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The Existing Intersectionality of Gender and Race Differences in Science, Technology, Engineering and Math Fields

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The Existing Intersectionality of Gender and Race Differences in Science, Technology, Engineering and Math Fields

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Abstract

This thesis will examine the gender differences women and men experience in Science, Technology, Engineering and Math fields (STEM) in undergraduate education focusing on the binary genders--men and women--and their experiences in STEM. Thus, the research question is: Do undergraduate women in STEM experience higher levels of gender differences compared to men in STEM? This is an important research question because if female undergraduates in STEM are experiencing sexism while their male colleagues are not, this phenomenon may create a large issue of inequalities for women in our society. STEM fields are typically higher paying fields and if women are not given the same opportunities as men, it may create more inequalities and more barriers.

This thesis will specifically address the patterns among men and women that they experience in undergraduate STEM courses. The experiences men and women encounter in undergraduate STEM courses will affect their chosen careers due to their gender differences. This thesis will also utilize intersectionality theory to find how race and gender may intersect when analyzing gender differences that may occur in STEM fields. Analyzing the gendered differences and experiences is best practiced when utilizing intersectionality because it can help explain the interwinnings of discrimination women of color face when being in a space that was created for white men (Alfred, Ray, & Johnson 2019).

However, it is also important to acknowledge how power and privilege is demonstrated in society and at the meso-level of our institutions like STEM fields. When STEM is over represented with hegemonic males, people of color and women may face additional challenges to be included in fields that are historically and contemporarily dominated by white males. For instance, women and women of color may experience feelings of isolation and stereotype threat and may question

if they belong. Thus, this paper will discuss the challenges women of color face when in STEM. The results of this study will help us address the desired needs for women of color in STEM.

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Introduction

Science, Technology, Engineering and Mathematics (STEM) is a male-dominated field with very little representation of women. Therefore, my research question is: Do women in STEM experience higher levels of gender differences compared to men in STEM? Research demonstrates that women in STEM indeed experience higher levels of gender differences compared to men in STEM. For instance, women in STEM experience gender differences such as sexism, lower pay wages and gender identity threat (Hango 2013; U.S. Department of Commerce 2011; Wang and Degol 2013).

Women in STEM careers, who were able to overcome sexism and discrimination, continue to experience extreme sexism in their careers (U.S. Department of Commerce 2011). For instance, in the U.S. in 2009 women in STEM only represented 2.5 million female workers compared to 6.7 million male workers (U.S. Department of Commerce 2011).

When analyzing the gendered differences in STEM, it is crucial to focus on the intersectionality of gender and race. Intersectionality, in this context, are the ways in which gender and race inform and transform each other to create unique experiences (Crenshaw 1990). This paper will analyze the experiences of women and men and how gender and race create unique experiences for undergraduates in STEM. Furthermore, women of color in STEM are the most underrepresented group. (The following statistics are seen on page 7) When focusing on science and engineering and race and gender, white women made up 18%, Asian women made up 7%, Hispanic women made up 2%, Black women made up 2% and other men and women made up 1% each (National Science Foundation 2017). According to this data, Black women and Hispanic women are the overall most underrepresented groups in STEM.

Women of color are continuously challenged due to their race and gender identities. While White women are also being discriminated against, they are less likely to experience race driven discrimination/prejudice. Women of color experience racism and sexism and are challenged due to their race and gender, instead of factors such as performance or professionalism. Thus, further research on the challenges and experiences of women of color in STEM are necessary to bring change in male-dominated fields.

Literature Review

Theme 1: STEM Careers Among Men and Women

In STEM careers research shows that men and women have extreme differences, even when they have the same degree, such as men are less likely to be unemployed with a STEM degree compared to women being more likely to be unemployed with a STEM degree. For instance, in Canada, men who hold STEM degrees experience a 4.7% unemployment rate compared to 5.5% of men who do not have STEM degrees (Hango 2013). In comparison, women with a STEM degree experience a 7.0% unemployment rate and women with no STEM degree experience a 5.7% unemployment rate (Hango 2013). However, this only represents the small percentage of women who were able to graduate with a STEM degree, many others were not able to graduate with a STEM degree due to the intense sexism they encountered during their time of attaining a degree in STEM.

To elaborate on the extreme sexism women face in STEM careers, in the U.S. in 2000-2009 women are extremely underrepresented in STEM careers and as mentioned before, extremely underrepresented in obtaining a degree to begin with (U.S. Department of Commerce 2011). For instance, when focusing on only science and engineer occupations, 71% of scientists and engineers were males and only 29% of scientists and engineers were females (National Science Foundation

2017). In 2009, U.S. Department of Commerce (2011) shows that there were 6.7 million male STEM workers and 2.5 million female STEM workers. Within that data, 57% of women in STEM had a physical and life sciences degree, 18% engineering degree, 14% computer degree, and 10% math degree (U.S. Department of Commerce 2011).

In addition, women's representation in engineering specifically has declined in 2000-2009. In 2000, 30% of women were engineers, but in 2009 it declined to only 27% of women engineers (U.S. Department of Commerce 2011). A major finding in most research is the fact that in the U.S. about 48% of women have jobs, but only 24% of those women obtain STEM jobs, given that more women have degrees as well; in comparison, 52% of men hold jobs in the U.S. and of that 52%, 76% are STEM jobs (U.S. Department of Commerce 2011).

It is true that the gender wage gap exists today in the United States. On average, women earn 80.7% to a man's earning (U.S. Census Bureau 2017). In STEM careers specifically, a woman earns 14% less than a man (U.S. Department of Commerce 2011). On average, men in STEM earn $36.34 an hour compared to the average $31.11 an hour that women make, meaning that women make 86 cents to every man's dollar (U.S. Department of Commerce 2011). In perspective, assuming men and women work 40 hours a week, for 4 weeks, over one year, men earn $69,722.80 a year. This is assuming they do not get paid overtime, have promotions, or any other factors. In comparison to women with the same 40 hours a week, for 4 weeks, over one year, they earn $59,731.20 a year-- about a $10,000 difference.

Race/Ethnicity in STEM Careers

The number of women in STEM also varies by race/ethnicity. When a woman of color is in STEM, they are more underrepresented. To begin with, in 2015, data shows that about 15% of

engineers are women, almost 30% were employed with science and engineers' occupations, about 25% of computer and math scientists were women, and less than 25% were science and engineering technologists and technicians (National Science Foundation 2017). However, when comparing to Hispanic scientists and engineers in 2015, male or female, the percentages change drastically. Data shows that about 7% of engineers were Hispanic, about 6% of science and engineer employees were Hispanics, 5% of computer and math scientists were Hispanic, and there is no data for science and engineering technologists and technicians (National Science Foundation 2017).

The number of Hispanics who have STEM occupations is drastically low compared to women. Women are indeed underrepresented in STEM fields, but when comparing women to all Hispanics (male or female), Hispanics are more underrepresented and marginalized. When comparing all Hispanics and all Blacks to women, Black males and females are also very underrepresented. In 2015, data shows that less than 5% of engineers were Black, almost 5% of science and engineer employees were Black, 5% of computer and math scientists were Black, and once again, there is no data represented for science and engineering technologists and technicians (National Science Foundation 2017). Data on Asians show that a total of 21% work in science and engineering occupations (National Science Foundation 2017). When focusing on science and engineering and race and gender, white women made up 18%, Asian women made up 7%, Hispanic women made up 2%, Black women made up 2% and other races of women made up 1% (National Science Foundation 2017). "Other" in this data represents American Indian or Alaska Native, Native Hawaiian or Pacific Islander, and multiple race.

Research shows that overall, Hispanics and Blacks in STEM are the most underrepresented group and these women of color are more underrepresented compared to their male counterparts.

Thus, when focusing on gender, there is often more male representation in STEM compared to females in STEM.

Factors Underrepresented Women Encounter

There are many factors that can contribute to the underrepresentation of women who are White, Hispanic, Black, Asian or who identify as "other" obtaining a career in STEM. There are four major reasons why women with STEM degrees reported not working in STEM careers. The 2017 National Science Foundation found that in 2015, unemployment rates were high for underrepresented women in STEM due to various reasons.

Underrepresented women in STEM were not working among scientists and engineers in 2015 due to family, jobs not being available, being laid off, or being retired. Over 35% of underrepresented women were retired, almost 10% were laid off, 18% reported that jobs were not available, and about 25% reported they were not working as scientists and engineers due to family reasons (National Science Foundation 2017). When focusing on Asian women not working as scientists and engineers almost 20% of Asian women in STEM were retired, about 2% of Asian women were laid off, over 10% of Asian women said jobs were not available and almost 40% of Asian women said it was due to family (National Science Foundation 2017). The National Science Foundation reported that women are more likely to cite family reasons compared to men (2017).

Women in STEM face many disparities when working in STEM or having to leave their STEM careers. As stated earlier, family is one of the four main reasons women do not work in STEM. Research shows that women and women of color experience difficulties balancing career and their STEM jobs, for the reason that family and household priorities are too demanding (Alfred, Ray & Johnson 2019). Many women find the demands of family and their careers too

hard to balance, but many women also never start a STEM career because they already know there will be conflicts between family and work (Heilbronner 2013). Women also plan for careers that allow flexibility if they plan to have children and STEM demands do not make this flexibility (Wang and Degol 2013). However, older women in STEM (over 30 years old), were more likely to leave STEM occupations because of family responsibilities, which can be due to having to handle child care responsibilities (Heilbronner 2013).

In comparison, men are more likely to remain with their STEM occupations. Degol and Wang (2013) state that "females place more importance on making occupational sacrifices for the family than males" (310). Their evidence suggests that women prefer to commit to a home lifestyle than a work lifestyle (Wang and Degol 2013). These comparisons show how there are societal expectations and gender roles--where women are expected to be the nurturer and take care of family responsibilities. These expectations and gender roles are fulfilled when the women have no choice but to leave her STEM career, while males/fathers remain in their STEM occupations. Which thus in turn represents how men are expected to provide for the family. However, there are other factors that contribute to the underrepresentation of women in STEM.

There is research Wang and Degol (2013) not that the expectations for women are socially constructed and have a social orientation that place more value on jobs that are focused on helping people and that are helpful for society, whereas males place more value on jobs that grant them access to making more money, grant them more power, and jobs that can potentially make then famous. When focusing on men in women in STEM careers and men and women of color in STEM careers, the data is drastically different and shows the difficulties women and people of color face compared to white males. However, when looking at gender differences in STEM among all men

and all women, the data is more complex and offers more insight to the challenges women face in STEM--outside of career choices.

Theme 2: Gender Differences in STEM Between Men and Women

In addition to males always outnumbering women in STEM, women are often negatively stereotyped. This leads to causing identity threat which in turn negatively predicted women's work engagement and career confidence (Van Veelen, Derks, & Endedijk 2019). Identity threat is "when people feel concerned about being negatively treated, stereotyped or devalued in some way on the basis of their group membership" (Van Veelen, Derks, & Endedijk 2019:2). So, when women are in a male-dominated feel, they are experiencing identity threat due to the fact that their group as women are underrepresented and fear being treated negatively compared to men, this is also called gender identity threat. Gender identity threat is similar to identity threat, except it focuses on gender, in this case women, and how they are treated negatively due to their gender rather than their professionalism (Van Veelen, Derks, & Endedijk 2019).

Gender identity threat negatively affects women's performance when asked to complete a task, because when they are told that the task they are about to perform is better performed by men, they focus more on not failing and actually perform poorly (Van Veelen, Derks, & Endedijk 2019). Furthermore, this intentionally or unintentionally creates a cycle that perpetuates the inequalities in STEM and the underrepresentation of women in STEM. When women are told that they are doing a task that is better performed by men, this is gender identity threat and stereotype threat which causes them to perform poorly due to this gendered stereotype information. So, if they perform poorly, they are most likely not going to be successful in STEM, while their male peers are. Women then leave STEM and men remain in STEM. However, there are other inequalities women face compared to men.

Gender stereotypes from women's and men's parents can also be responsible for outcomes of their STEM journey. For example, "parents who endorse math and science gender stereotypes are likely to underestimate their daughters' ability and overestimate their sons' ability in these areas" (Wang and Degol 2013:316). If parents are enabling gender differences which thus creates gendered performance, this shows how socialization and gender identity/gender stereotype threat occurs when you are a child and is likely to occur for the rest of your life. Thus, "parental beliefs influence youth ability beliefs which, in turn, impact their future achievement and career choices" (Wang and Degol 2013:317). As mentioned earlier, these are patterns that women endure from a young age. It is a cycle that occurs in the family, in organizations/institutions such as STEM and in our policies.

Since STEM outcomes are usually due to socialization and gender identity threat, women recognize these inequalities early on. However, this socialization follows in their experiences in undergraduate STEM courses and later in their careers. Women perceive STEM as "being object-oriented, male-dominated, and not family friendly—issues that have yet to be addressed on a meaningful level" (Wang and Degol 2013:328). All three factors are detrimental of women's success in STEM. For the reason that if you are in a object-oriented, male-dominated and not family friendly field (Wang and Degol 2013), you are most likely under constant pressure and receive little to no support because men in STEM cannot relate to your experiences. However, when looking at inequalities and sexism in STEM, women of color face the most disparities and the receive the least amount of support.

Theme 3: Different Experiences for Women of Color in STEM

Women are the most underrepresented group in STEM fields, facing sexism and discrimination in their desired careers and threatened with gender identities and stereotypes.

However, when focusing and analyzing gender differences in STEM, it is important to look at the intersections of gender and race. Furthermore, in 2006 a total of 12% of STEM Bachelor of Science degrees were given to women of color (Espinosa 2011). In comparison to White women, a total of 25% received a STEM Bachelor of Science degree (Espinosa 2011). In 2006, the percentages of women of color in science and engineering varied by race. In 2006, there were a total of 5.9% bachelor of science degrees for Black women in science and engineering, 4.3% bachelor of science degrees were for Hispanic women in science and engineering, and 0.4% bachelor of science degrees were for American Indian women in science and engineering (Mack, Rankins and Woodson 2013; National Science Foundation 2009).

When focusing on women of color as faculty in STEM disciplines in 2006, they represented 3.6% of all assistant professors, 2.5% of all associate professors and 1.2% of all full professors (Mack, Rankins and Woodson 2013). On the basis of race and gender of the percentages of women of color as faculty, 1.9% of assistant professors were Black women, 1.5% of assistant professors were Hispanic women and 0.2% of assistant professors were American Indian women (Mack, Rankins and Woodson 2013; National Science Foundation 2009). For associate professor faculty, 1.2% of associate professors were Black women, 1.1% of associate professors were Hispanic women and 0.2% of associate professors were American Indian women (Mack, Rankins and Woodson 2013; National Science Foundation 2009). For full professor faculty, 0.7% of full professors were Black women, 0.4% of full professors were Hispanic women and 0.1% of full professors were American Indian women (Mack, Rankins and Woodson 2013; National Science Foundation 2009).

There have been findings of women of color in their undergraduate STEM program encountering microaggressions in classrooms with male and white students due to their race and

gender (Espinosa 2011). There have also been reports of women of color feeling invisible, feeling unsupported and feeling unwelcome with peers and faculty due to their race and gender (Espinosa 2011). Espinosa's (2011) most significant finding is the impact of institutional selectivity for women of color. Espinosa (2011) suggests this can be due to small ethnic representation on campuses and feeling isolated due to the lack of role models who are also from underrepresented backgrounds.

Research has also shown that women of color experience a double bind--where women of color encounter both sexism and racism in STEM (Ong, Wright, Espinosa and Orfield 2011). This is unfortunately a problem that has not been addressed (Ong, Wright, Espinosa and Orfield 2011). Women of color's needs are not being supported in STEM and researchers suggest this is due to "programs intended to serve women disproportionately benefit White women, and programs intended to serve minorities mainly benefit minority males" (Ong, Wright, Espinosa and Orfield 2011:176). Women of color in STEM also feel a sense of tokenism, where they are the only women of color in a room (Ong, Wright, Espinosa and Orfield 2011). In Kachchaf, Ko, Hodari and Ong's (2015) research with three women of color, they revealed that women of color have an automatic disadvantage in STEM because they hold multiple intersectional identities which is not the norm in STEM. All three women also reported feeling tokenized in STEM which led to isolation (Kachchaf, Ko, Hodari and Ong 2015).

Another study by Allen and Eisenhart (2017) consisted of four women of color and their experiences in STEM. All four women, who were in high school, resisted the oppression they faced in their math and science classes and even excelled (Allen and Eisenhart 2017). They all four experienced gender and race differences in the classroom and one reported they were usually the only women of color in the classroom (Allen and Eisenhart 2017). This study suggests a need

to address the intersectionality of race and gender in high school STEM courses (Allen and Eisenhart 2017).

While research has shown that women are the most underrepresented group, when using and intersectional lens and examining the impact of race *and* gender, women of color are the most marginalized group in STEM. As discussed in Theme 1, women who are Black or Hispanic are the overall most marginalized groups in STEM compared to all men and White women.

The inequalities in the experiences of women of color is presented in all areas of science, technology, engineering and mathematics. One case study shows that there was a program known as the Mentored Undergraduate Research Program (MUR) that consisted of a successful pedagogy for a majority of students in STEM. This program consisted of 35 undergraduates, 10 faculty members, 10 graduate students, and 1 program coordinator n=56. Faculty members spent their time on site with graduate students to give support and mentor them. This study was based on the bi-weekly observed mentor-student workshops and interviews. However, though this program was successful, there were students who felt isolated and marginalized throughout the entire program. These students were women and students of color (meaning men and women of color) (Greene, DeStefano, Burgon, & Hall 2006).

In the success of the MUR program, women and/or students of color were still not represented as much as white men or women were--there were not a lot of women or students of color entering the program (Greene, DeStefano, Burgon, & Hall 2006). However, the women and/or students of color who were in the MUR program, reported they felt “somewhat isolated and unsupported by their graduate student mentors, and mostly ignored by their faculty mentors. Most graduate students feel ill prepared to serve in a mentoring role; some even question whether it is a legitimate part of their job description, noting that the concept of mentorship requires an

experienced person with wisdom born of years of practice" (Greene, DeStefano, Burgon, & Hall 2006:67). Thus, even though MUR was an overall successful program, women and/or students of color felt isolated and were given less mentoring/support than their White male peers. This displays that even though you may have an overall successful program, it does not solve or diminish the inequalities women and/or students of color face.

Research also show that when women of color transitioned from community colleges to universities, while in STEM, they felt isolation and invisibility, lack of social networks and social capital on campus, difficulty managing conflicting priorities and expectations and more. (Reyes 2011). There is a pattern of isolation and lack of support women of color endure while in STEM fields. This pattern reinforces the cycle of oppression in STEM fields, programs and careers. This cycle of oppression also reinforces the messages women receive. For instance, "overall, career development for women of color in STEM fields begins within family and community and is influenced by societal messages about their place as women— minority women—in male-dominated careers in the fields of STEM" (Alfred, Ray, & Johnson 2019:128). This systemic cycle of oppression creates a "push out" for Hispanic and Black women.

Though socialization begins during childhood, women of color face discrimination and sexism in public high schools as well, making it difficult to graduate high school and even more difficult to pursue a career in STEM. For instance, this systemic oppression women of color face are reinforced in the "policies and guidelines... enacted that often represent the values and ideologies of the dominant members of society, resulting in the perpetuation of privilege and marginalization" (Alfred, Ray, & Johnson 2019:122). Hispanic and Black girls have to follow the problematic guidelines of maintaining hair, clothing and controlling their so-called attitudes

(Alfred, Ray, & Johnson 2019). Thus, Hispanic and Black girls are being "pushed out" of high schools, making it impossible to graduate and thus impossible to have a career in STEM.

This oppression, sexism, and racism thus reinforces the cycle and patterns of oppression, stereotype threat and gender identity threat. Women of color are being oppressed and discriminated against due to the color of their skin and their perceived gender, which then oppressed them in their journey of entering STEM--if they can enter it (Alfred, Ray, & Johnson 2019). The intersections of race and gender create barriers that women of color face from childhood until the rest of their lives. They can never solely represent their professionalism or knowledge on STEM because their race and gender will always be judged and oppressed first. Therefore, women of color in STEM are experiencing gender differences based on their race and gender.

Analysis and Conclusion

Gender differences exist for women in STEM compared to men in STEM. Women are experiencing issues such as isolation, marginalization, (Greene, DeStefano, Burgon, & Hall 2006) and seeing STEM as a male-dominated field (Wang and Degol 2013). These differences are more present for women of color in STEM. There are patterns displayed through research that shows women of color feeling isolated, unsupported (Greene, DeStefano, Burgon, & Hall 2006) and tokenized (Ong, Wright, Espinosa and Orfield 2011; Kachchaf, Ko, Hodari and Ong 2015).

There are also gaps in literature comparing the differences among women of color and white women in STEM. This is important to address because while women in STEM experience sexism and other forms of discrimination, it is important to look at the intersectionalities and experiences of women of color in STEM. Women of color experience different forms of discrimination based on their race and gender. The gap in literature is important to address because

if we can be knowledgeable on the needs and resources women of color need to be successful and represented in STEM, we can create a successful pathway and pedagogy.

There are many gaps that need to be addressed for women of color in STEM. There is a crisis of women of color feeling isolated and receiving less support (Greene, DeStefano, Burgon, & Hall 2006). This crisis needs to be addressed and maintained throughout STEM programs to ensure that women of color are receiving the appropriate resources, mentoring and transitioning in STEM programs and through their careers in STEM. Thus, there is little research on what women of color need in order to be successful in STEM. Because of the little representation women of color have in STEM, there is little research on women of color in STEM and their desired needs. Throughout my research, there have also been suggestions in the literature I researched. Suggestions such as:

> 1. Ensure students have equal access to the teacher and classroom resources. 2. Create examples and assignments that emphasize the ways that science can improve the quality of life of living things. 3. Use cooperative groups in class, or at least avoid dividing students by sex for class competitions or in seating arrangements. 4. Eliminate sexist language and imagery in printed materials. 5. Do not tolerate sexist language or behavior in the classroom. 6. Increase depth and reduce breadth in introductory courses. 7. Openly acknowledge the political nature of scientific inquiry" (Clark Blickenstaff 2005:384).

My research will examine the sexism encountered by undergraduate students and I will compare experiences across gender (male and female) and also look at how race intersects those experiences.

Project Design

For this thesis, I analyzed data collected for a larger research project. For the larger, NSF-funded research, Principle Investigators Drs. Julie Sexton and Kevin Pugh collected survey responses from undergraduates enrolled in geology courses between semesters Fall/Spring 2012 through Fall 2014. The larger project examined geology classes as transformative spaces and sought to capture the impact of sexism on students' academic and career trajectories. Researchers collected 2,041 responses from students from departments that were graduating an average of 60 students or greater female students per year. I analyzed these 2,041 responses to determine the rate of sexist experiences between male and female students and whether the intersection of race and gender had an impact on students' likelihood of experiencing sexism.

Methodology and Research Design

My approach to my research analyzed academic literature on gender differences in STEM. I researched statistics on the amount of men and women in STEM, the careers men and women pursue in STEM and analyzing literature relatable to factors/issues contributing to STEM. This research project used a quantitative method. I analyzed pre-existing data regarding gender discrimination in STEM.

I analyzed Drs. Julie Sexton and Kevin Pugh's research which entails "A quantitative investigation of geoscience departmental factors associated with the recruitment and retention of female students." My Thesis Advisor, Dr. Newman, helped me analyze their research and was also in contact with Dr. Julie Sexton with any questions or clarifications we needed.

Data Collection Procedures

For my data collection, I analyzed about 2,041 post-survey responses from undergraduate geology students. I did not utilize the pre-survey questions because it was not valuable to this project. There are six different sites where students were recruited. Two sites had a low rate of female graduates, two sites had a nationally average rate of female graduations, and two sites had a higher than average rate of female graduations.

Data Analysis Procedures

This study utilized quantitative data analysis. SPSS was utilized for quantitative data analysis. I purposefully analyzed each post response and searched for themes. Included in the survey were pre and post test questions that utilized a 5-point Likert scale on social support, institutional supports, institutional barriers, and gender discrimination scales (1 = strongly disagree, 5 = strongly agree). The Likert scale responses will be included in the Appendices section on page 29.

Data Handling

All participants will remain confidential. The researcher will keep the responses recorded confidential.

Analysis of Results

Demographics

There were 2,041 responses recorded and 41.5% reported they were male (846) and 53.4% reported they were female (1087), there were 108 unreported. When analyzing race, there were 65.5% reported who were White (1,335), 11.7% Hispanics (238), 5.3% Asians (107), 3.9% reported they were Black (80), 5.5% who were Mixed (113), and 4.5% reported "other" (91), there were 77 unreported. When focusing on the intersections of race and gender, males reported there were 69.5% (585) Whites, 12.6 % (106) Hispanics, 5.7% (48) Asians, 3.2% (27) Blacks, 6.1% (52) Mixed, and 2.7% (23) males reported "other," there were 5 missing reports. When focusing on females, 68.8% (746) were White, 12.1% (132) Hispanics, 5.4% (59) Asians, 4.8% (53) Blacks, 5.6% (61) Mixed, and 2.9% (32) females reported "other," there were 4 reports missing. The intersection of race and gender are fairly similar amongst males and females. Furthermore, we see a majority of males and females who are White and very few who are Black or "other." Table 1 shows the demographics.

Table 1: Demographics

%	Male	Female
White	**69.5**	**68.8**
Hispanic	**12.6**	**12.1**
Asian	**5.7**	**5.4**
Black	**3.2**	**4.8**
Mixed	**6.1**	**5.6**
Other	**2.7**	**2.9**

Gender Discrimination

When analyzing the independent variable "sex" and the dependent variable "in my geoscience program, I receive unfair treatment because of my gender", 78.4% of males disagreed or strongly disagreed to receiving unfair treatment because of their gender. A total of 86.2% of females reported disagree or strongly disagree to receiving unfair treatment because of their gender. More females than males reported strongly disagree to receiving unfair treatment because of their gender. Also, more males than females reported strongly agree to receiving unfair treatment because of their gender. Table 2 shows the total percentages.

Table 2: I Receive Unfair Treatment Because of My Gender

Sex	1.0 (%)	2.0 (%)	3.0 (%)	4.0 (%)	5.0 (%)
Male (N=436)	**56.4**	**22.0**	**8.7**	**6.0**	**6.9**
Female (N=603)	**57.7**	**28.5**	**6.5**	**2.7**	**4.6**

When analyzing the independent variable "sex" and the dependent variable "I feel that I am different from others in the geosciences because of my gender", 80.1% of males disagreed or strongly disagreed to feeling they are different from other in the geosciences because of their gender. A total of 85.1% of females reported disagree or strongly disagree to feeling that they are different from other in the geosciences because of their gender. More males than females reported strongly disagree to feeling they are different from other in the geosciences because of their gender. Simultaneously, more males than females reported strongly agree to feeling they are different from others in the geosciences because of their gender. Table 3 shows the total percentages.

Table 3: I Feel That I am Different from Others in the Geosciences Because of My Gender					
Sex	1.0 (%)	2.0 (%)	3.0 (%)	4.0 (%)	5.0 (%)
Male (N=437)	**53.3**	**26.8**	**8.2**	**4.1**	**7.6**
Female (N=598)	**45.3**	**39.8**	**6.9**	**2.2**	**5.9**

When analyzing the independent variable "sex" and the dependent variable, "in my geoscience courses, I receive unfair treatment because of my gender, 81.8% of males reported disagree or strongly disagree to receiving unfair treatment because of their gender in their geoscience courses. A total of 90.3% of females reported disagree or strongly disagree to receiving unfair treatment because of their gender in their geoscience courses. Table 3 shows the total percentages. More males than females reported strongly disagree to receiving unfair treatment in their geoscience courses because of their gender. Simultaneously, more males than females reported strongly agree to receiving unfair treatment in their geoscience courses because of their gender. Table 4 shows the total percentages.

Table 4: In My Geoscience Courses, I Receive Unfair Treatment Because of My Gender					
Sex	1.0 (%)	2.0 (%)	3.0 (%)	4.0 (%)	5.0 (%)
Male (N=436)	**59.6**	**22.2**	**8.0**	**3.9**	**6.2**
Female (N=598)	**56.7**	**33.6**	**4.7**	**1.0**	**4.0**

When analyzing the independent variable "race-ethnicity" and the dependent variable, "I receive unfair treatment because of my gender", 84.6% of Whites reported disagree or strongly

disagree to receiving unfair treatment because of their gender. A total of 77.1% of Hispanics reported disagree or strongly disagree. A total of 77.6% of Asians reported disagree or strongly disagree, 86.7% of Blacks reported disagree or strongly disagree, 80% of mixed race reported disagree or strongly disagree, and 91.3% of those who reported "other" or non-reported said disagree or strongly disagree. Those who are "other" or non-reported were the highest to report strongly disagree. However, more Blacks than any other race-ethnicity reported strongly agree to receiving unfair treatment because of their gender (10%). Table 5 shows the total percentages.

Table 5: I Receive Unfair Treatment Because of My Gender

Race-Ethnicity	1.0 (%)	2.0 (%)	3.0 (%)	4.0 (%)	5.0 (%)
White (N=734)	**58.2**	**26.4**	**7.2**	**3.1**	**5.0**
Hispanic (N=123)	**56.1**	**21.1**	**4.9**	**8.9**	**8.9**
Asian (N=58)	**56.9**	**20.7**	**12.1**	**8.6**	**1.7**
Black (N=30)	**46.7**	**40.0**	**0.0**	**3.3**	**10.0**
Mixed (N=60)	**55.0**	**25.0**	**10.0**	**3.3**	**6.7**
Other or non-reported (N=46)	**67.4**	**23.9**	**6.5**	**2.2**	**0.0**

When analyzing race-ethnicity and "I feel that I am different from others in the geosciences because of my gender", 85.5% of Whites reported disagree or strongly disagree. A total of 79.9% of Hispanics reported disagree or strongly disagree to feeling they are different from others in the geosciences because of their gender. A total of 67.3% of Asians reported

disagree or strongly disagree, 76.7% of Blacks reported disagree or strongly disagree, 81.7% of those who are mixed reported disagree or strongly disagree, and 82.2% of those who marked their race as "other" or those who did not mark their race reported disagree or strongly disagree. Those who are "other" or non-reported were the highest to report strongly disagree (53%). However, more Blacks than any other race-ethnicity reported strongly agree and agree to feeling they are different from others in the geosciences because of their gender (13%). Table 6 shows the total percentages.

Table 6: I Feel That I am Different from Others in the Geosciences Because of My Gender

Race-Ethnicity	1.0 (%)	2.0 (%)	3.0 (%)	4.0 (%)	5.0 (%)
White (N=729)	**50.5**	**35.0**	**5.8**	**2.6**	**6.2**
Hispanic (N=124)	**44.4**	**35.5**	**8.9**	**4.8**	**6.5**
Asian (N=58)	**39.7**	**27.6**	**22.4**	**5.2**	**5.2**
Black (N=30)	**43.4**	**33.3**	**3.3**	**6.7**	**13.3**
Mixed (N=60)	**51.7**	**30.0**	**10.0**	**0.0**	**8.3**
Other or non-reported (N=46)	**53.3**	**28.9**	**8.9**	**4.4**	**4.4**

When analyzing race-ethnicity and "in my geoscience courses, I receive unfair treatment because of my gender", 88.6% of Whites reported disagree or strongly disagree. For Hispanics, 81.3% reported disagree or strongly disagree to receiving unfair treatment in their geoscience courses because of their gender. For Asians, 77.6% reported disagree or strongly disagree, 86.7%

of Blacks reported disagree or strongly disagree, 85% of those who are mixed reported disagree or strongly disagree, and 86.7% of those who marked "other" as their race-ethnicity or who did not mark their race-ethnicity reported disagree or strongly disagree. Those who are "other" or non-reported were the highest to report strongly disagree (67%). However, more mixed race-ethnicities than any other race-ethnicity reported strongly agree to receiving unfair treatment because of their gender in their geoscience courses (7%). The total percentages are found in Table 7.

Table 7: In My Geoscience Courses, I Receive Unfair Treatment Because of My Gender

Race-Ethnicity	1.0 (%)	2.0 (%)	3.0 (%)	4.0 (%)	5.0 (%)
White (N=729)	**59.1**	**29.5**	**5.1**	**1.8**	**4.5**
Hispanic (N=123)	**56.1**	**25.2**	**8.1**	**4.9**	**5.7**
Asian (N=58)	**46.6**	**31.0**	**17.2**	**1.7**	**3.4**
Black (N=30)	**56.7**	**30.0**	**3.3**	**3.3**	**6.7**
Mixed (N=60)	**58.3**	**26.7**	**3.3**	**3.3**	**8.3**
Other or non-reported (N=45)	**66.7**	**20.0**	**6.7**	**2.2**	**4.4**

Discussion

A majority of the results of the project were not aligned with that of the research. The research stated that people of color and women are more likely to experience racism, sexism, discrimination, and more. However, the results indicated that males are experiencing more

discrimination than females. This may be due to females embodying resistance and stating they do not experience discrimination because they do all they can to avoid it. This may also suggest that males are experiencing discrimination in their geoscience program. The results that do align with the existing literature is that there is more representation of White males compared to women of color. For instance, there is 69.5% of White males, compared to 4.8 Black females.

Conclusion

In the geoscience program, there are grossly more White males and females than any other race-ethnicity. The least represented race-ethnicity for males and females are those who reported "other" and Black folks. Few females are reporting that they receive gender discrimination in their geosciences and geoscience courses. This may suggest that they are portraying embodied resistance towards feeling they receive unfair treatment, feeling they are different, and receiving unfair treatment in their geoscience courses. They may be resisting the stereotypes of females in STEM or they may not recognize the unfair treatment.

There are more Black and "other" race-ethnicities that are reporting strongly agree for receiving unfair treatment, feeling they are different, and receiving unfair treatment in their geoscience courses because of their gender. This suggests that there may be race and gender discrimination in their geoscience program. Though Blacks and "other" are the least represented race-ethnicity, they are reporting strongly agree to discrimination more than any other race. This suggests that because they are grossly underrepresented, they are feeling/receiving unfair treatment.

Limitations

There were many limitations for this research. This study contained 241 more females than males, so the data was not as equal in regard to the representation of males and females.

This data also did not focus on race, nor the intersection of race and gender. Since it only focused on gender, it is difficult to analyze whether there was discrimination on their race-ethnicity. For future research, asking the same questions but with the independent variable “race-ethnicity” instead of “sex” can enhance the project. Lastly, the question “I feel I am different in my geosciences because of my gender” is not clear on whether this “feeling different” is positive or negative. The respondents may have interpreted this question in different ways. For instance, there were more males who agreed to feeling different, however, this may be due to feeling different because they receive better treatment, more guidance, etc. For future research, changing this question to be clearer and more concise may enhance the project.

Appendices

The following statements were included in the post-test surveys:

- In my geoscience program, I receive unfair treatment because of my gender.
- I feel that I am different from other in the geosciences because of my gender.
- In my geoscience courses, I receive unfair treatment because of my gender.

References

Alfred, Mary V., Ray, Sarah. M., & Johnson, Michele. A. 2019. Advancing women of color in STEM: An imperative for US global competitiveness. *Advances in Developing Human Resources*, *21*(1), 114-132. doi:10.1177/1523422318814551

Allen, Carrie. D., & Eisenhart, Maragret. 2017. Fighting for desired versions of a future self: How young women negotiated STEM-related identities in the discursive landscape of educational opportunity. Journal of the Learning Sciences, 26(3), 407-436. doi: 10.1080/10508406.2017.1294985

Clark Blickenstaff, Jacob. 2005. Women and science careers: leaky pipeline or gender filter?. *Gender and education*, *17*(4), 369-386. doi: 10.1080/09540250500145072

Espinosa, Lorelle. L. 2011. Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. Harvard Educational Review, 81(1), 209-240. doi: 10.17763/haer.81.2.92315ww157656k3u

Greene, Jennifer. C., DeStefano, Lizanne., Burgon, Holli., & Hall, Jori. 2006. An educative, values-engaged approach to evaluating STEM educational programs. *New Directions for Evaluation*, *2006*(109), 53-71. doi: 10.1002/ev.178

Hango, Darcey. W. 2013. *Gender differences in science, technology, engineering, mathematics and computer science (STEM) programs at university*. Statistics Canada= Statistique Canada.

Heilbronner, Nancy. N. 2013. The STEM pathway for women: What has changed?. *Gifted Child Quarterly*, *57*(1), 39-55. doi: 10.1177/0016986212460085

Kachchaf, Rachel., Ko, Lily., Hodari, Apriel., & Ong, Maria. 2015. Career-life balance for women of color: Experiences in science and engineering academia. Journal of Diversity in Higher Education, 8(3), 175-191. doi:10.1037/a0039068

Crenshaw, Kimberle. 1990. Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stan. L. Rev.*, *43*, 1241. doi: 10.2307/1229039

Mack, Kelly., Rankins, Claudia., & Woodson, Kamilah. 2013. From graduate school to the STEM workforce: An entropic approach to career identity development for STEM women of color. New Directions for Higher Education, 2013(163), 23-34. doi:10.1002/he.20062

National Science Foundation. 2009. *Women, minorities, and persons with disabilities in science and engineering: 2009*. Arlington, VA: Author.

National Science Foundation, Digest. 2017. *Women, minorities, and persons with disabilities in science and engineering*.

Ong, Maria., Wright, Carol., Espinosa, Lorelle., & Orfield, Gary. 2011. Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. Harvard Educational Review, 81(2), 172-208. doi:10.17763/haer.81.2.t022245n7x4752v2

Reyes, Marie. E. 2011. Unique challenges for women of color in STEM transferring from community colleges to universities. *Harvard Educational Review*, *81*(2), 241-263. doi: /haer.81.2.324m5t1535026g76

U.S. Department of Commerce, Economics and Statistics Administration. 2011. Women in STEM: A gender gap to innovation. *Economics and Statistics Administration Issue Brief*, (04-11).

U.S. Census Bureau. 2017. American Community Survey 1-year Estimates. Retrieved from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_1YR_S2412&prodType=table

Van Veelen, Ruth., Derks, Belle., & Endedijk, Maaike. D. 2019. Double Trouble: How being outnumbered and negatively stereotyped threatens career outcomes of women in STEM. *Frontiers in Psychology*, *10*, 150. doi: 10.3389/fpsyg.2019.00150/full

Wang, Ming. T., & Degol, Jessica. 2013. Motivational pathways to STEM career choices: Using expectancy–value perspective to understand individual and gender differences in STEM fields. *Developmental Review*, *33*(4), 304-340. doi: 10.1016/j.dr.2013.08.001