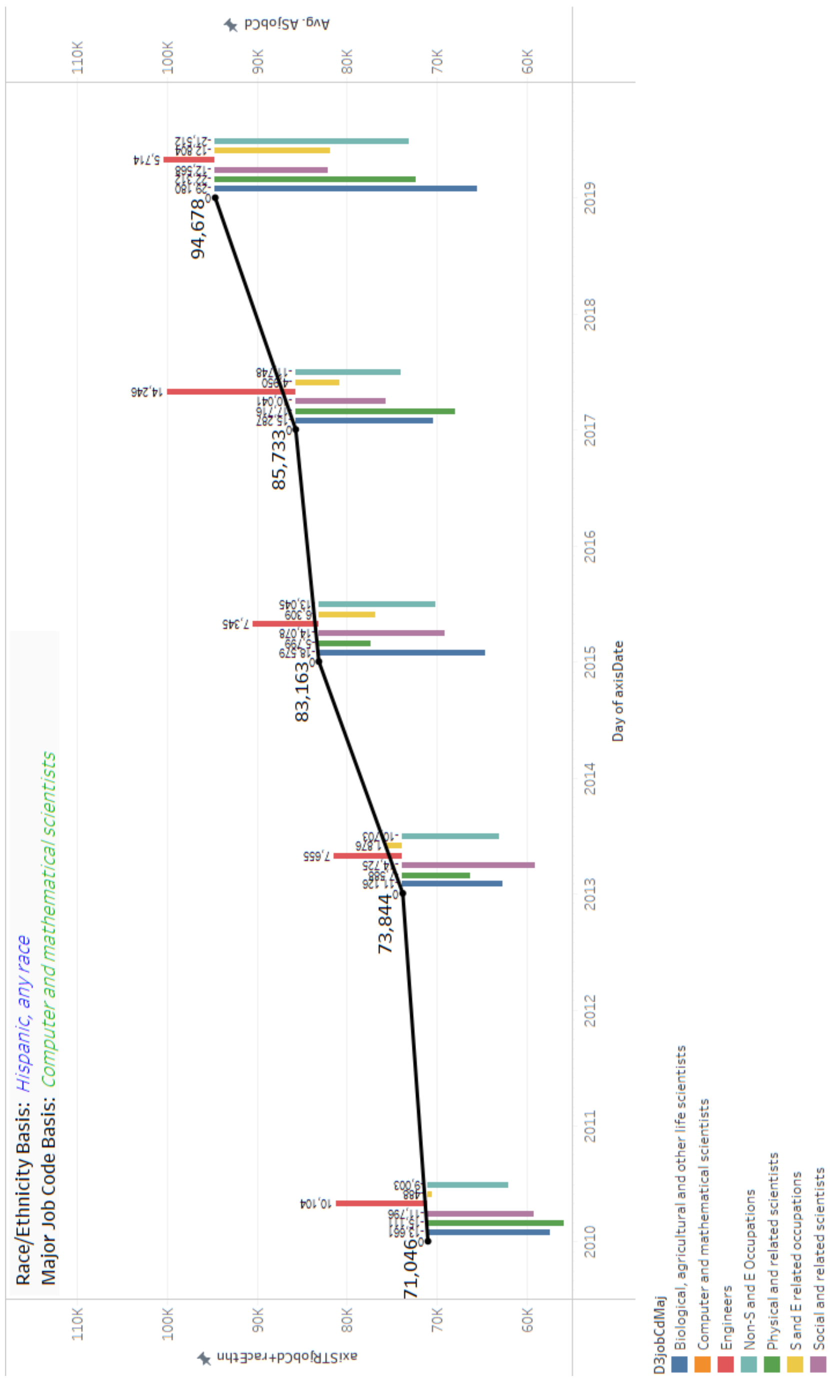
STEM Job Salary Comparison: Latinx and Biology and Other Life Sciences



The presentation of average salaries for the Latinx community focused on biology, agriculture, and other life sciences shown in Figure 10 showed most other major job codes earned higher wages with few exceptions over the nine years. Biology salaries earned approximately 18.23% less overall compared against all the other primary job codes. After factoring in the exceptions where it led by a modest 4.59%, the salary deviation increased 20.39% behind the remaining occupations. Notably, this field experienced a spike in 2017 before returning to the overall data's modest growth line.

Figure 11

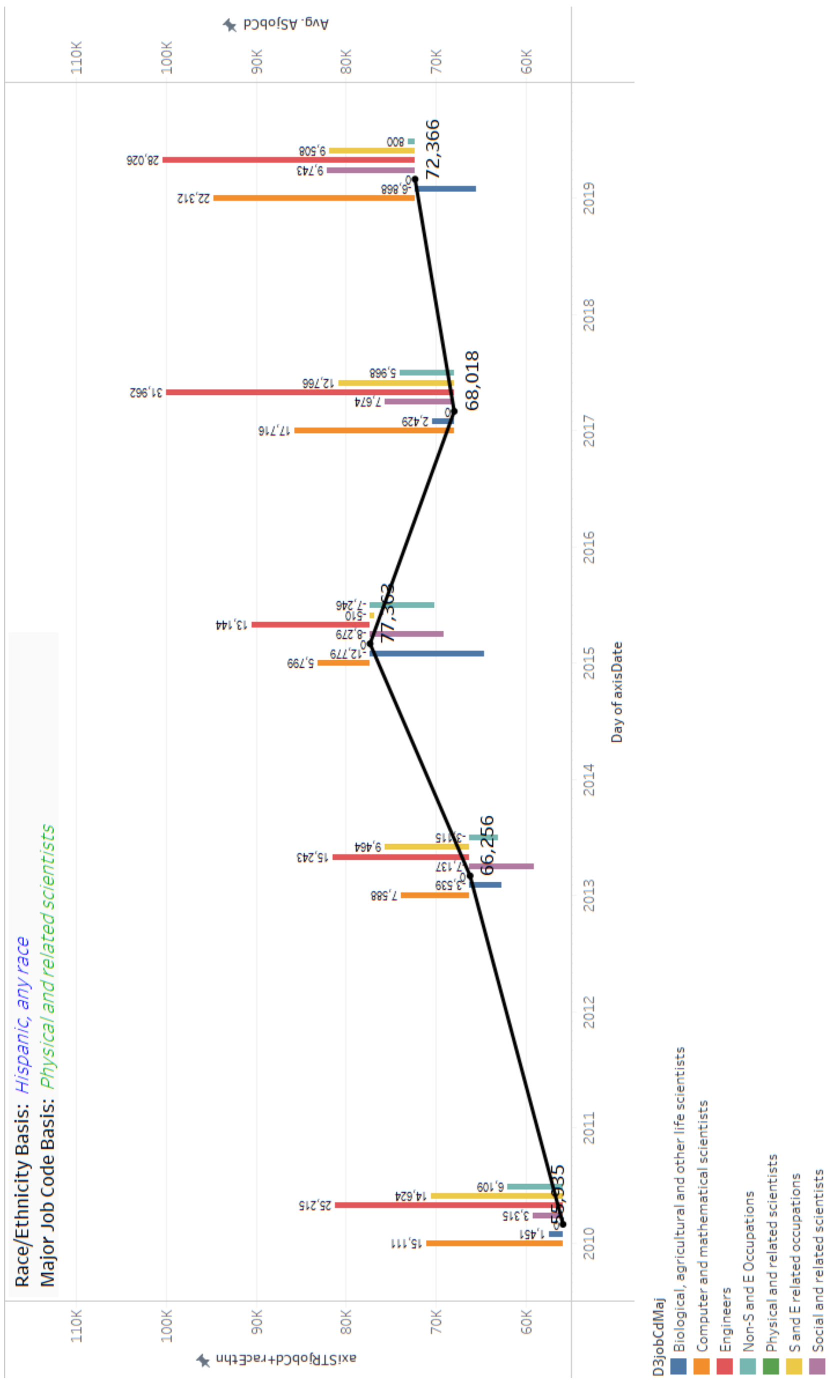
STEM Job Salary Comparison: Latinx and Computer and Mathematical Science



Having shifted the focus from biology to computer and mathematical scientists, as presented in Figure 11, reveals this is a strong field in terms of earning potential, with only one field making more during the same period: engineering. Overall, this field earned approximately 10.49% compared with all the occupations. Technology’s average salary led the other disciplines by 15.53% after factoring out the engineering code (which lags by 10.43%). This data is congruent with the research on STEM salaries being highest in technology and engineering fields. Technology shows an average of 16% higher wages over non-STEM fields over the same period, which is on the lower end as found in the literature. It was also higher than the other STEM fields, consistent with research on pay. It was also worth noting that computer and mathematical studies had a consistent upward trend with two spikes in saary earnings in 2015 and 2019.

Figure 12

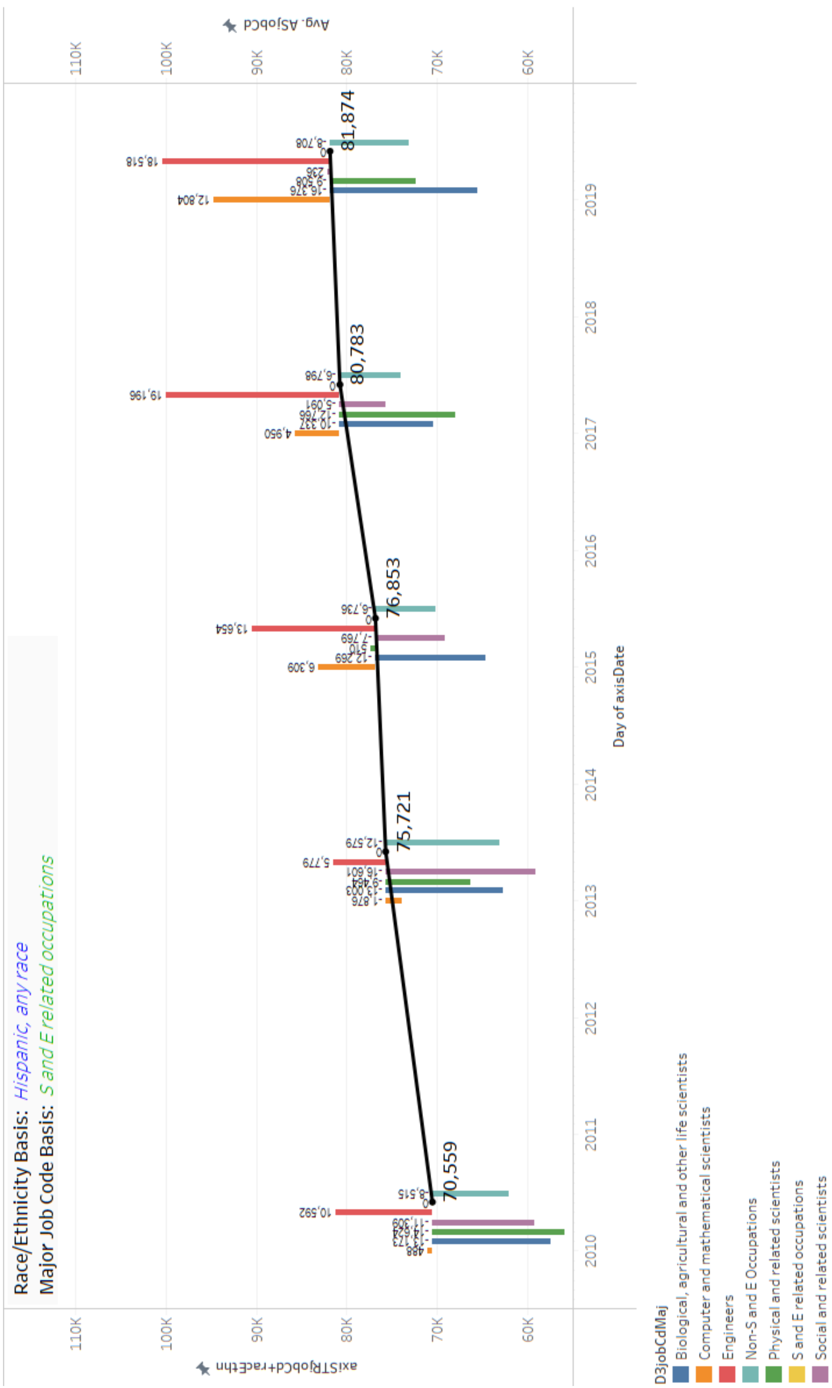
STEM Job Salary Comparison: Latinx and Physical and Related Sciences



Changing the focus from technology to physical and related scientists, found in Figure 12, reveals other STEM and non-STEM jobs have more variation in the magnitude and direction of their differential pay. The other disciplines predominantly earned a higher salary over the physical sciences, with few exceptions. For example, the physical science field makes approximately 11.2% less than all the job codes. The variation is evident in 2015 where a spike in the average salary rose to $77,362, resulting in only technology and engineering being the only higher-earning salaries. The difference represented a slight 8.12% edge more salary over the other disciplines before returning to a more consistent trendline of the average wage during this analysis period. Salary differentials were recalculated by factoring out a couple of instances where it led and revealed the average loss in salary became 17.36%.

Figure 13

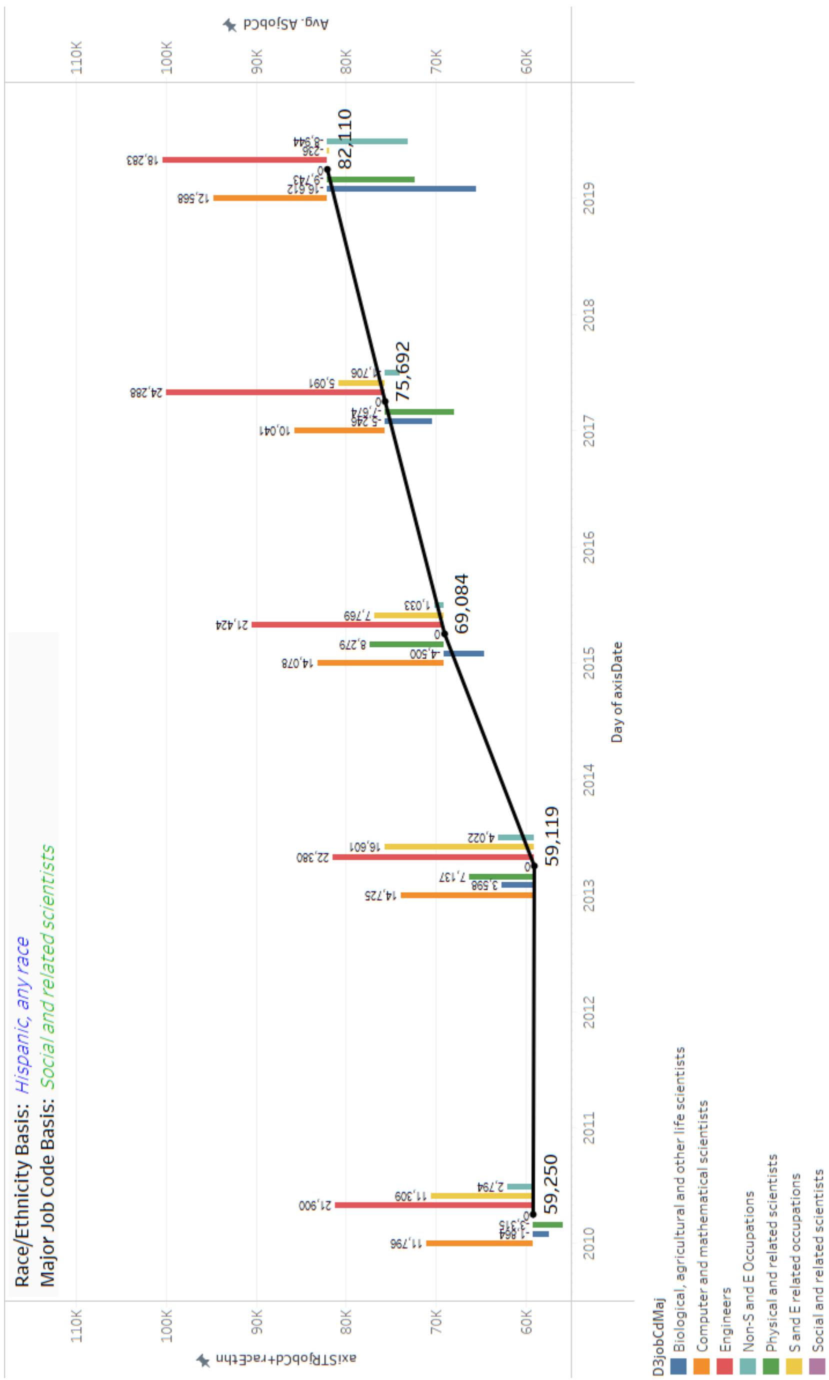
STEM Job Salary Comparison: Latinx and S&E-Related Occupations



Using science and engineering (S&E) related occupations as the comparative baseline, as seen in Figure 13, showed its average salary was the third-highest pay and consistently grew over time. The only two fields that earned higher wages were engineering and technology (computer and mathematical scientists). It has an overall average salary of approximately 4.67% higher when comparing all the fields. However, when the two leaders were factored out, it earned about 11.5% less, which made the average differential salary that S&E-related occupations had relative to the remaining fields approximately 12.76% more.

Figure 14

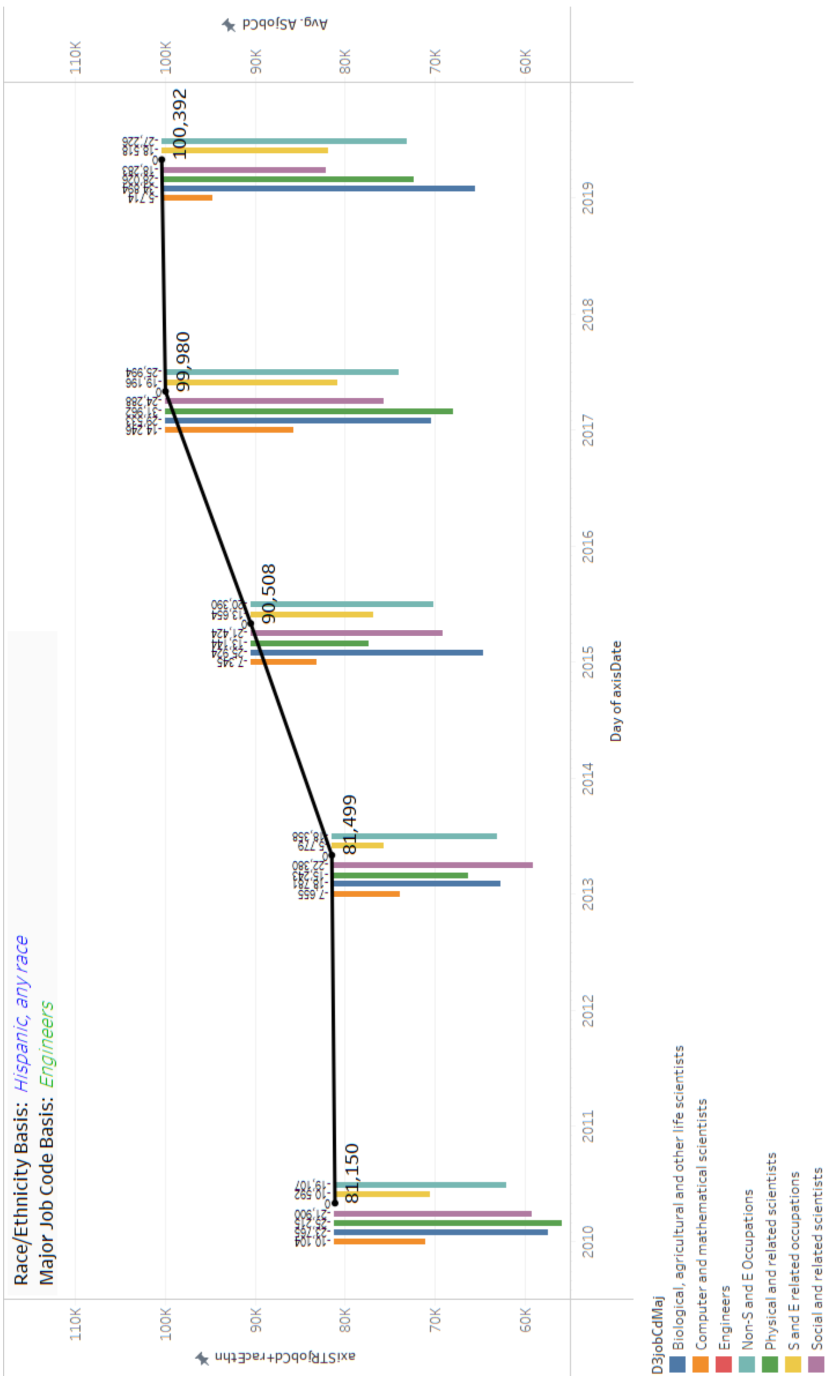
STEM Job Salary Comparison: Latinx and Social and Related Scientists



The penultimate primary job category, social and related scientists, depicted in Figure 14, earned less salary than most other codes by about 9.48% overall. However, accounting for the instances where it made more than a few occupations, by approximately 7.04%, resulted in the average social and related scientists' salary about 18.17% less than the rest of the disciplines. Notably, although wages were consistent in 2010 and 2013, there was contiguous growth across the entire period, with a higher bump in rate in 2015.

Figure 15

STEM Job Salary Comparison: Latinx and Engineering



The last primary job code major is engineering, where engineers consistently earned 21.15% more in salary than all the other fields. Comparing each field's overall average wage for the entire period, seen in Figure 15, across all the racial/ethnic communities shows engineers earn $95,542, with computer and math careers next at $94,702, followed by $85,006 for S&E, $77,542 non-S&E, $76,110 physical, $72,984 social, and $71,356 for biology. This higher average base salary contributed mainly to the differential analysis and was congruent with the literature where engineering and technology were the two highest salaries.

A two-way ANOVA analysis was computed between STEM categories and race/ethnicity and their effect on salary, which showed both variables as highly significant ($p = 0.000$). Therefore, race/ethnicity and STEM category impacted the salary in this nine-year perspective.

The last of our hypotheses analyzes the effect of a three-way interaction between Race/Ethnicity, Gender, and STEM categories on salary. This is important to determine if STEM as a discipline can mitigate the effect that gender and race/ethnicity have on compensation, if any of the attributes have a profound impact that the other variables cannot overcome, or if they compound their effect. The eighth null hypothesis stated the three-way interaction between race/ethnicity, gender, and STEM categories do not affect salary.

Table 16

Average Salary by STEM Category, Race/Ethnicity, and Gender

STEM Category	Race/Ethnicity	Gender	2010	2013	2015	2017	2019
Non-STEM	American Indian/ Alaska Native	F	$47.1 K	$43.6 K	$47.1 K	$54.9 K	$57.8 K
		M	$55.8 K	$61.7 K	$71.6 K	$75.1 K	$79.6 K
	Asian	F	$59.4 K	$65.4 K	$73.2 K	$76.9 K	$81.6 K
		M	$79.5 K	$94.6 K	$102.4 K	$113.4 K	$115.0 K
	Black	F	$57.0 K	$55.7 K	$55.0 K	$57.7 K	$59.6 K
		M	$67.1 K	$71.6 K	$74.7 K	$77.2 K	$73.3 K
	Latinx	F	$52.0 K	$51.5 K	$58.8 K	$61.2 K	$61.9 K
		M	$72.9 K	$77.8 K	$84.4 K	$90.4 K	$88.1 K
	Multiple Race	F	$51.6 K	$51.1 K	$57.6 K	$65.2 K	$62.8 K
		M	$74.5 K	$76.7 K	$84.5 K	$95.5 K	$87.5 K
	Native Hawaiian/ Pacific Islander	F	$57.3 K	$70.0 K	$62.5 K	$67.4 K	$71.5 K
		M	$71.7 K	$72.4 K	$75.4 K	$91.7 K	$82.8 K
	White	F	$54.4 K	$56.9 K	$61.2 K	$66.2 K	$67.9 K
		M	$79.8 K	$97.2 K	$105.4 K	$106.1 K	$104.2 K
STEM	American Indian/ Alaska Native	F	$62.8 K	$60.7 K	$82.3 K	$64.5 K	$64.3 K
		M	$81.1 K	$88.9 K	$83.0 K	$97.3 K	$86.1 K
	Asian	F	$73.4 K	$74.6 K	$82.7 K	$88.2 K	$90.9 K
		M	$89.1 K	$93.1 K	$98.9 K	$106.0 K	$111.0 K
	Black	F	$66.0 K	$63.2 K	$69.6 K	$72.1 K	$72.6 K
		M	$75.9 K	$77.5 K	$81.0 K	$87.2 K	$87.9 K
	Latinx	F	$59.9 K	$64.2 K	$69.3 K	$72.5 K	$72.2 K
		M	$77.3 K	$82.0 K	$88.6 K	$93.0 K	$97.1 K
	Multiple Race	F	$62.1 K	$62.8 K	$66.4 K	$73.8 K	$76.3 K
		M	$76.9 K	$81.5 K	$89.3 K	$93.4 K	$96.5 K
	Native Hawaiian/ Pacific Islander	F	$66.4 K	$65.0 K	$72.1 K	$83.2 K	$83.4 K
		M	$77.6 K	$90.3 K	$82.0 K	$92.3 K	$94.8 K
	White	F	$64.1 K	$66.5 K	$70.8 K	$76.5 K	$78.8 K
		M	$86.1 K	$92.5 K	$98.5 K	$103.6 K	$105.7 K

The data in Table 16 revealed the average salary for non-STEM and STEM careers for all races/ethnicities and genders were $71,894 and $80,529, respectively. When viewed by gender, the non-STEM average salary for women was $60,028, and men's was $83,760, which were less/greater than the overall average by $11,866 or 16.5%. Looking at average salaries for STEM by gender revealed women earned $71,257 to men's $89,801, representing an 11.51% variance or $9,272 in opposite directions, respectively. Comparing non-STEM and STEM average salaries by gender showed women in STEM earned $11,229 more, or 15.76%, during the last decade, while men in STEM made $6,041 more or 6.73% than their non-STEM colleagues. Focusing on gender within each category, beginning with non-STEM, showed women earned $23,732 less or 28.33% than men in the same period. The gender pay gap in STEM was a little less, with women earning $18,544 less, or 20.65%, than men during this duration.

Regression and three-way ANOVA analysis were computed to identify the effect of race/ethnicity, gender, and STEM categories on salary, which showed all variables were highly significant ($p = 0.000$). Because both the regression and ANOVA were consistent in their highly significant result ($p = 0.000$), the nine-year period concluded race/ethnicity, gender, and STEM category impacted the salary.

Chapter Summary

Chapter 4 reviewed the two research questions around if there was a wage gap between the two STEM categories and if the wage gap was affected by gender, race/ethnicity, discipline, degree level; if so, what were the effects on the Latinx community relative to other race/ethnicities. The STEM category significantly impacted salary ($H_0 1$) from RQ1. The hypotheses from RQ2 are also all found to have a significant effect on pay: gender ($H_0 2$), race/ethnicity ($H_0 3$), degree level ($H_0 4$), race/ethnicity and gender ($H_0 5$), gender and STEM category ($H_0 6$), race/ethnicity and STEM category ($H_0 7$), and race/ethnicity and gender and STEM category ($H_0 8$). Though all research questions and null hypotheses were assessed across the study's 2010-2019 range, those that do not include the race/ethnicity variable are also tested in an expanded NSCG 1993-2019 data set, which also found high significance effects on salary. Chapter 5 reviews the analysis from this chapter in a larger context, including the preceding two pre-studies, to determine implications and recommendations for further research and present final study conclusions.

CHAPTER 5: DISCUSSION AND CONCLUSION

This study explored various factors' impact on salary over the last decade to determine their significance for graduating students who entered the workforce in science, technology, engineering, and math or alternate fields. This study found a wage gap through the evaluation of NSCG 2010-2019 archival data correlating salary with occupation, degree level, the area of study, and demographics (e.g., gender, race/ethnicity). This inequity existed between genders, race/ethnicities, and STEM and non-STEM fields.

The wage gap experienced by the Latinx community and the gender wage gap were good examples of a trailhead on a journey of change. The salary was used as a measure to indicate potential and thereby effect change. The potential comes from the growth that can be realized from eliminating what is causing the inequity - biases, mores, cultural beliefs, and expectations. For example, why are Latinas and other women consistently earning less than males in equivalent jobs? Why are some racial/ethnic groups consistently valued more than Latinx or other communities? How does this affect our homes, society, workplaces, or, more importantly, the world? In an era where people would like to believe these inequalities are no longer prevalent, this study sought to add to the conversation on where we are and offer ideas on where we can go. Despite the literature showing slight differences in human development between genders and how detrimental gender biases impact society, there has been little change in the expression and culture that students experience, which can negatively affect them throughout their academic careers.

This study focused on a limited number of variables in the NSCG and built a foundation for subsequent analyses. The research questions explored effects on demographical, education, and professional attributes on salary. The study also looked at the intersection of various variables to examine their impact on salary.

This chapter reviews the analysis performed in Chapter 4. It explores the study's findings of what was significantly impacted salary in the data collected by the National Science Foundation's *National Survey of College Graduates*. Finally, this chapter discusses the study's strengths and weaknesses, implications for future application, recommendations for future research, and conclusions.

Discussion

The literature showed the harmful effects of how environmental factors such as gender biases and stereotypes can be internalized by a student to be then incorporated into their self-image. It also presented examples of how to combat these harmful environments with direct and intentional interactions such as mentoring, creative and inclusive experiences to make the material more meaningful and relatable to the student. With the existence of these paradigms, what can lead to a more just world is the level of intentionality and thoughtfulness that is expended to bring about the world we seek. The under-valuation of the community, seen through comparing the starting salaries for comparable jobs between racial/ethnic communities, genders, and fields, show evidence of a wage gap (Melguizo & Wolniak, 2012; Michelmore & Sassler, 2016; National Center for Education Statistics, 1997; Pascarella & Terenzini, 2005). Undervaluation of a person's worth as an employee negatively impacts the person and can perpetuate gender biases and stereotypes today (Aisenbrey & Brückner, 2008; Cha & Weeden, 2014; Fluhr et al., 2017; DiPrete & Buchmann, 2013; Goldin et al., 2006; Michelmore & Sassler, 2016). The opportunity is to address the wage gap in our era to eliminate this injustice and replace it with equity. The completed analysis established an informational foundation for engagement from a social justice perspective to correct systemic oppression, enculturated biases, and social mores.

Why does this research matter? This question is answered by looking at the study results through each major framework from the literature review, beginning with SDT. Because this study started with the end of the academic journey, at the intersection of graduating and embarking on a professional career, the measure is an average salary for a standard job code. So, the first question becomes, how does the salary affect the student, using the STEM gender wage gap as the factor, specifically if and how it exists as they are employed. The analysis of the STEM category (a.k.a. job code) for the employee's role, factoring in their gender, race/ethnicity, and degree level, revealed if employees are treated the same based on salary. For example, two detrimental unfair situations occur when the graduated students are compensated less or more for the same role. A just environment will provide a compensation structure agnostic to gender, race/ethnicity, and other demographical characteristics, focusing on the skill, competencies, and education required for the job code.

Research Question 1

Is there a wage gap between STEM and non-STEM positions immediately upon graduation? The 2010-2019 NSCG sample analysis revealed a significant impact on salary depending on which field, STEM or non-STEM, the graduating student's job is part of.

The first hypothesis tested in this study (H_1) explored if a STEM career versus a non-STEM career had no significant impact on the salary earned by the graduating student. Although the data revealed the STEM gap is less than what the literature previously reported (20-35% higher) over non-STEM fields, it supported the research that STEM jobs earn more at a rate of 11% during the last decade. The data also suggests that the growth rate for STEM salaries is higher than non-STEM salaries. However, expanding the STEM/non-STEM categories into their respective primary job codes reveals that not all STEM fields earn higher wages than non-STEM occupations. Using the non-science and engineering (non-S&E) job code, which comprises the non-STEM category, as a basis for differential analysis shows that only half of the standard discipline codes exceed non-S&E wages: Computer and mathematical scientists (22.13%), S and E related occupations (9.63%), and Engineers (23.21%). The remaining fields lagged by less than 10%: biological, agricultural, and other life scientists (-7.98%), Social and related scientists (-5.88%), and Physical and related scientists (-1.85%).

H_1 provides an initial data point that students from the Latinx and the rest of the communities could use to discern what field they see themselves in. The information revealed that, based on the data in the sample, standard STEM job categories were ranked by primary job code from highest to lowest salary: 1) engineering, 2) computers and mathematics, 3) S and E related occupations, 4) non S and E occupations, 5) physical and related scientists, 6) social and related scientists, and 7) biological, agricultural and other life sciences. Although these data were congruent with the literature, it is essential for the students, especially in primary and secondary school, to consider a broader range of factors, not just salary, as they seek to answer what they want to be when they grow up.

This broad perspective of attributes is critical because of the other environmental factors they are exposed to as they progress throughout their academic career. Lower salaries for women support the existence of detrimental environmental factors, such as gender biases and stereotypes, as described by both EVT and SDT. In addition, they substantiate the potential internalization of unhealthy gender biases and stereotypes coming from friends, family, faculty/administrations, or society at large in the acceptance of the wage disparity. The second research question was needed to expand this analysis's detail initially provided.

Research Question 2

Is there a difference in the wage gap based on gender, race/ethnicity, discipline, and education level for the Latinx community? The study looked to identify if various isolated and combined independent variables impacted salary.

The second hypothesis (H_2), gender has no statistically significant impact on respondent's salary, was false. Two analyses were run on this for both the 2010-2019 period and complete data set spanning 1993-2019, which found gender was highly significant on salary. The data showed that women overall earned 29.93% less salary during the study's focus period than males in the same fields; men's average wage for the period was $95,615 versus women's $67,006. The wage gap's existence was similar, but its magnitude exceeded the data compiled by the U.S. Department of labor and statistics for data in a comparable period. As a community, the gender wage gap was verified. However, this says nothing about the intersection of gender and race/ethnicity or STEM categories, which were addressed by other hypotheses (H_6 and H_7, respectively). The lower salaries indicated women from all communities, including Latinx women, saw they were undervalued as employees, indicating potential gender or cultural biases in the workplace. Tests to identify environmental factors contributing to and establishing these biases were not part of this study and require additional research to explore those effects.

The third hypothesis (H_3), the race/ethnicity of the respondent has no significant impact on the salary, was determined to be false. The data, summarized in Table 6, showed the Asian community earned the highest wages across the entire study period, followed by the White, Native Hawaiian / Pacific Islander, multiple races, Latinx, Black, and American Indian/Alaska Native communities. This supported the fundamental discussion point of H_3, which is employees should earn equivalent salaries for equivalent jobs. The use of standard occupational codes established a common baseline from which this conversation could be had. Two key takeaways from this hypothesis testing during this recent history were: 1) the Asian community overtook the White community as earning higher average wages, and 2) the Latinx community was in the middle to low range of average salary earned.

The fourth hypothesis (H_4), the degree level of the respondent has no significant impact on the salary, was found to be false. The data showed each degree level had a significant effect on pay. The average wage increased respectively according to the level achieved beyond a bachelor's degree. A graduate with a master's earned 13.5% more, a doctorate earned 36.6% more, and a professional 85.2% more than the average salary of a bachelor's degree during the 2010-2019 study period. This supported a planning perspective for students to consider graduate school to increase their salary potential. Ultimately, I hoped salary was one of many attributes considered by students during their discernment process. However, more data is required to fully contextualize the degree level's impact outside of this study. Other future study areas include testing the environmental factors, analyzing the institution they are employed at, and researching companies' organizational culture and processes.

The fifth hypothesis (H_5), the two-way interaction effect of race/ethnicity and gender on the salary is not statistically significant, was determined to be false. The expanded race/ethnicity:gender lens revealed the mean salary for women lowered to $65,136, whereas men's mean wage increased to $86,788 compared to the original race/ethnicity wages analysis ($76,433). The gender pay gap within each racial/ethnic communities, seen in Table 11, revealed that women earned approximately $21,673 less than men in their respective communities. This equated to a wage gap of 27.73% less salary than men. A few key takeaways from this hypothesis testing were: 1) males earned more than all females with one exception, Asian females had higher period average salaries over Black males, 2) the Latinx community was in the middle to the middle-lower position of the average salaries of their respective gender groupings, and 3) the Latinx community were fourth and twelfth, for males and females respectively, when ranking the 14 gender-race/ethnicity period average salary combinations as shown in Table 17.

Table 17

Ranked Average Salaries by Race/Ethnicity and Gender

Race/Ethnicity	Gender	2010	2013	2015	2017	2019
Asian	M	$86.0 K	$93.5 K	$99.9 K	$108.3 K	$112.1 K
White	M	$83.5 K	$94.3 K	$101.0 K	$104.6 K	$105.1 K
Multiple Race	M	$75.8 K	$79.6 K	$87.3 K	$94.4 K	$92.7 K
Latinx	M	$75.2 K	$80.1 K	$86.8 K	$91.8 K	$93.0 K
Native Hawaiian/Pacific Islander	M	$74.9 K	$82.0 K	$79.3 K	$92.1 K	$89.0 K
American Indian/Alaska Native	M	$68.4 K	$75.5 K	$77.7 K	$85.1 K	$82.8 K
Asian	F	$67.4 K	$70.7 K	$78.7 K	$83.1 K	$86.9 K
Black	M	$71.3 K	$74.5 K	$77.9 K	$81.9 K	$80.4 K
Native Hawaiian/Pacific Islander	F	$61.6 K	$67.7 K	$66.7 K	$73.8 K	$76.3 K
White	F	$59.3 K	$61.8 K	$66.2 K	$71.3 K	$73.5 K
Multiple Race	F	$55.9 K	$56.4 K	$61.5 K	$68.7 K	$68.4 K
Latinx	F	$55.3 K	$57.2 K	$63.6 K	$65.6 K	$66.0 K
Black	F	$60.5 K	$58.7 K	$61.0 K	$62.9 K	$64.3 K
American Indian/Alaska Native	F	$54.4 K	$51.8 K	$63.4 K	$58.9 K	$60.4 K

The confirmed gender wage gap is expected to interrupt female students' self-efficacy and self-image due to the message that they are not as valuable as males. The reinforced gender bias can be detrimental to females' self-identity and goal setting when visualizing their profession, especially in secondary school, as they prepare to select and apply to higher education programs.

The sixth hypothesis (H_6), the two-way interaction effect of gender and STEM on salary is not statistically significant, was false. Table 14 revealed the wage gap between men and women over the period for both STEM/non-STEM fields. In 2010, women in non-STEM fields earned approximately $22,541 less than men, and women in STEM fields earned $19,623 less. In 2019, the gap increased to $32,980 and $25,126 for non-STEM and STEM fields, respectively. The overall gap in average salary for women compared to men is $33,014 to $23,641. Notably, the pay gap spiked in non-STEM fields between the 2013 and 2017 surveys and settled down in 2019, but STEM kept on a consistent growth trend the entire time. The data point provided by this hypothesis to Latinx women and other women was mixed in that it was congruent in reinforcing the salary advantage females in STEM have over those who chose non-STEM fields. The other data point confirmed the STEM gender wage gap's existence and women's undervaluation as employees compared to males.

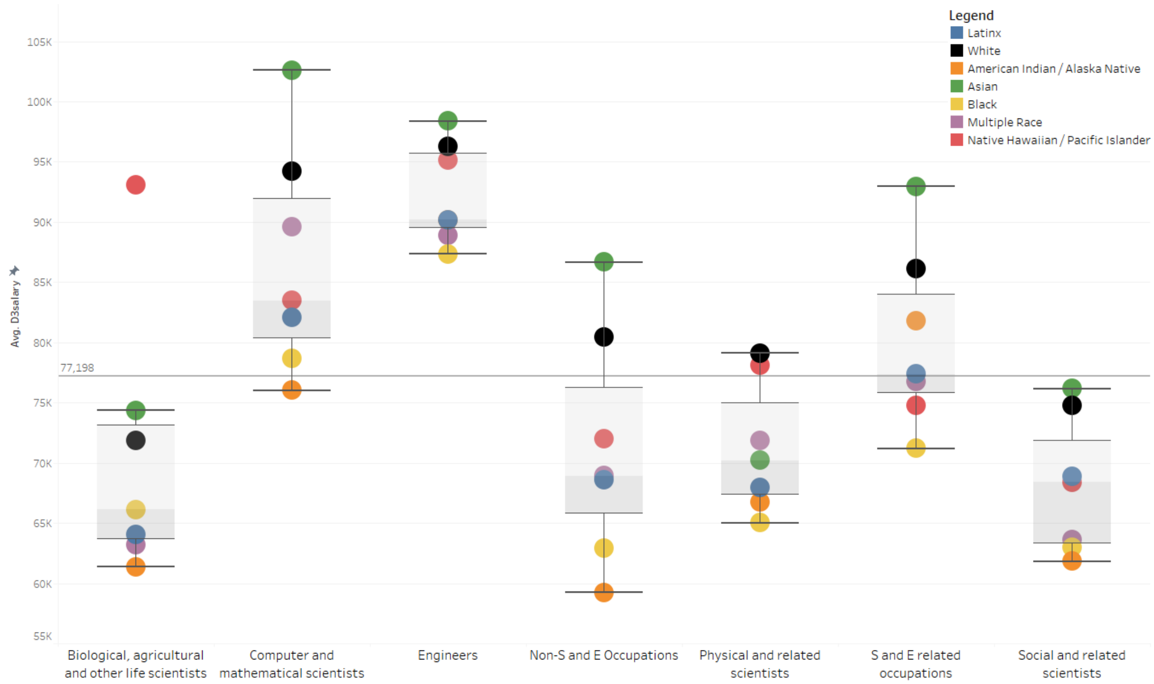
The seventh hypothesis (H_7), the two-way interaction effect of race/ethnicity and STEM on salary is not statistically significant, was determined to be false. Summarizing the NSCG data for 2010-2019 by STEM category then by race/ethnicity, depicted in

Table 15, showed that average salaries for the period by major primary job codes for all communities are as follows: biology at $71,356; computer and mathematics at $94,702; Engineers at $95,542; Non-S and E occupations at $77,542; Physical and related scientists at $76,110; Science and engineering-related occupations at $85,006; Social and related scientists at $72,984. Those data were analyzed by selecting a single racial/ethnic community combined with a single major primary job code as the basis for a job categorical salary gap analysis. Studying average salaries for each race/ethnicity combined at the intersection with the standard job codes provides a historical perspective to view the opportunity from which each community can earn a higher salary. H_7 presented this analysis at the intersection of the Latinx community and all of the primary job codes.

Figure 15 revealed the highest average salary for the Latinx community across the entire period was in engineering. Plotting the average salary for the period for each of the communities by job code provides another way to see the wage disparity. Figure 16 visualizes this wage gap for the 2010-2019 period.

Figure 16

Average period salary by job and race/ethnicity community



Ranking all 49 race/ethnicity-STEM category job code combinations showed that the Latinx community had three instances in the top half of the average salaries for the period: Engineering at ninth, Computer and mathematics at 16th, and S&E related occupations at 22nd. The remaining job codes for the Latinx community ranged between 35th to 42nd. The 49 combinations were broken down into seven equal bands to create a normal distribution, where the top and bottom two bands represent an area just outside one standard deviation from the center to highlight the largest differentials in salary.

Looking at the rankings for the top and bottom 14-period average salaries by community revealed the following:

- the American Indian/Alaska Native community had one in the top and four in the bottom;
- the Asian community had four of the top and none in the bottom of the ranking;
- the Black community had one in the top and four in the bottom;
- the Hawaiian/Pacific Islander community had two in the top and one in the bottom;
- the Latinx community had only one in the top and three in the bottom;
- the Multiple race community had two in both the top and bottom; and
- the White community had three of the top and none in the bottom 14 positions.

Table 18 shows salary rankings at the intersection of race/ethnicity with standard job codes. The green font indicates the top 14 salaries; the red font highlights those in the bottom 14 salaries, with all non-shaded cells in the middle section of the rankings.

Table 18

Period Average Salary Rankings by Race/Ethnicity and Job Code

Primary job code	Biological, agricultural, and other life scientists	Computer and mathematical scientists	Engineers	Non-S&E Occupations	Physical and related scientists	S&E related occupations	Social and related scientists
American Indian / Alaska Native	48	25	8	49	39	17	47
Asian	28	1	2	13	33	7	24
Black	40	20	12	46	41	32	45
Latinx	42	16	9	36	38	22	35
Multiple Race	44	10	11	34	31	23	43
Native Hawaiian / Pacific Islander	6	15	4	29	21	26	37
White	30	5	3	18	19	14	27

Note. 2010-2019 NSCG Data

These data showed that although the Asian community has taken the leading position in terms of having the highest period average salaries, closely followed by the White community, the Latinx community has a long way to grow in terms of equitable wages with only one top 14 (engineering at 9) and three of the bottom 14 positions. Factoring all the average salaries by period for all job codes showed a disparity of -$21,950 compared to the top grouping ($74,148 vs. $96,098). The Black community had the penultimate worst position, with the American Indian/Alaska Native community last, having one top and four of the bottom 14 positions of the ranking. The period average salary for each band of seven places revealed a significant disparity between each level compared to the top position, as shown in Table 19.

Table 19

Period Average Salary by Ranking Level

Band (Positions)	**Period Average Salary**	**Differential from 1**
1. (1 through 7)	$96,098	$0
2. (8 through 14)	$88,440	-$7,658
3. (9 through 21)	$80,518	-$15,580
4. (22 through 28)	$75,755	-$20,342
5. (29 through 35)	$70,701	-$25,397
6. (36 through 42)	$66,694	-$29,404
7. (43 through 49)	$62,180	-$33,917

Note. 2010-2019 NSCG Data

From the major job code perspective, the data revealed that engineering had captivated the top average salaries, with seven of the top 14 positions, over computer and mathematics, which only had three top positions, including the top spot in the ranking. The rankings for the remaining occupational codes were in line with the findings previously presented. This trend was consistent with the different communities and is congruent with the conclusions of H_3. Thus, the intersection of race/ethnicity and the STEM field revealed the impact on the wage gap and confirmed what was shown in the literature.

The eighth hypothesis (H_8), there is no significant three-way interaction effect of race/ethnicity * gender * STEM on the salary, was false. The data, summarized in Table

16, showed that the gender wage gap according to discipline is 28.33%, or they earn on average $23,732 less than men in non-STEM fields, whereas the wage gap in STEM occupations is 20.65%, or $18,544 less than men. Comparing the STEM wage gap for each gender shows that women in non-STEM fields earn 15.76%, or an average salary of $11,229, less than women in STEM fields, whereas men in non-STEM earn 6.73%, or $6,041, less than men in STEM fields when aggregated by STEM, race/ethnicity, and gender. These STEM wage gaps were less than those found in the literature when comparing the salary of STEM and non-STEM fields but confirmed the gender STEM wage gap's existence.

All the hypotheses, when taken together, found gender, race/ethnicity, STEM field, and degree level all affected salary earned upon graduation and starting a job. The data also showed congruence with the literature where some disciplines made more than others, with having a tighter gap between genders depending on the profession. Though evidence was found indicating the wage gap has reduced in some areas, and in some cases grown, the gap's existence was confirmed. The finding was critical because of the overall implications it can have on students at the beginning of their academic career and those entering the workforce or graduate school. From a developmental perspective supported by all three theories, the identity and self-image a person has or built would be affected by the external valuation associated with their salary. Although SDT contained intrinsic motivation components, which have mitigated a negative perception of being undervalued by a lower salary for an equivalent job, the impacts on internalization and even future visualization could be experienced. This situation is not restricted to the female Latinx community but extends to other women and men of other non-White communities and requires an intentional, thoughtful conversation to explore the systems that caused this inequality.

Conceptual Framework

The analysis revisited the conceptual framework to determine the additional effects of the gender STEM wage gaps. Those effects were viewed as perspectives, the first where the gap affects the various theories and those expected to be impacted by elements of those same theories. The first perspective deals with how the expectations for the student impact them based on environmental, societal, and cultural factors. The second perspective describes a set of reasons and questions about what drove the existence of the gap.

Table 20

Gender STEM Wage Gap Effects Through the Conceptual Framework

SDT	**EVM**	**GP**
A critical factor in SDT is PERSISTENCE. Wage Gap affected: Expectation Persistence *Visualization* Wage Gap was affected by*: *Biases* Expectations *Experience* Freedom Roles *Stereotypes* Values	A critical factor in EVM is VISUALIZATION. Wage Gap affected: Motivation *Visualization* Wage Gap was affected by*: *Biases* Characteristics Competencies *Experience* Norms (cultural and gender) Personal values and goals Skills *Stereotypes*	A critical factor in gender performance is COST. Wage Gap affected: Performance Utility Cost : Value *Visualization* Wage Gap was affected by*: *Biases* Culture Expectations *Experience* Gender norms *Stereotypes* Values

*The wage gap being affected by attributes is expected and not measured.

Wage Gap Effect on Conceptual Framework Components

Whereas the wage gap could positively and negatively impact how students see themselves in STEM, a positive perception, i.e., a favorable wage gap from their perspective, could entice them to pursue a particular career. For example, suppose they perceive the wage gap as unfair because it represents an inequitable situation in treating employees based on gender, race/ethnicity, or job. In that case, that could impact whether they would want to pursue that career. So even though they may see themselves in a STEM career, with this factor being what it is, they may choose not to pursue it because of the inherent unfairness and discrimination.

The driving factor here is the concept of visualization contained across the theories. How does the student envision their future, full of promise and potential, or hardship and inequity? The visualization as described across SDT, EVM, and GP had real effects on the student.

In SDT, whose critical factor was persistence, visualization directly influenced how the student persevered. This is seen through the expectations and how much effort they were willing to exhibit to complete their program of study, graduate, and gain employment. Similarly, EVM's critical visualization factor was impacted by the motivation that the student experienced. EVM focuses on motivation, intrinsic and extrinsic, which could be affected if there is a STEM gender wage gap in the field the student wants to pursue. If injustice is perceived, motivation could be reduced because of the value placed on the skills, characteristics, competencies, personal values, and goals held. Therefore, that motivation may be weak or may drive them to an alternate career. Lastly, the critical factor of GP was cost, in that was the student willing to pay the 'cost' to develop the skills, attributes, and competence to achieve success? Similar to the other models, going from higher education to employment, the student factored the three significant concepts of importance, competence, and interests in selecting, working on the program of study, and completing that degree, in hopes of getting a job upon graduation. What is known is that all respondents in the sample were successful in graduating and gaining employment. Visualization is common throughout the conceptual framework as a means of achievement, vis-à-vis work, the wage gap, and could encourage some and drive others to or away from STEM disciplines.

As previously stated in Research Question 1, the student's employment field impacted their earning potential. From Research Question 2, the other factors such as gender, race/ethnicity, and degree level all impacted compensation individually and in conjunction with other elements. Both of these findings were derived from the data and the conceptual framework.

The work, resilience, and tenacity to perform well and consistently to gain acceptance into a program of study are required. Then it is needed to continue through the completion of the program to graduate. Inequities in salaries based on gender, race/ethnicity, job, and degree level can be seen by students throughout their academic careers. For students who begin preparing for what they want to be early in their education, junior high/middle school could have up to six years before entering higher education to be affected by the realities of fairness and equity they see from statistics like these. The statistics, coupled with the other encounters intended to combat the leaky pipeline discussed in the literature, such as mentoring and STEM experiences, to relate STEM concepts and curriculum with their thoughts to help them see themselves in the future “when they grow up.” What could derail those visualized futures? The nine-year data set reflected in this study shows disparity across gender, STEM field, race/ethnicity, and degree level. In the case of degree level, it is understandable that those with more education and training are valued because of the knowledge, skill, and competence they may possess. For example, in the case of the STEM field or job code, it was understandable where some disciplines could require more training and justify higher wages. A more direct study is needed to assess the effect of attributes, skills, and knowledge needed to practice a particular profession and explore this phenomenon's exact nature. The remaining gender and race/ethnicity factors were expected not to be significant because they are rooted in our humanity. However, despite many students having perspectives where they live in a community or country, if not a world, where generally speaking there is fairness and equity for all people, the reality of maltreatment and inequity could be stifling for our global future. The NSF data analyzed by this study could have a couple of significant implications.

For women, wage disparity’s consistent existence reinforced the notion that one gender is more “valuable” in the construct of the workplace. The data showed that this was true for all women, with one minor exception; Asian women were previously earning more than one male community. According to the data, earnings by women ranked by race/ethnicity were: 1) Asian, 2) Hawaiian/Pacific Islander, 3) White, 4) Multiple races, 5) Latinx, 6) Black, and 7) American Indian/Alaska Native. Male wage disparity was often compared to White males due to their historically highest wages, but the data from the last decade showed that Asian males are now the highest wage earners, even if it is only by $2,711 or 2.69%. As previously studied, males from the other racial/ethnic communities earned fewer wages than White males. According to the data, earnings by males ranked by race/ethnicity were: 1) Asian, 2) White, 3) Multiple races, 4) Latinx, 5)

Hawaiian/Pacific Islander, 6) Black, and 7) American Indian/Alaska Native. In a world where possibility and potential have often been expressed as limitless, especially before the effects of a harsh reality that the ‘world is unfair,’ resulting in the jading or elimination of energy, innovation, and creativity, the wage gaps present a problem.

The problem is the injustice of how people are seen, treated, and valued in the world, unequally. The potential impact this study previously alluded to was that it could be used to either derail any progress made in encouraging students, especially women and people of color, to enter STEM fields. Another impact is one in which it could bolster the pursuit of equity in the workplace and across our society through an open, honest, and authentic discussion of fairness in how we see, treat and value each other. The first impact could be rooted in fear, seen as a message of despair driving people away from fields because they favor certain genders and races/ethnicities instead of compensating people equally for a standard job code. The latter could leverage the human spirit in which we can come together, build, establish, and sustain, a just world where we all can contribute and be valued based on our commonality, our humanity. This second potential impact is believed to be the more powerful of the two because it can grow over time and even sustain itself beyond our imagination.

Wage Gap Potential Effects by Conceptual Framework

Although the wage gap could have been affected positively and negatively by various conceptual framework components, the existence of the wage gaps points to a negative impact. Three components across the theories are believed to be sources of the wage gap: 1) biases, 2) experience, and 3) stereotypes. Though other factors share commonality between some of the theories, all could explain how the wage gaps were established and why they persist today. Highlights from SDT factors include freedom, roles, and values; from EVM, norms, skills, characteristics; and from GP were culture, expectations, norms, and values. Please refer to Table 20 for the summary of affected and affecting conceptual framework components. This study began at the end of the students' journey when they commenced their careers after graduation. Therefore, future studies are needed to explore the corporate culture and other environmental factors that impact the wage gap and the student/employee on both ends of this journey. I expect the literature would be sustained in the potential link between the impact of the environment on a student and its long-term implications as they enter and eventually lead in their organizations throughout their career. This possible link could also be seen as either hindering or fostering growth. As previously stated about this study's powerful potential second impact (pursuit of equity in the workplace), this link is expected to be a source of energy toward growth in establishing a just workplace. The root of this energy is located at the intersection of the expression of a corporate goal of how they intend to treat their employees and operate in the world with how they actually treat them. A starting point for this honest examination is to review the organization's policies, procedures, and practices. It is purported that if there were a disparity between what was sought and what was real, it would inspire a thoughtful and intentional dialogue resulting in growth toward making a more just workplace and world.

Justice would be visible in fields that paid the worker equally for the job code despite gender, race/ethnicity, and depending on the job code level/degree level. The notion of equal pay for the same job would be achieved. Couple this with continued and innovative collaborations between academia, the public, and private sectors to deliver meaningful experiences to help make the STEM concepts more relatable to increase student learning and plant seeds where they can see themselves in a future career. Mentorships between students and the collaboration partners would also be improved through this more just paradigm, as those improved workplace experiences could be shared between the mentor and mentee/prodigee. As the literature states, student–professional STEM career connections can influence current and future self-concept (Esprivalo-Harrell et al., 2004; Tyler-Wood et al., 2012).

Strengths and Limitations

Strengths

The data leverages an existing data set from 2010–2019, which started back in 1993, which provides a strong foundation of integrity and a richness of attributes for analysis. A significant strength in this study was in the overall sample contained in the data set. Additional rigor is extended to this study because it was collected by the U.S. Census Bureau and also due to the longitudinal nature of the NSF NSCG study. Using a standardized occupational code, primary job code major enables an objective normalizing basis for analysis, further refined when other attributes were added to the study.

Limitations

There are inconsistencies in the attributes available within the public data for race/ethnicity, which is the primary reason for limiting the date range of this study. Though the protocol leveraged the data available to have the integrity required to perform statistical analysis, the reduction from 26 years to nine eliminates a more extensive story from being understood. Although I provided insight into various questions and hypotheses using the entire data set when not using race/ethnicity, the overall assessment would be more complete. Therefore, these data were pulled from the whole set.

Another limitation to this study was that it focused on salary. Factors that would need future assessment include exploring organizational culture, societal biases, and stereotypes, which may impact persistence in a professional setting beyond graduation (beginning with a bachelor's degree) as found in the literature show a potentially significant area of change (Glass et al., 2013).

Implications for Future Practice

This study found evidence the wage gap exists and is affected by gender, race/ethnicity, degree level, and discipline (STEM/non-STEM fields). This study affirmed the importance of this subject as an injustice needing rectification. The study also provided a foundation for conversations with current students, especially women, with facts and data concerning one aspect of life after college when they try to answer what they want to be when they "grow up." This research aimed to enable thoughtful and intentional dialog in the public and private sectors concerning areas of compensation, organizational development, and leadership. Both the literature and this study showed some fields where the gap has decreased, and in some cases grew, it confirmed the gap's existence. The study was encouraging in that it found some work had already been done.

In contrast, more work is needed to increase salaries until all people are fairly and equitably compensated for equivalent jobs. Salary was a single data point in a more extensive set of attributes used to predict success, growth, and achievement; the more significant social implications experienced have been ignored. The systemic environmental factors, corporate, social, and political, can result in a loss of productivity, creativity, efficiency, and profit because of the overall effect contained from this single starting point. I hope corporations (for-, non-, and not-for-profit) intentionally review their hiring and compensation practices, including their organizational culture, to establish a sound and living improvement process to establish a sustained place of inclusion to reach the benefits from a more dynamic and just environment.

Recommendations for Future Research

As previously stated, an immediate study would be to expand this study using the entire 1993-2019 dataset. Additional studies comparing the NSCG data with other national data sets, such as the NSF's Survey of Doctorate Recipients (SDR) and US Labor and Statistics surveys, to see if the results are congruent over the same period. Another study could investigate if a correlation of additional education (e.g., earning higher degree levels) or training (e.g., certifications) existed and if they impacted persistence in the same career field. A study to look into the composition of a corporate structure (board, executives, managers, employees) to evaluate the effect on the culture, biases, mores, and values perceived and expressed could also be conducted. Another critical study could focus on students' support or adversities in their academic journey leading to graduation and employment. Those studies could reveal fundamental areas where our society is and can grow to improve, so women feel confident in having a full range of career choices, both STEM and non-STEM, without societal pressures limiting their options implicitly or explicitly.

This study's three frameworks could be further researched, focusing on the core components and their effects on self-identity development, visualization, persistence, performance, and enrollment. Environmental factors that appear to impact the student through how people are portrayed in the media, movies, textbooks, values, expectations, and roles could also be researched. These future studies may provide measures and data on how the environmental factors affect the workplace, which could support movement toward more just and equitable treatment of people.

Conclusion

As confirmed by the wage gap, a disparity exists in how we see, value, and treat each other. Inequities in compensation for equivalent job codes between genders and race/ethnicities are a call for a reality that is often glossed over as non-existent. Claims of seeing and valuing each other equally, seeing "no color" when working with others, question the notion's substance. Is it a dream, wishful thinking, or is it real? Where are the facts and data that substantiate its actual existence? The NSCG data, since its inception, showed that all women are paid less than men; within their racial/ethnic communities, career disciplines, and education levels. The data also showed not all race/ethnicity communities are paid the same. While there was a shift in the top earnings position, most non-white or multiple-race communities fell in the bottom five of seven places. The Latinx community being in the middle of the places points to growth potential, but the goal is a truly just and equitable world for everyone. I believe this will only come about when there is equity in practice, supporting a helpful and healthy self-image and identity development. Establishing equitable and fair business practices in the treatment and valuation of all employees and combining it with a collaboration between academia and workplaces can improve corporate culture. This product could strengthen and bridge a student's education to enable them to envision their future once they graduate with their degrees; how they may even help change the world. If we take the opportunity now to usher in an era of fairness and solidarity, the effects could be limitless and far more significant than we can currently imagine. It begins with us looking at what we want, what we say we do, against the data of what we actually do – as individuals, organizations, communities all the way through as global citizens. To start acting with intentional introspection and honesty to examine how we behave to identify where we can grow to build a more just world. To address those current or persistent biases, stereotypes, and experiences in our processes, mannerisms, and ways we see and encounter each other crucial eliminate this injustice and inequity. This authentic process can help us explain and eliminate those factors causing wage gaps and other inequities and become part of our nature to consistently discern and seek to improve the way we act and live.

This study sought to provide a spark of hope for a more equitable valuation of all human beings, beginning with this first factor in a cornucopia of variables that need to be gathered and considered when planning out life through an inspired discussion of the underlying reasons why the inequities existed. Other factors such as culture (corporate and societal), social and gender biases, how the media and printed materials portray people's roles, expectations, and ideals can lead people to doubt themselves, diverting from a particular dream, goal, profession, or vocation. This study supports the subsequent conversation, focusing energy not on the existence of the wage gap but toward areas where thoughtful dialog can begin to eliminate it. The data helped establish a solid baseline, using standard occupational code, where employees' salary was relative to each other when discussing parity based on gender, race/ethnicity, education, or discipline.

Confirming the wage gap was only the beginning, additional research to investigate those other areas more discretely is needed on this path of justice, equity, and solidarity. At a minimum, these data can be shared with students in primary and secondary education to help inform them on how jobs are distributed to help them progress toward maturity. It can also reinforce the importance of mentoring, especially with successful women in all leadership levels (lead through executive). This is the beginning of what leads to a new normal in how we see and treat each other. The opportunity lies in the conversation and values that reside in our youth and grow as they progress throughout their academic career into their professional life. As they learn, they engage; we grow as we engage with them and each other. Together, the world can be a more just and equitable place for all.

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APPENDIX A

Institutional Review Board Approval

September 28, 2020

David R. Orozco
Dept. of Educational Leadership
Seattle University

Dear David,

Thank you for your materials. After careful consideration, I have determined your study **Out on a STEM** exempt from IRB review in compliance with **45CFR46.104(d)**:

4) Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met: (i) identifiable private information or identifiable biospecimens are publicly available; (ii) the investigator records Information in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects; (iii) the research involves only information collection and analysis involving the investigator's use of identifiable health information regulated under 45 CFR 160 and 164 (subparts A and E), for the purposes of "health care operations" or "research" as defined at 45 CFR 164.501 or for "public health activities and purposes" [45 CFR 164.512(b)]; or (iv) the research is conducted by, or on behalf of, a Federal department or agency using government-generated or government-collected information obtained for non-research activities.

Note that a letter of exemption does **not** mean IRB "approval." *Do not include statements for publication or otherwise that the SU IRB has "reviewed and approved" this study*; rather, say the SU IRB has "determined the study to be exempt from IRB review in accordance with federal regulation criteria." Please retain this letter with your study files.

If your project alters in nature or scope, contact the IRB right away. If you have any questions, I'm happy to assist.

Best wishes,

Andrea McDowell, PhD
IRB Administrator

Email: irb@seattleu.edu
Phone: (206) 296-2585

cc: Dr. Colette Taylor, Faculty Adviser

APPENDIX B

Full Size Charts

Figure 17 Box-Plot of average salaries by year, race/ethnicity and gender

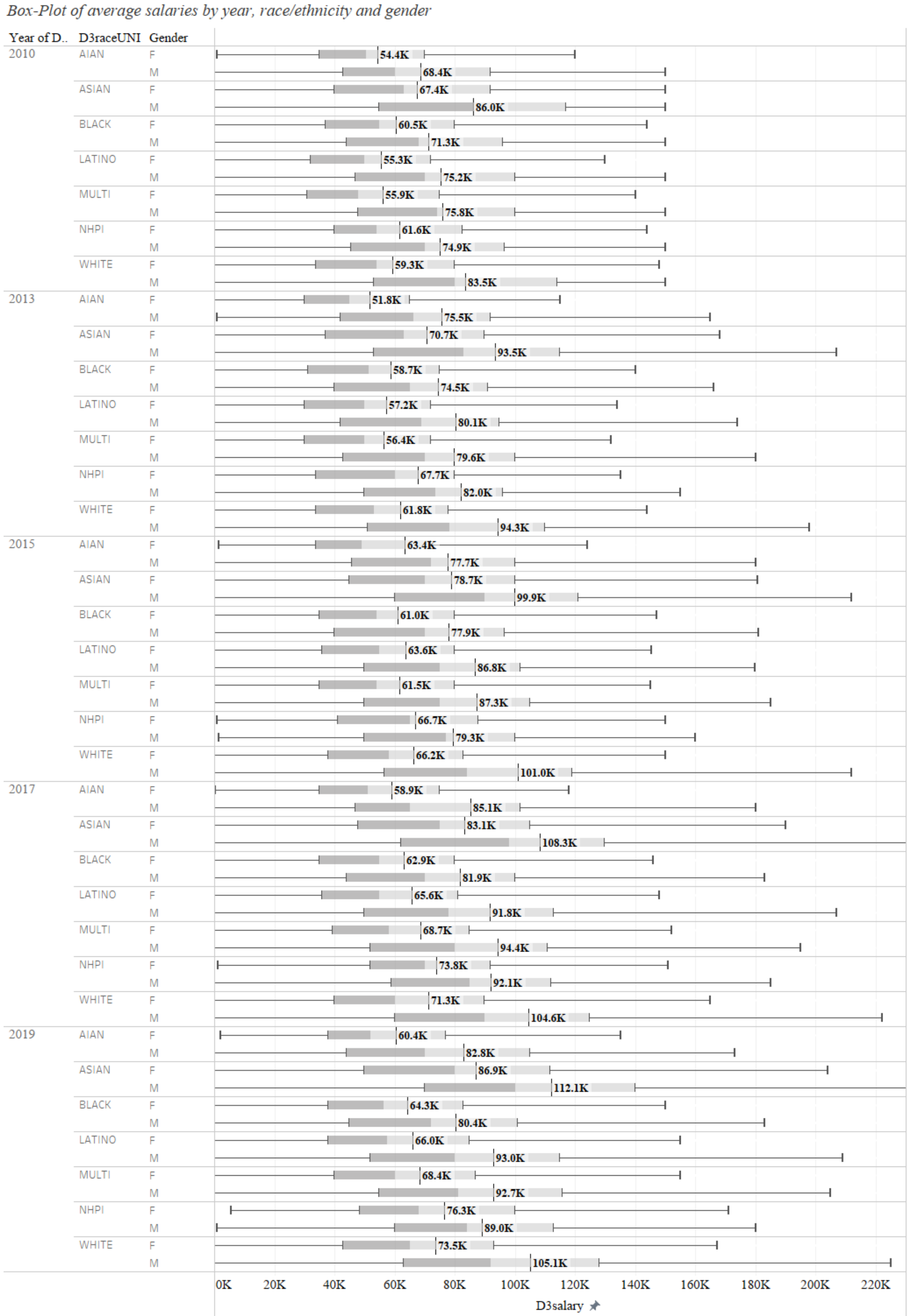

Table 21 Box-Plot of average salaries by year, STEM, race/ethnicity and gender

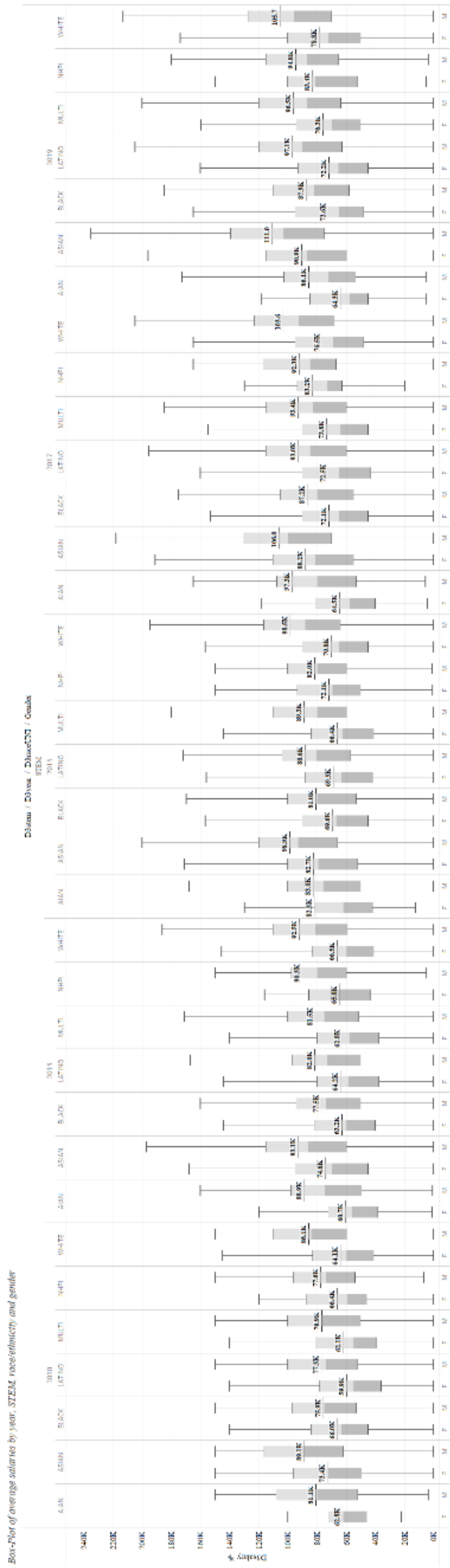

Table 22 Box-Plot of average salaries by year, non-STEM, race/ethnicity and gender