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Perceptions of stress: a gendered comparison of undergraduates in STEM

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Abstract

Students enrolled in undergraduate universities face numerous stressors every day. Outside of stress from their academic studies (i.e., homework, studying for exams, writing papers), they also encounter daily life stressors relating to self-sufficiency, career choices, families, housing, and many other areas. While every student deals with stress coming from multiple areas of their life, women tend to place more stress on themselves than men due to social pressure to perform well and the feeling of societal expectation to have a high stress load from which to derive personal value. Within the field of Science, Technology and Math (STEM), —a field dominated by men until relatively recently—the same findings of women reporting higher stress levels holds true. Since there is relatively limited research on these broader perceptions of stress between men and women and the worth one derives from perceived stress loads, this study aimed to look at gender differences in such perceptions among STEM students. Survey data were gathered from 151 STEM undergraduate students. This study examined proposed differences in perceptions of stress using four subscales from viewing stress as a badge of honor: stress as achievement, relaxation remorse, stress-related social comparison, and stress-related impression management. Based on previous research finding women to report higher perceived stress levels, we hypothesized that women in STEM will report higher perceptions of stress as compared to men in STEM; and they will also report higher levels of stress as a badge of honor than men. Our findings indicated that women indeed perceived more stress than men in STEM as well as less “stress-is-enhancing" mindsets. However, we found that men reported slightly but not significantly higher levels of stress as achievement, relaxation remorse, stress-related social comparison, and stress-related impression management than women.

Perceptions of Stress: A Gendered Comparison of Undergraduates in STEM

Stress is a widely studied topic, especially among undergraduate students as it is an inevitable experience for this population (Brown, 1992). Something that researchers have noted is that the reported student stress in the United States has steadily increased over the years (Misra & McKean, 2000). Stress has been defined in a variety of ways, and there are multiple aspects that play into an individual's perception of stress. Selye (1956) defined stress as anything causing or having potential to disrupt homeostasis. Moreover, a "stressor" refers to the specific threat the individual perceives, and the response that follows the presentation of a stressor is called the "stress response" (Selye, 1956). Expanding upon Selye's (1956) definition of stress, Folkman and Lazarus (1985) add that stress should not be seen as a solitary moment, but as an ongoing process that individuals adapt to differently based on their available coping strategies. As an individual enters a new phase of life, they are met with different challenges and stressors. College students, in particular, are vulnerable to stress as they inhabit a transitional phase of life where many things are uncertain and temporary (Baghurst & Kelley, 2014). Most undergraduate students begin a season of their educational careers that is full of increased academic, personal, social, and moral responsibilities and pressures (Baghurst & Kelley, 2014).

Stress is a natural adaptation reaction by human bodies to daily experiences, which can include serious threats to the human body like abuse or trauma or from everyday hassles like running late or getting projects at work and school done (McEwen, 2008). However, this normal process for bodies is not meant to last for an extended amount of time. Periods of prolonged stress in one's life can negatively affect their health in the long run (McEwen, 2008). The elevated heart rate and blood pressure that accompany stress, over a prolonged period of time, have been shown to lead to a higher risk for strokes and heart attacks (McEwen, 2008).

Additionally, reacting to persistent stressors can lead to heightened experiences of hunger for comfort foods (thus increasing one's caloric intake), sleep deprivation, and depressive moods (McEwen, 2008). These high, continuous stress loads have the potential to increase further as one compares their experiences to those around them.

Many studies have compared stress in male and female undergraduate students (Baghurst & Kelley, 2014; Gadzella, 1994; Gadzella & Carvalho, 2006; Misra & McKean, 2000; Wohlgemuth & Betz, 1991). Misra and McKean (2000) found that women with more goal-oriented and organizational behavior reported less frustration and less heightened reactions to stress. However, they also found that women who had better time management skills than their male counterparts experienced more academic stress and anxiety (Misra & McKean, 2000). Furthermore, Allen and Hiebert (1991) found that while men and women faced approximately the same number of stressors, women reported more negative responses to stress than men, and Gadzella (1994) found that female students reported higher scores on stressors relating to pressure and changes along with physiological, emotional, and behavioral reactions to stressors than male students. While women reported higher scores on experiencing and reacting to stressors, Gadzella (1994) found that men reported significantly higher scores for cognitive appraisal of stressors and their coping strategies, meaning that they were less concerned about the stressors and the strategies they used to cope than women.

While individuals may endure the same stressful experiences, their perceptions of those events can be quite different. Stress alone, as defined earlier, can be understood as an ongoing experience that disrupts one's homeostasis to which an individual adapts using their personal coping strategies (Selye, 1956; Folkman & Lazarus, 1985). However, there can be an added element of stress based on one's stress mindset (Crum et al., 2013). The extent of how much one

sees the consequences of stress as beneficial outcomes from various circumstances like wellbeing, performance, and growth or how much one believes the outcomes to be impairing can be referred to as a stress mindset (Crum et al., 2013). Crum et al. (2013) posed that stress can either be enhancing and motivating or debilitating and inhibitory. Some physical stress responses can be beneficial, increasing hardiness of the mind and optimism, which allows for the individual experiencing positive responses to potentially thrive and enjoy their work (Crum et al., 2013). Conversely, stress can induce negative responses as well like depression and anxiety, which can lead to perceiving stress as debilitating, thus negatively affecting performance (Crum et al., 2013). Experiencing stress as helpful or harmful can lead to a mindset of either “stress-is-debilitating" or “stress-is-enhancing" (Crum et al., 2013). If women are reporting more stressors and stressful experiences than men, then perhaps differing stress mindsets from men are a contributor to heightened stress levels.

What we know less about is perceptions of stress both outwardly and inwardly. In college, students are constantly comparing their academic performances to their peers’ to measure how well they are doing (Gibbons & Buunk, 1999). Using this knowledge, one can assume that some of those students might find a portion of their worth and identity in such performances, and even the associated stressors they manage. Jennings (2017) created a way to measure social perceptions in which one experiences deriving social value from a high workload compared to others, called a stress badge. The stress badge has four parts: stress as achievement, relaxation remorse, stress-related social comparison, and stress-related impression management. Stress as achievement is defined as seeing a high workload as the means to validating one’s importance and defining their worth. Relaxation remorse refers to the feelings of guilt or discomfort that accompany time spent not working. Stress-related social comparison involves

one's proclivity for judging other's workload against one's own. Stress-related impression management encompasses the creation of outward perception of having a high workload.

In addition to women undergraduates reporting higher levels of stress and stressors, particularly among STEM majors, Maltese and Tai (2011) found that while men viewed themselves as more capable, women saw themselves as working harder than men in their college courses. Women in STEM are of a particular research interest because of the increased focus on the lack of women in these fields and on the perceptions of women in these roles (Blackburn, 2017; Piatek-Jimenez et al., 2018). Specifically, undergraduate students reported viewing women STEM majors as being more driven and academically motivated (Piatek-Jimenez et al., 2018). Seeing as women tend to experience more stress than men and knowing that prolonged stress can lead to negative health outcomes, finding how men and women STEM undergraduates individually view and use stress can help the understanding of realistic stress experiences (Allen & Hiebert, 1991; Gadzella, 1994). It is known that there are differences in stress loads, but what there is a lack of research in is the stress perceptions and stress mindsets of undergraduate men and women. Differences in perceptions and dispositions among STEM undergraduate students may be a cause for differences in stress levels and views of capability.

Hypothesis 1: Women in STEM majors will experience more perceived stress than men.

Hypothesis 2: Women in STEM majors will report higher stress as achievement compared to men.

Hypothesis 3: Women in STEM majors will report experiencing more relaxation remorse than men.

Hypothesis 4: Women in STEM majors will report more stress-related social comparison than men.

Hypothesis 5: Women in STEM majors will report higher levels of stress-related impression management than men.

Hypothesis 6: Women in STEM majors will report higher ratings of stress as performance enhancing mindsets than men.

Methodology

Participants and Procedure

I recruited 151 undergraduate students to participate in the study via emails to various STEM professors asking them to share the survey with their students. Participants were also recruited through The University of Tennessee at Chattanooga's subject research pool (SONA system) aided by the Department of Psychology, flyers and by word of mouth. The survey was open for approximately a month. Additionally, we assessed stress perceptions towards the end of the semester, but before finals began when stress levels were likely to have been higher than normal.

Participants consisted of 65% women and 33.3% men, and two participants preferred to self-describe their gender. The non-binary individuals were not included because of insufficient sample sizes. The majority of participants identified as White (86.3%), with the rest identifying as American Indian or Alaska Native (0.9%), Black or African American (9.4%) or Hispanic, Latino/a, or of Spanish origin (7.7%). Freshmen made up 24.8% of the sample, sophomores made up 16.2%, juniors made up 29.9%, and seniors made up 28.2% of the participants. Most participants (30.9%) had majors belonging to the department of Biology, Geology, and

Environmental Science. The Psychology department made up 25.5% of participants and the department of Health and Human Performance made up 22.7% of participants. Departments that were represented to a lesser degree included Chemistry and Physics, Civil and Chemical Engineering, Computer Science, Electrical Engineering, Mechanical Engineering, and Nursing. The average age of participants was 21 (M = 21.19 SD = 4.44).

Measures

Perceived Stress. Stress perceptions were measured using the 10-item perceived stress scale developed by Cohen et al. (1984). Participants answered questions based on a reflection over the past month (e.g., "have you felt difficulties were piling up so high that you could not overcome them"). Responses can range from *never* (0) to *very often* (4). Cronbach's alpha in the current sample was 0.83.

Stress Badge Perceptions. Four subscales of the stress badge perceptions from Jennings (2017) were used: stress as achievement, relaxation remorse, stress-related social comparison, and stress-related impression management. Participants indicated the extent to which they agree with a statement (e.g., "it is difficult for people to achieve great things without experiencing a high workload"). Responses range from *strongly agree* (1) to *strongly disagree* (7). Cronbach's alpha in the current samples was 0.87 for the stress as achievement subscales, 0.92 for relaxation remorse, 0.90 for stress-related impression management, and 0.89 for stress-related social comparison.

Stress Mindsets: Stress mindsets were assessed using the 16-item Stress Mindset Measure from Crum et al. (2013). Participants indicated the extent to which they agree or disagree with a series of statements (e.g., "the effects of stress are positive and should be

utilized"). Responses range from *strongly disagree* (0) to *strongly agree* (4). Scores were averaged so that higher scores represented a "stress-is-enhancing" mindset. Cronbach's alpha was 0.77.

Demographics. We also asked for participant-reported gender, major, year in school, race, and interest in pursuing graduate school.

Results

Hypotheses were tested using a series of independent samples t-tests in SPSS to determine if there were mean differences in undergraduate women's perceptions of stress compared to men's on all six of the measures. Considering Hypothesis 1, there were no outliers for women's or men's perceived stress scale scores, as assessed by the inspection of a boxplot. Perceived stress was normally distributed, with skewness and kurtosis values between -2 and +2. There was homogeneity of variances, as assessed by the Levene's test ($p > .05$). There was a significant difference in stress based on gender, $t(115) = -4.08$, $p < .05$. Whenever applying a Bonferroni correction (alpha = .008), the result was still considered significant, with p = <.001. The effect size indicated a medium to large effect (Cohen's $d = -0.79$). Women reported more perceived stress ($M = 3.34$, $SD = 0.59$) compared to men ($M = 2.85$, $SD = 0.67$).

Second, considering Hypothesis 2, there were two outliers for stress as achievement, as assessed by the inspection of a boxplot, but because they were valid cases not dramatically removed from the rest of the sample, they were retained for the analysis. Stress as achievement was normally distributed, with skewness and kurtosis values between -2 and +2. There was homogeneity of variances, as assessed by the Levene's test ($p > .05$). There was not a significant difference in stress as achievement based on gender, $t(118) = -0.70$, $p > 0.05$. The effect size

indicated no effect (Cohen's *d* = -0.13). Women reported slightly higher stress as achievement (*M*= 3.37, *SD* = 1.11) compared to men (*M*= 3.22, *SD* = 1.07).

Third, considering Hypothesis 3, there were three outliers for relaxation remorse, as assessed by the inspection of a boxplot, so analyses were conducted with and without the outliers. Relaxation remorse was normally distributed, with skewness and kurtosis values between -2 and +2. There was homogeneity of variances, as assessed by the Levene's test ($p > .05$). When outliers were included, there was a significant difference based on gender for relaxation remorse, $t(116) = 2.12$, $p < 0.05$. Whenever applying a Bonferroni correction (alpha = .008), the result was not considered significant, with p = .018. The effect size indicated a small effect (Cohen's *d* = 0.41). Women reported less relaxation remorse (*M*= 2.48, *SD* = 1.29) than men (*M*= 3.02, *SD* = 1.44). This difference did not remain significant when outliers were excluded $t(113) = 1.12$, $p > 0.05$.

Fourth, considering Hypothesis 4, there were no outliers for women's or men's stress-related social comparison, as assessed by the inspection of a boxplot. Stress-related social comparison was normally distributed, with skewness and kurtosis values between -2 and +2. There was homogeneity of variances, as assessed by the Levene's test ($p > .05$). There was not a significant difference in stress-related social comparison based on gender, $t(116) = 0.75$, $p > 0.05$. The effect size indicated no effect (Cohen's d = 0.15). Women reported slightly less stress-related social comparison (*M*= 3.71, *SD* = 1.43) compared to men (*M*= 3.91, *SD* = 1.34).

Fifth, considering Hypothesis 5, there were no outliers for women's or men's stress-related impression management, as assessed by the inspection of a boxplot. Stress-related impression management was normally distributed, with skewness and kurtosis values between -2

and +2. There was homogeneity of variances, as assessed by the Levene's test ($p > .05$). There was not a significant difference in stress-related impression management based on gender, $t(118) = 0.53$, $p > 0.05$. The effect size indicated no effect (Cohen's $d = 0.10$). Women reported slightly less stress-related impression management ($M = 4.47$, $SD = 1.35$) compared to men ($M = 4.60$, $SD = 1.17$).

Finally, considering hypothesis 6, there were no outliers for women's or men's "stress-as-enhancing" mindsets, as assessed by the inspection of a boxplot. One's "stress-as-enhancing" mindset was normally distributed, with skewness and kurtosis values between -2 and +2. There was homogeneity of variances, as assessed by the Levene's test ($p > .05$). There was a significant difference in stress mindsets based on gender, $t(116) = 2.24$, $p < 0.05$. Whenever applying a Bonferroni correction (alpha = .008), the result was not considered significant, with p = .014. The effect size indicated a small effect (Cohen's $d = 0.43$). Women viewed stress as less performance enhancing ($M = 2.62$, $SD = 0.65$) compared to men ($M = 2.89$, $SD = 0.58$).

Discussion

This study explored gender differences in stress perceptions among STEM undergraduate students. Previous studies have found differences in stress levels among men and women, but none have specifically looked at STEM majors and what their mindsets regarding stress are like (Baghurst & Kelley, 2014; Gadzella, 1994; Gadzella & Carvalho, 2006; Misra & McKean, 2000; Wohlgemuth & Betz, 1991). We proposed that women would report higher levels of perceived stress, have more perceptions of stress as a badge of honor, and view stress as enhancing rather than debilitating. We found that women indeed report higher levels of perceived stress compared to men, which aligns with previous research finding that women report more stress in college

than men (Gadzella, 1994; Misra & McKean, 2000). This could be because women may have better self-awareness regarding their emotions and what in their lives are stressors, causing them to report more accurate stress evaluations (Gillespie & Eisler, 1992). Women may also objectively have more stress (Gadzella, 1994). Research has found that women tend to take on the stressors that their significant others also experience, adding to their perceived stress loads (Wethington et al., 1987). Gillespie and Eisler (1992) found that women tended to appraise events in their lives as more stressful and meaningful when they were related to societal gender roles, indicating that their perceived stress loads not only include their daily hassles, but how they are expected to interact with their environment and subsequent appropriate social responses.

Regarding stress as a badge of honor, our hypotheses that women would report higher stress as achievement, experience more relaxation remorse, and report more stress-related social comparison and stress-related impression management compared to men were not supported. The majority of the *t*-test results corresponding with the stress badge measures were nonsignificant. Although we found non-significant differences, it is interesting to note that the mean differences were opposite the direction anticipated for all variables except stress as achievement. Men reported slightly higher levels of stress perceptions relating to self-esteem and social value as shown by the means of stress-related impression management, stress-related social comparison, and relaxation remorse all being higher for men than women. Men reporting more feelings of needing to have more work to do than other people may be caused by social norms equating men's value to their workload (Eisler & Skidmore, 1987). While women do report higher perceived stress loads, perhaps they are more equipped with tools to manage their stress perceptions, so they are less affected by social comparison and are able to detach more often from stress when relaxing and interacting socially than men do.

Contrasting our hypothesis that women would view stress as more performance enhancing, we found statistically significant results indicating that men viewed stress as more enhancing than women. Men and women may view stress differently (enhancing versus debilitating) because of how they perceive their gender's norms. Men experience societal pressure to embody masculine norms by associating workload with achievement as a means to derive value from the amount of stress they experience (Eisler & Skidmore, 1987). Perhaps men report having "stress-as-enhancing" mindsets because when they are under stress, they feel like they are able to live up to societal gender expectations which boosts their confidence, enhancing their performance in things like school and work. Societal expectations works both ways: women feeling like they must be in tune with their emotions and express this emotionality to be seen as acceptable and men feeling like they must express dominance and masculinity by not properly addressing their stress. Both sides add to perceived stress loads that can negatively impact their health depending on whether an individual has adaptive or maladaptive coping mechanisms (Perrotta, 2021).

Understanding that, in general, STEM undergraduate students report moderate views of stress as important could better inform academic advisors, counselors, and professors how to educate their students about appropriate coping mechanisms for experiencing stress. Stress is a natural response by the body to changes in one's environment, but the way one handles that stress can be either adaptive or maladaptive. Finding that men and women STEM undergraduates report similar views of stress badge attitudes indicates that they may be similarly impacted by these types of views of stress. However, women in STEM reporting viewing stress as more debilitating than enhancing could mean that they need to be reminded of key resources for coping with heightened stress loads, one of which could include connecting women with

mentors. Leaders in the students' lives can use this information to intervene to help reframe mindsets by retraining thought patterns from maladaptive to adaptive models. Understanding the complexity of stress perceptions and how they can impact students can help advisors provide appropriate coping strategies and help with understanding emotional regulation to their undergraduate students. Additionally, these comparisons of stress perceptions for men and women STEM students could help professors and counselors better understand potential feelings of anxiety, depression, and general stressful experiences that their students may undergo. These findings can also help undergraduate STEM students better understand their individual experiences with stress, stress perceptions, and societal value by enabling them to set more realistic expectations for handling stress in their lives.

Our study had a few limitations that can be highlighted as areas for future research. Future studies should consider a more diverse sample to find results that can be generalized to a larger population. Additionally, our study gathered data towards the end of a fall semester a month before finals began, so stress perceptions could have been altered by that timing. Furthermore, there could be differences in results by STEM discipline as certain majors may have vastly different experiences with stress (e.g., psychology versus computer science). Since our participants gave self-report responses, our data is subjective, meaning that it could be affected by a response bias. Future studies could examine specific sources of stress among undergraduate men and women STEM majors to identify a more objective representation of daily hassles and other impactful stressors. The experiences of non-binary/transgender students could also be investigated. Depending on a student's future career goals, the impacts of stress and how they respond to demands of what is required to achieve those goals could also differ

(e.g. students interested in attending graduate school may have additional requirements outside of school).

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