Girls Gone STEM:

Understanding the relationship between early adversity and willingness to compete in STEM fields

By Jana Wisniewski

Given the significant challenges stereotypes and societal gender expectations present, women pursuing STEM (science, technology, engineering and mathematics) degrees and careers remain grossly underrepresented in the United States. The purpose of this thesis is to investigate whether women who have faced adversity in the attainment of secondary education are more likely to pursue STEM post-secondary degrees, compared to those that did not experience adversity. The data used came from the National Center for Education Statistics' (NCES) Beginning Postsecondary Students Longitudinal Study. A male population of students with and without adversity was also tested for STEM participation for comparison. The proportion of males and females pursuing STEM degrees was measured in respect to two different adversity indicators: income and race. The findings show that minority students pursue STEM degrees at a higher proportion than their white counterparts; this finding is stronger for woman than for men.

Key Words: Secondary Educational Attainment Differentials, Women in STEM, Job Competition, Gender Differences, Resilience and Schemas, Stigma and Stereotypes

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1. Introduction

The 21st century is marked with the globalization of ethical conduct standards and communication technology. Feminism is, perhaps, the social issue garnering the most momentum from this proliferation of information exchange. Feminism is an ideology that women should have political, social, and economic equality to men. In the United States, significant gender equality reform began in the 19th century with challenges to government policies. Ultimately, this endowed women the legal right to compete in the market economy. However, stereotypes, societal expectations, and other pressures have prevented women from reaching social and economic equality.

Women face pressure to be both the domesticator and a member of the workforce. These sometimes conflicting roles are made even more challenging when preexisting stigmas have resulted in women earning $.78 for every dollar a man makes.[1] According to the Institute for Women's Policy Research, this gap will take 44 years to close. Some media, such as the dated portrayal of women on sitcoms, has arguably damaged the progress of the feminist movement, however, new communication technologies have also allowed the sharing of feminist ideals and principles.

Technology has been a driving force in the global feminist movement. In foreign nations, technology has been a main source of career, education, and civil rights opportunities. In the U.S., the introduction and meteoric rise of social media as a communication tool has led to feminism becoming one the most pervasive social issues of the twenty-first century.[2] The ubiquity of the topic has led to controversy over the

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1 Institute for Women's Policy Research. Statistic is from 2013 research, for the same job.

2 According to Twitter information, in 2014 discussions on "feminism" had increased by 300% over three years

existence and handling of women's issues. For example, affirmative action and public programs to encourage women and other minority-group participation in historically under-represented fields is met with mixed responses.

Despite the championing of gender equality in social media and other channels, decades of social expectations and stereotypes have prevented women from getting the resources and necessary confidence to compete in certain job markets. The same is true for racial minority groups. The Gender Parity Index (GPI) in the U.S. for post-secondary education not only decreased, but reversed; more women attain a bachelors degree than men. However, the GPI for most science, technology, engineering, and mathematics (STEM) degrees has been stagnant or increased. This disparity translates into the exceptionally low participation of women in certain career and job markets. For instance, according to the United States Department of Labor, the percentage of women in the information industry in 2013 was 1.7%.

There is growing demand for qualified STEM personnel in the national job market. Computer science jobs alone are predicted to demand 1.4 million personnel by 2020.[3] The current and future demand, however, is and will not be met due to an insufficient supply of qualified individuals. Increasing the pool of people interested in pursuing these careers depends on the engagement of the underutilized groups of the American workforces.

Increasing the labor pool is important beyond simply filling the demand; diverse teams are typically more productive and successful than their homogenous counterparts (Gellman, 2014). Because these fields are currently not reflective of the consumers for

[3]According to the Bureau of Labor Statistics

which they develop goods and services, there is room for new insight and innovation. According to a 2012 study by Intel, women in Western nations use the Internet 17% more than their male counterparts. They also use social media sites more often and comprise the majority of technology device-owners. Technological solutions are dangerously limited when one specific gender or racial group primarily is responsible for development and innovation. Insights and opportunities go unnoticed.

In developing countries, women often face greater gender inequality, especially in secondary education attainment, and represent a much smaller proportion of the consumption of technology.[4] Despite this adversity, the proportion of women who pursue STEM careers far exceeds the percentage of women that pursue these industries in the Western world, especially in the U.S. This phenomenon challenges the assumption that public policy (i.e. affirmative action) is enough to incite change. It is evident that the motivation and willingness to compete in STEM fields can arise in spite of high barriers to entry. Alternatively, this trend suggests that the exposure to adversity is correlated with relatively higher STEM field participation.

The theories of motivation and willingness to compete are complex and extremely interrelated. Women in developing countries are seemingly going against societal grain and pursuing non-traditional careers. This raises the question of identifying what gives these women the confidence and desire to reject societal expectations. It is particularly difficult for a woman to earn a high school-equivalent education in developing countries, especially when compared to attainment in the U.S. Women in developing nations must

[4] United Nations Development Program – Human Development Reports

therefore first overcome adversity and stereotypes in getting a high school education and then must overcome similar barriers in post-secondary pursuits.

Research Question

The seemingly high levels of STEM degrees pursuits of women in developing countries, provides a potentially interesting insight into motivation and resilience. While this is not a proven relationship in developing countries, it does point to an angle that may apply to the U.S. My research focuses on understanding whether the presence of successfully overcoming high school educational adversity, in the U.S., results in women who are more willing to pursue degrees with high social barriers of entry namely STEM careers. Successfully navigating educational adversity in high school might build a sense of resilience and self-confidence. This maturation of sense-of-self might be critical in fostering a willingness to compete in industries with historically homogenous populations. The over-arching question is as follows: Are women more likely to pursue STEM degrees after experiencing and overcoming adversity in high school attainment, compared to their male or low adversity counterparts? I will look to secondary data from the National Center of Education Statistics regarding college-enrollment information. High school adversity was measured using household income and race. The presence of these adversity indicators was tested on male and female populations separately to evaluate the proportion of each segment that pursues a STEM bachelor's degree. This question is intended to signal the possibility that adversity may be linked to the building of skills or competencies to reject or disregard social norms.

The contribution of this study to existing literature is to identify a potential relation between adversity and STEM participation for women in the US. The findings

can be used to understand how to better engage and prepare women and other minority students in STEM participation, during their secondary education.

2. Literature Review

There is ample research and discussion regarding behavioral outcomes for disadvantaged or minority groups. In general, those in stigmatized groups often exhibit lower performance on tasks related to one's identity (i.e. tasks that relate to intelligence), regardless of ability or potential. My research relies fundamentally on how individuals make decisions, which is what this thesis, at its core, addresses. The first section of this literature review considers the existing studies on decision and behavioral outcomes for stigmatized groups, with an emphasis on education and career pursuits. The section is divided into two outcome areas: high school attainment and pursuit of STEM degrees. The next section provides the psychological framework to abstract the human decision-making process; this is used to explain the decisions of stereotyped groups. In particular, it provides an overview of schemas and their use in the development and protection of an individual's sense of self. This review ends with a summary of the literature and the gap this investigation is intended to explore.

2.1 High school attainment and STEM decisions

Gilgun (2005) suggests that how people handle adverse situations and the resulting outcomes, are the result of an individual's perception of self, the world, and those around them. Much of these perceptions are a direct result of schemas and other "internal working models." This section of the review considers existing literature on the adversity someone faces when pursuing a high school degree and pursuing a STEM degree, respectively.

The primary barrier to education in the developing world is gender and the resulting expected societal role (Atkinson, 2008). This manifests in women facing much

greater difficulty accessing and completing secondary education, compared to their male counterparts

The major factors in educational attainment in the US, in contrast, are economic and racial minority status. In the United States, the achievement gap is a well-documented phenomenon that suggests certain groups of students – especially low-income and racial minority individuals– exhibit lower performance across many education measures (i.e. standardized testing and graduation-rates) than other groups of students. Students from racial minorities and/or low-income households are the groups most challenged in getting a high school diploma. While availability to tangible resources, such as computer labs or Advanced Placement classes, students from low-income households not only have access to fewer academic resources, but also use them in a less effective manner (Celano and Neuman, 2015). Celano and Neuman's research found that when students with lower socioeconomic standing are given equal resources – in this case, access to a public library – the resource is used for entertainment while their higher-income counterparts use the resources for research. From this it is clear that low income has repercussions that are far beyond tangible resource limitations.

While race is not implicitly tied to low resources, race has psychological repercussions that can prevent students from reaching their full potential. Andersen and Ward (2013) found that societal expectations for minority students and their perception of education are vastly lower than that of their white counterparts.

There is hope, however, as people have the ability to challenge and change their schemas. According to the findings of Cohen's (2009) research, small self-affirming practices, such as writing reflection exercises, can lead to substantially improved

academic outcomes for high-school African-American students. As Cohen's research stipulates, the psychological repercussions of an improved sense-of-self are potentially lasting – up to 2 years – as the disposition is perpetuated over-time. However, there is no literature investigating if these changes to psychology will result in other changes to educational goals.

In Masten's (2001) study of resilience there is a discussion of the Main Effects Model, which stipulates low resources lead to high adversity and vice-versa. This information paired with the understanding that low-income students have difficulty attaining education, suggests that resilience is a necessary trait to successfully graduate. Interestingly, this literature suggests that an individual may not be resilient in all situations. It is unclear if multiple events within a single subject or domain- for example, all decisions pertaining to education, or all decisions around substance abuse- may exhibit similar resilience.

Conclusive research indicates racial minorities, women, and with limited socioeconomic backgrounds are vastly underrepresented in STEM. According to Haveman (2006), cites the link between motivation, preparedness, and ability and a student's family income. While ability certainly inhibits future academic success, Havemann notes that there are significantly more low-income students that meet standardized test thresholds for top tier universities than actually pursue these degrees. It is unclear if this is caused my low motivation or resources or other factors.

Andersen and Ward (2013) use the Expectancy Value Model (EVM) to suggest that students from disadvantaged backgrounds have a lowered sense of likelihood of success and task value when completing STEM coursework. Students in stigmatized

groups perceive a lower likelihood of success as a result of lowered senses-of-self and are less likely to risk the pursuit of fields that are considered challenging. The perceived task for minority students is decreased as they question the subject task value (STV) because it is not salient with their group identity, as STEM fields in the US are predominantly white men. Essentially, these students are less likely to find "identity congruence" with STEM and technical careers; they are drastically underrepresented in these fields, despite equal academic ability.

Gender is an important characteristic in predicting participation in STEM degrees. Gender is considered a diffuse characteristic, which implies that men are believed, as a societal expectation, to perform most tasks better than females. There are certain particular tasks, such as manual labor and technical fields that men are especially believed to outperform women(Conway, Pizzamiglio, & Mount, 1996). The psychological under-pinning of gender and STEM are twofold. First, women question their ability to perform STEM-related careers. Correll (2004) found that men over-estimate their task ability when exposed to a condition that suggested male-superiority for that task. It was found that these assessments play a key role in determining gender aspirations in a certain field. When an individual thinks they are good at a task, they are more likely to want to compete in a field, as the EVM suggests.

The second challenge for women participating in STEM comes from women not identifying with the field. According to Eccles (2005), societal stereotypes suggest that women are not supposed to be in STEM. In a study by Rosenthal (2011), women that attend single-sex STEM programs are more successful in their performance as well as perceived belonging in the field. This supports the importance of the social identity

theory, where individuals desire to be a member of a group that is important for forming their identity.

Interestingly, Hafkin (2001) notes that while women may represent a smaller fraction of the post-secondary degree seekers in developing countries, they seem less effected by the schema of STEM degrees and the resulting assignment as a masculine job types. This may be indicative of built resilience from first overcoming gender stereotypes to complete high school. Understanding the psychology of an individual's development of perception of self-identity is the underpinning of the previously described research.

2.2 Schemas and the development and protection of self-identity

Creating a schema is a method humans use to organize information that creates the framework for how people interpret their surroundings. When a person encodes information during an event, they organize it into meaningful blueprints that can be used in similar situations (Dimaggio, 1997). Essentially, schemas are mental "short-cuts" that allow us to draw on previous exposure to infer information without consciously encoding new data. Schemas allow people to reduce cognitive burdens by not requiring the brain to interpret every situation as a unique event. During the critical years of adolescent development, humans are deeply influenced by their surrounding environment, including families, peers, and greater society. Schemas, therefore, inform how people see the world and, ultimately, their role in society (Piaget, 1983). New schemas are developed over-time and existing ones can be changed. Schemas present a danger, however, to learning new information. When people use static schemas to understand their world, prejudice and biased thinking can be pervasive, because people "remember" something as true (Anderson, 1990). In regards to the previous section, schemas are what allow stereotypes

to affect people both consciously and subconsciously (i.e. having a lowered sense of self without having an event that would have caused it).

The study of sense-of-self is a particularly complex field in psychology. Individuals use different mechanisms to rectify the differences between their existing schema and external challenges. For the purpose of this thesis, I am interested in how adverse conditions, in the form of stereotypes and stigmas, affect motivational behavioral outcomes, such as desire to pursue a STEM degree.

Gilgun (2005) stipulates that to successfully navigate adversity, an individual must have a positive sense of self and schemas that support the idea that they are able to complete and value a task. Adversity comes in many forms. Stigma and prejudice create an environment where people are subject to societal prophecies of their choices. This is the idea that because a person is a member of a certain group, they will behave in a way that society deems as correct (Crocker, 1989). The degree to which someone believes a factor threatens their sense-of-self, coupled with their disposition for acquiring and adjusting their sense-of-self, results in an array of coping mechanisms and resulting behavior outcomes. People develop coping mechanisms to preserve their identity, despite the fact that some of these coping mechanisms can have negative repercussions.

Crocker (1989) considers how self-confidence and self-esteem are affected by stigmas and prejudices. She identifies four major coping mechanisms used by stigmatized individuals to make sense of their situation that typically result in lower self-esteem and sense of ability. This explains why people of stigmatized groups may have lower performance, despite equal ability, than a non-stigmatized group. Additionally, the degree to which environmental factors affect a person's self-assessment is based on how

one builds their sense of self. For example, people whose self-esteem is based on self-fulfilling prophecies find that if they believe a certain outcome to be true, it often is. If a woman believes that she in mentally inferior, then she will be. This means some people are predisposed to being more sensitive to adverse stimuli.

Other people, however, have developed or have a psychological characteristic that allows them to reject stereotypes. Resilience is a psychological concept that suggests an individual's adaptability and coping are superior. Masten (2001) found that resilience is not an extraordinary occurrence and is a survival response to adversity. People change their working model of self to reject societal expectations and to achieve a desired outcome.

It is helpful to return to the Expectancy Value Model as described earlier. It postulates that a behavior is informed by two dimensions: perceived likelihood of success and the subjective task value (STV) (Eccles, 1983)(Figure A). Both of these dimensions are results of the schemas developed and resulting schema protection coping mechanisms employed in the face of adversity. Because of this, people from stigmatized groups are less likely to want to do a task because they think they are inferior. The second dimension, STV, can be broken down into four value propositions: utility to future goals, intrinsic value based on enjoyment, consistency with identity, and the cost of spending time doing this task compared to other tasks.

The consistency with identity value is important in the context of groups. According to social identity theory (Turner and Oakes, 1986), a part of a person's sense of identity is driven by their inclusion of a certain group. For example, people from

minority groups are less likely to pursue an outcome that is traditionally dominated by the majority group, as it is a violation of group salience.

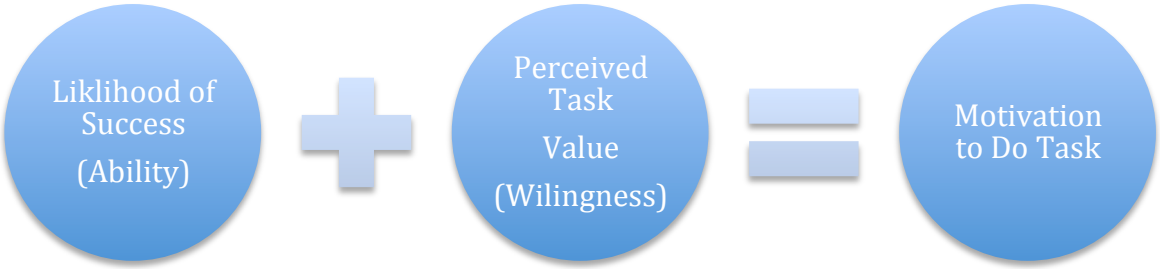

Figure A: This figure shows the components of the EVM. When people are willing and able, they are more likely to do a task. If they are not able and willing, the probability of them doing the task dramatically decreases.

2.3 Summary

According to the existing literature, environmental variables (i.e., income, race) influence the perceived belief of success and assigned task importance of a behavior. The present research focuses on the motivation to complete a high school diploma and a person's motivation to pursue a STEM degree. When stigmatized people defy their expected trajectory in earning a high school education, it has yet to be investigated what other education decisions are potentially affected by the change in their psychological disposition. Because it is evident that STEM pursuit decisions are a function of the ones' belief of success and assigned task importance, it is important to understand if changes to these concepts apply to a similar decision-process. My research specifically addresses this link between early adversity, which I defined as racial minority or low-income status in high school, and behavioral outcomes in later education decisions, which concerned the intention to purse a STEM degree.

3. Methodology

The following section presents the hypotheses and tools used for analysis in this study. The section begins with the justification and empirical research for the hypotheses. To explain how I tested my hypotheses, I discuss the variables I chose to measure and explain my data collection method and the appropriateness of the data. This section concludes with an explanation of my tools for analysis, including the strengths and limitations.

3.1 Hypotheses

Gender, adversity and degree decision are the three variables I chose to study. In order to break down the complexity of the relationships between these variables, I proposed three hypotheses. The first and second evaluate adversity and degree decisions for females and males separately, and the third one considers the difference of these outcomes across genders.

Competing in a job market that does not align with societal expectations requires tenacity and a willingness to face adversity (Giligun, 2005). As the literature review suggested, successfully navigating adversity is indicative of one's perception of self and value assigned to task, both of which are influenced by schemas. When an individual overcomes adversity, their perception of self is enhanced and schemas that may have been heavily influenced by society are challenged. An individual may also have a unique psychological predisposition that allows them to preserve their sense of self despite adversity (Crocker,1989). Sense-of-self is a major force behind an individual's willingness to compete in a given field.

I apply this line of thinking to the United States where women who are in low-income brackets or are of a racial minority are likely to develop an improved sense-of-self upon successful high school graduation. This success manifests in greater confidence that allows them the desire and ability to compete in technical fields.

I hypothesize that women who successfully navigate severe adversity develop resilience in protecting their sense of self, thereby adopting a belief of success and increased task value for future educational endeavors. This relationship brings me to my first hypothesis:

Hypothesis 1: Women exposed to adversity in earning a high school diploma are more likely to pursue postsecondary degrees in STEM fields compared to women without adversity

Although men are not overcoming a gender social norm to compete in STEM fields, those from low-income and racial minority groups are still members of stereotyped and underrepresented groups. This means that the rejection of schemas from previous adversity may allow racial minority and low-income men to pursue STEM degrees at a higher degree than their low adversity counterparts.

Hypothesis 2: Men exposed to adversity in earning a high school diploma are more likely to pursue postsecondary degrees in STEM fields compared to men without adversity

However, because males dominate STEM fields, it does not require the defiance of schemas to the same degree for men to participate, regardless of belonging to another

stereotyped group. Therefore, I expect that the presence of adversity will influence women degree choices more than men. My third hypothesis is as follows:

Hypothesis 3: The positive effect of adversity on pursuing a STEM degree is larger for women than men.

3.2 Variable Definition and Data Collected

I evaluated my hypotheses using secondary data from the National Center of Education Statistics (NCES). The Beginning Postsecondary Students (BPS) is one of the most comprehensive data sets available regarding a student's educational experience. While the NCES conducts many longitudinal studies that give great detail and insight to the development of a student's post secondary experience, the scope of this thesis is to consider only the actions during or immediately following high school. BPS has been conducted three complete times. During each study, a group of respondents is tracked for 5-6 years. The 2003-2004 enrollment cohort represents the most robust sample, including approximately 16,500 first-time college enrollment respondents. Participants were interviewed and surveyed on information ranging from demographic to personal experiences. Transcript and administrative record matching were conducted to ensure the quality of the data. This data set aligned exceptionally well with the identified variables to measure the hypotheses. Despite this data being 10 years old, I am operating under the assumption that it is reflective of the major decision outcomes that women generally make.

Degree choice (i.e. choosing STEM degree) is the dependent variable for all hypotheses. Deciding what was considered a "technical" field was important in evaluating my hypotheses. Current research regarding U.S. global competitiveness in

math and science fields often uses science, technology, engineering and math (STEM) fields as the indicator of participation in technical majors.

Major when first enrolled 2003-04 A critical component of using STEM fields was identifying the degree fields that were included in the STEM framework. The NCES survey includes 30 degree fields for participants to select; they are coded on a 0-34 integer scale. See Appendix item A for a full listing of the categorization of the degree types relative to STEM, non-STEM, and excluded types. By using enrollment information, it is possible to see a student's initial degree intention. While the intention, as opposed to the actual behavior outcome, is what I am most interested in for this study, whether or not the student actually graduates is a limitation. This thesis does not consider major changes or adversity faced in post-secondary outcomes that may ultimately affect career decisions.

The dependent variable for this hypothesis is the decision to participate in a STEM degree program. The independent variable is the presence of an adversity. As per the literature review, low-income and race are the most prevailing sources of high school attainment adversity (Andersen & Ward, 2013; Celano & Neuman, 2015). The dummy variable for adversity was coded as follows: 1 indicates the student comes from a low-income household or racial minority and 0 represents no low-income or not a racial minority. Adversity is defined as low-income or racial minority or both.

Low-income and race as proxy for adversity The BPS had a number of measures that were indicative of a student's incoming economic status. I looked primarily at a student's family income as a percent of the poverty level. When income was at or below the poverty level, they were marked as experiencing adversity. Those above the poverty

level were not marked. This approach has limitations, such as not considering family circumstances and debt characteristics. BPS measures these variables as a continuous number. For the scope of my research, it seemed most appropriate to segment the variable into poverty and non-poverty groupings. Race was another measure, which I manipulated to be defined as either minority or not minority. Not minority was defined as white, all other races where considered minority.

Gender All academic information is linked to student attribute information. For the sake of this study, gender is a clearly defined attribute.

Control Variables used for entire population In order to find meaningful relationships between variables, it was vital to identify and attempt to eliminate extraneous variables. The following are variables that I identified as critical to control for my population. I used this information to filter my population accordingly.

- Degree Program type: My population included students pursuing bachelor and associate degree programs.
- Academic preparedness and potential: Despite low-income students often attending lower-performing high schools, it was important for the subjects of the study to have as similar of academic potential and understanding of STEM fields as possible. I used SAT admission test scores as a proxy for academic preparation and potential. I included all students who scored an average test score 991 or higher. This seemed to be the fairest measure as GPA standards or AP class offerings can vary greatly depending on the student's high school.
- Other potential areas of adversity: While it was not feasible for me to control for this entirely, I was able to filter out students with potential areas of adversity that

were not income related. I removed all students from the population that where declared as an independent as that signals as potential adversity.

The third hypothesis compares the findings of the first and second hypotheses; the dependent variable is still the decision to participate in STEM degree programs, and adversity is measured with respect to economic status and race separately, which act as the independent variables. In order to test the differences between gender sensitivity to adverse conditions and resulting decisions, I include another variable: gender.

The limitations of using economic and racial minority status as the indicator comes from not knowing whether the student faced a different form of adversity, unrelated to financial or racial situations. It was not feasible to entirely control for all possible adverse conditions due to the nature of the data collected. The measures collected were limited in variables that may indicate adversity.

3.4 Method of Analysis

To test both hypotheses, I analyzed the data using proportions. In particular, I used proportion analysis to compare the probability of selecting a STEM degree. Using a z-test for difference of proportions allowed me to compare the different populations of degree outcomes.

	Alternative Hypothesis
Hypothesis 1	$P(F_{LA})<P(F_A)$
Hypothesis 2	$M(F_{LA})<M(F_A)$
Hypothesis 3	$P(M_L)-P(M_{\underline{H}})<P(F_L)-P(F_{\underline{H}})$

Figure C: M or F indicates male or female populations used. Subscript LA is low adversity and HA is high adversity.

For hypothesis 1 and hypothesis 2 to be supported, there needs to be a significant positive relationship between the presence of adversity and the proportion of females and males choosing a STEM field, compared to all other majors. For hypothesis 3, the difference between these proportions also needs to be significantly positive in favor of women. For these hypotheses, comparing the derived p-value at a pre-defined significance level of .05 allowed me to assess support or fail to reject the null hypothesis of no effect.

3.4 Appropriateness

Proportion tests are a clear way to test for relationships between a dichotomy of a dichotomous independent variable. However, an essential requirements for conducting inference for proportions is sufficiently large number of successes (i.e., sample size times proportion needs to be at least 10) due to the binary nature of the variable underlying the proportion. For my research, this implies that there needs to be at least ten STEM-degree pursuers in each of my samples. Before conducting inference, I assessed whether this condition was met. An additional limitation with proportion testing is the lack of flexibility compared to other statistical alternatives, like regression modeling. In particular, proportion does not allow for accounting for additional differences across individuals in each sample. Because individual-level (or student-level) data were not accessible due privacy restrictions on the NCES, I used public use file. To best address this, I applied filters regarding degree-type, academic preparedness, and dependency status, however, this did not address all possible differences that may be of interest if individual-level data were available.

4. Results

This section reviews the results used to assess support for my three hypotheses. While I intended to use income and race as proxies for adversity, the data do not allow for conducting a statistics test by income because the sample size condition for proportions was not met. For each hypothesis, I report the proportion for differences by income group and race, but I only assess support for my hypotheses using differences by race.

For hypothesis 1, I found that the proportion of women from low-income families pursing STEM degrees (.084) was actually smaller than those above the poverty level (.111). However, the sample size failed to meet the ten success cases criterion for proportion testing (i.e., the proportion .084 x sample size 10 = .84 successes). Interestingly, race proved to have a stronger relationship and met condition for inference. Those from a minority racial group where nearly twice as likely (.193 compared to .111) as their white counterparts to pursue STEM degrees; this finding was statistically significant.

In contrast to women, men show a positive correlation between poverty and STEM pursuits, however the sample size meant the proportion test could not be conducted (i.e., the proportion .228 x sample size 11 = 2.508 successes). Men seem to exhibit a similar relationship when race is used as the adversity indicator; men that were a minority participated in STEM fields at a proportion of .308, compared to white males, who participated at a lesser degree, .282. These results must be interpreted with caution, as they were statistically insignificant, with a p-value of .336.

Table 1: Proportion of population pursuing STEM fields by income adversity indicator

	Income Indicator			
	At or below poverty	n	Not at or below poverty	n
Female	.084	10	.111	305
Male	.228	11	.205	283

Table 2: Proportion of population pursuing STEM fields by race adversity indicator

	Race Indicator			
	Racial Minority	n	Not Minority	n
Female	.193**	77	.111	305
Male	.308	75	.282	283

*** p<.01 **p<.05

Once the magnitude of a potential relationship between adversity and decision outcome was measured, I tested to see if the relative size of these differences is significant between the female and male populations. The third hypothesis was tested for race only, as a result of the income sample having an insufficient size. Here, race was a stronger indicator for women and STEM careers than it was for men. Men, however, still had a positive relationship with the presence of a minority indicator and STEM pursuits of approximately 2.6%.

Table 3: Proportion differences between those with and without adversity

	Race Indicator
Female	.082**
Male	.026

*** p<.01 **p<.05

The support or failed support for each hypothesis is outlined below.

Table 3: Hypotheses support or failure to support matrix

	Hypothesis	**Income**	**Race**
Hypothesis 1	$\mathbf{P(F_{LA})<P(F_A)}$	NA	Support
Hypothesis 2	$\mathbf{M(F_{LA})<M(F_A)}$	NA	Fail to Support
Hypothesis 3	$\mathbf{P(M_L\text{-}M_{\underline{H}})< P(F_L\text{-}F_{\underline{H}})}$	NA	Support

5. Discussion

The purpose of this study was to test if the presence of adversity – and the subsequent rejection of stereotypes – affects career choice. This study has a two-fold implication. First, it begins to address the notion that certain types of stereotypes (i.e. those related to identity) may have generalizable properties. This means, for example, that if you overcome one threat-to-self, you may be able to overcome another one, provided it is close enough in nature to the initial threat. Second, it suggests the transferability of resilience over time. If someone is resilient at one point in their life, it may point to their continued ability to reject social norms and persevere despite challenges. Current literature shows that overcoming recurring adversity is possible, and requires changes to people's psychological disposition.

The first hypothesis was supported, using race as the adversity indicator: women from minority racial groups are more likely to pursue STEM degrees than their white counterparts. This may speak to the idea that characteristics related to one's identity (race), may be translatable to other identity characteristics (gender). Due to the data limitations, this could not be compared to low income. It would be interesting to successfully test income. Comparing the results to race may indicate which identity characteristics are most strongly tied to identity characteristics. Hypothesis 3 could only be evaluated using race as the indicator; it was supported. The difference in change in the population with the presence of the indicator does suggest that women may be more prone to requiring self-identity protection mechanisms to compete in fields that challenge their sense of self.

In general, future research in this area would require larger sample sizes or primary research collection to ensure the most relevant measures are gathered. Testing other adversity indicators may lead to greater insight on adversity. For example, my research tested income and race separately. When testing the low-income population, evaluating data from white students controlled race. When I tested the relationship of STEM participation and race, the entire population was above the poverty level. Future testing may look to the compound effects of race and income. Different measures for income adversity could be used to test the robustness of these findings (i.e. whether the student was a Pell Grant recipient). Other areas of potential testing may attempt to isolate an adversity index that only women face in high school. Perhaps testing if a woman competed in high school athletics may be tied to whether she builds confidence in sense of self in a different capacity that may stay be translatable to STEM participation.

6. Conclusion

STEM participation is a critical issue for the future of the U.S. economy. Like any supply and demand issue, filling the labor needs in these fields is more than developing government programs. Understanding the psychological underpinnings of career decisions, especially for minority populations, is critical in engaging underutilized human resources.

The purpose of this study was to begin to identify possible variables that point to STEM degree participation. Using a proportion analysis to evaluate existing data, I was able to leverage resources to clearly draw relationships between key variables: race, gender, and income. The most important insight from this research comes from the finding that minority women are more likely to pursue STEM degrees than white women. Moreover, the positive relationship between race and STEM pursuits is stronger women relative to men. While the exact cause of this is unknown, it illustrates an interesting phenomenon that may be critical for engaging women in STEM fields.

The most significant limitation to this thesis comes from the nature of the data used. While using secondary data allowed great access to a wealth of information on the students, the inability to see the individual sample data points for each student made analysis difficult. This also resulted in a very low sample size, which made conducting inference impossible for the income measure of adversity.

This thesis opens the door for further research on discovering which characteristics are most closely tied to identity. In order to better engage women in STEM careers, educators may try and show that going against stereotypes is a critical part of development and that sense of self should be maintained. More research is

required to test what type of programs best build confidence for men and women, respectively.

Appendix

STEM v Non-STEM fields

STEM	Biological and Biomedical (5), Computer/IS (8), Engineering (11), Mathematics & Statistics (18), Physical Sciences (25), Science/Technologies (28), Engineering Related (34)
Not-STEM	Undeclared (0), Agriculture (1), Architecture (2), Area/gender studies (3), Visual and Performing Arts (4), Business and Marketing (6), Communication (7), Construction Trades (9), Education (10), English & Literature (12), Family/consumer sciences (13), Foreign Language (14), Legal Professionals (16), Mechanic/Repair (19), Parks (21), Personal and Culinary (23), Philosophy (24), Psychology (26), Public Administration (27), Homeland Security (29), Social Sciences (30), Transportation (31), Liberal Arts (33), Precision Production(22)
N/A	Health professionals (15), Multi-disciplinary (20 -small fraction .14%, impossible to categorize)

Numbers (n) refers to the coded value assigned by NCES during data collection

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