

Understanding the Role of Social Support in the Association Between
Loneliness and Well-Being for STEM Graduate Students

by

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ABSTRACT

As women enter STEM fields they are often presented with chilly climates. The chilly climate refers to incidents of sexism, isolation, and pressure to prove themselves to peers and higher level academics (Callister, 2006; Hall & Sandler, 1982). For women of color, the status of being a double minority can intensify the psychological distress experienced by students (Joseph, 2012; Ong, 2011; Malcom, Hall, & Brown, 1976). For minority populations in STEM, loneliness is experienced due to lack of belonging and social isolation (Morris & Daniel, 2008; Walton & Cohen, 2007). This study sought to investigate whether social support could serve as a protective factor in the negative relationship between loneliness and psychological well-being (Cohen, 2004; Lawson, 2001; Lazarus & Folkman, 1984) for those who hold a minority status. In addition, this study explored differences in the associations between loneliness, social support, and psychological well being and whether or not the moderation relationships were different for sub-groups based on gender or ethnic minority status. Cross-sectional data from 205 STEM graduate students was collected through an online study. A hierarchical regression analysis was used to test the buffering effects (Barron & Kenny, 1986) of global social support (total support from friends, family, and significant others) and family social support specifically. Model results suggested that global social support buffers the negative associations between loneliness and psychological well-being for less lonely minority participants in the study. Family social support buffered the associations of loneliness on psychological well-being for men with less loneliness. An unexpected finding in the present study revealed that for men and non –minority participants with high loneliness, psychological well-being decreased as family support increased. These

results highlight the need for further research exploring through which mechanisms social support works as a buffer against loneliness in the sub-groups within STEM graduate student populations. The findings of this study could inform practices focused on the recruitment and retention of underrepresented STEM graduate students.

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CHAPTER 1

LITERATURE REVIEW

In the past twenty years, women have begun to enter the fields of science, technology, engineering and mathematics at an increased rate. Despite this, women in male dominated graduate programs in science, technology, and engineering, and mathematics (STEM) experience increased levels of isolation and lack of support due to what is deemed a chilly climate by recent researchers (Bernstein, 2011; Walton, 2015). The chilly climate refers to the unwelcoming atmosphere women in STEM fields experience through messages about their lack of fit in masculine environments (Flam, 1991). Women interpret these messages from the chilly climate as evidence that they do not belong in the STEM environment (Walton & Cohen, 2007) and in turn these feelings of non-belonging can influence academic outcomes for these students throughout their time in their program (Cohen, Garcia, Purdie-Vaughn, Apfel, & Brzustoski, 2009). Researchers have highlighted women's marginalization within these chilly climates as a potential contributor to gender disparities and inequality in STEM participation (Walton & Cohen, 2007; Walton & Spencer, 2009).

Research shows attrition of women from STEM can be partially attributed to a combination of factors including climate issues, barriers, and lack of support. The attrition of women from the STEM fields is often referred to as "the leaky pipeline" (STEM; Clark Blickenstaff, 2005). This phrase conveys the image of women leaving these fields due to issues of gender inequality. The breaks in the pipeline represent the challenging atmospheres that can force women to "leak out" of STEM fields. The leaky pipeline not only refers to the attrition of women from STEM, but also shows the

declining rates that ethnic minority students are being lost from these fields. Although ethnic minority women leaving STEM at any stage is important to understand, attrition at the graduate level highlights significant ethnic and gender disparities (Santiago & Einarson, 1998). Often times when women decide to leave their graduate programs, they also forgo opportunities to obtain advanced leadership positions in academia, research, and policy (CMP-WASE, 2007). This phenomenon not only affects the career potential for the women, but also creates a lack of mentorship for younger women entering the field.

Women of color in STEM programs, also referred to as double minorities, face even higher levels of feeling different. The double bind refers to the concurrent experience of racism and sexism for ethnic minority women in STEM graduate programs (Malcom, Hall, & Brown, 1976). As more women of color begin to enter STEM, current research seeks to understand the specific problems faced by this population. It is critically important to study minority women because this small population can bring new insight and perspective into STEM fields. An increased number of minority women completing advanced degrees in fields like science and engineering brings several benefits including: combating the negative effects of low socio-economic status, increasing social status mobility for this group, as well as adding needed diversity to STEM fields (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies, 2007; Ong, Wright, Espinosa, & Orfield, 2011). Diversification of STEM also can bring new ideas and innovation that will allow the United States to stand out on a global scale in science and engineering (Ong et al., 2011).

Despite the fact that the number of masters and doctoral degrees awarded to underrepresented groups in STEM has increased over the last twenty years, there are still large discrepancies between the number of doctoral degrees awarded and the number of minority women in faculty positions in these fields (National Science Board, 2012). While ethnic minority women collectively represented 10.1% of doctoral degrees awarded in STEM in 2008, this number is still largely disproportionate with their overall representation of 16.5% of the 25-64-year-old population (NSF, 2011). More recent statistics indicate that out of the 183,000 early career doctorate holders in science and engineering that are working within academic institutions, over 70% of them identify as white (NSF, 2017). This leaky pipeline for ethnic minority women is troublesome when viewed in the context of faculty member representation. A recent study highlighted the number of barriers for ethnic minority women's success in these advanced positions, despite findings that suggest there is no difference in teaching or research productivity between different races and genders (Jackson, 2004).

Initial research on this population helps to identify barriers at various levels of STEM education and participation. Barriers to female STEM participation at the adolescent level include parental influences on career choice, stereotype threat, and explicit and implicit gender stereotypes (Saucerman & Vasquez, 2014). Moving towards adulthood, barriers for women participating in STEM include perceptions of competence and social norms and attitudes (Saucerman & Vasquez, 2014). Although current literature investigates the experiences of women of color in their STEM graduate programs in regards to the aforementioned barriers, there is a lack of research on the associations of social support with loneliness and psychological well-being. While a

large amount of research connects social support with increased well-being (Cohen, 2004; Cohen & Wills, 1985), loneliness experienced by minority populations in academic context has often been overlooked within these associations. The focus of this study is to understand how much and from where minority women receive their social support and how this support can help to promote psychological well-being when facing loneliness. Since qualitative research in this area highlights the feelings of isolation and trouble navigating the graduate school experience, it is important for researchers to examine specific gender and racial differences for these underrepresented groups.

Theoretical Frameworks

The following chapter presents an analysis of relevant theories and concepts related to the conceptualization of the factors in this study. It begins with a review of the current climate for women of color in STEM graduate programs. Next, the connection between loneliness as a source of stress for women of color is explored. The chapter then reviews the Stress Buffering Hypothesis (Cohen & Wills, 1985) and the role of social support. The section ends with a review of the present study and covers the research questions and hypothesis of this study.

The Chilly Climate for Minority Women in STEM Graduate Programs

Researchers have identified the chilly climate for women in STEM as a factor contributing to their attrition. Literature on experiences of women working in this climate describe the atmosphere as tense, uncomfortable, competitive, and overall one that can bring increased feelings of dissatisfaction (Gunter & Stambach, 2005). The approximate 50% attrition rate for students in STEM programs increases significantly for ethnic minority students in these programs. For example, the attrition rate jumps to 66% for

African American students in science and engineering doctoral programs (Bethea, 2005). The feelings of isolation and exclusion experienced by women in STEM can have potential negative consequences such as, intention to leave the program, discouragement, and discomfort. According to Seymour and Hewitt (1997), women and ethnic minority students deal with stereotypes, differences in cultural values, and overall lack of program support, which can contribute to negative perceptions of the climate of their program.

An individual's numerical minority status within an environment often leaves them susceptible to stereotyped expectations, as their minority status makes them visible tokens (Kanter, 1977). A recent study explored isolation for ethnic minority individuals with the "solo" status in an information technology work environment. In the study the term solo was "defined as individuals who belonged to a workgroup in which there were no other members of his or her ethnic group," (Major, Fletcher, Streets, & Sanchez-Hucles, 2014). When comparing experiences of solo ethnic group members and non-solo group members in a sample of 239 ethnic minority employees, researchers found that those with solo status reported less affective support from coworkers and were less satisfied with the social environment (Major et.al, 2014). The authors found that solos were less likely to perceive the work environment as equal opportunity (Major et.al, 2014), possibly due to the higher likelihood that those who are sole members of their ethnic group experience scrutiny and attention due to their solo status. The experience of isolation for ethnic minority individuals in STEM work environments is similar to the solo status isolation experienced by double minority graduate students. The findings of this study are consistent with research on women and minority groups in environments like STEM, which suggest that the "token" or "solo" status can lead to stressors (Kanter,

1977) including workplace discrimination (Settles, Cortina, Buchanan, & Miner, 2013) and social isolation (Walton, Peach, Logel, Spencer & Zana, 2015).

Minority women are a growing population within STEM fields making the retention of these women a critical area of research. In a review of recent literature on issues experienced specifically by minority women, Ong and colleagues (2011) identify the STEM climate, role models, and family influence and support as among the most salient areas of research for minority women in STEM graduate programs. Research by Joseph (2012) highlighted the chilly climate for women through quotes gleaned in qualitative studies. One participant stated that during her first year she felt completely alone, which mirrored other statements of feelings of isolation and loneliness (Joseph, 2012).

Loneliness

Loneliness is defined as an “affective emotional condition experienced when a person feels apart from familiar social supports,” (Mullins, 2002, p.814). Loneliness is often conceptualized as an emotional response to the discrepancy between one’s social contact and their desired level of social contact (Hays & Dimatteo, 1987). The relationship between loneliness and social support is a key point of interest within the current study, given the evidence provided in past research on the two variables. Nicpon and colleagues (2006) found that for both male and female college students in the study, increased social support was related to lower loneliness. Their findings were consistent with current and past literature suggesting that loneliness and social support were associated in young adult and adult populations (Lee & Goldstein, 2016; Segrin & Passalacqua, 2010; Cacioppo et.al, 2000). The study investigates the relationship between

loneliness and social support in the context of STEM graduate programs. Since women often experience lack of social contact in chilly climates, such as STEM graduate programs (Wyer, Barbercheck, Geisman, Ozturk, & Wayne, 2001), the probability of increased feelings of loneliness being produced makes loneliness an important variable to investigate.

Lack of belonging in a student's program of study may be considered a source of stress for minority students (Hurtado & Ponjuan, 2005; Morris & Daniel, 2008).

Researchers have drawn connections between social isolation and well-being in the higher education realm through investigation of stressors affecting underrepresented groups. Social belonging is defined as "a need to form and maintain at least a minimum quantity of interpersonal relationship" (Baumeister & Leary, 1995 p. 499), and several factors can give rise to belongingness uncertainty for ethnic minority students. While investigating the experience of graduate students of color, reports indicate that the feelings of being underrepresented can contribute to feelings of being an outsider within their academic program.

Social determination theory suggests that developing secure attachments and connections within one's own social circle is a basic psychological need (Deci, Vallerand, Pelletier, & Ryan, 1991). In the context of academia, these connections are often built through faculty and peer connection. However, since many women experience isolation and loneliness within their program of study, we predict that the need social connections can be met through another venue, such as social support outside of their program of study. A recent study investigated feelings of belongingness in relation to experience of racial microaggressions for minority graduate students (Clark, Mercer,

Zeigler-Hil, Duferne, 2012). Findings of the study indicated that feelings of belongingness were strongly related to academic engagement for the population. The relationship between belongingness and academic engagement suggest that without social connections and support within their program, students of color could be at a disadvantage in comparison to their white counterparts (Walton & Cohen, 2007).

Stress and the Buffering Hypothesis

Many correlational studies have investigated the associations between social support and health in order to better understand in what ways social support can impact physical and mental health outcomes for specific populations. Epidemiological research dating back to the 1970's supports that social support can promote positive long term health effects (Cobb, 1976), although the specific directions of this associations are still disputed. Research on stress and social support indicates that social support can have both main effects and buffering effects (Cohen, 2004), meaning that social support can improve health by reducing negative effects from stress (Broadhead et al., 1983; Cohen, 1988; Cohen & Wills, 1985; Wheaton, 1985). The buffering hypothesis of social support proposed by Cohen and Wills (1985) suggests that social support can protect the individual from the effects of stressful events. The authors studied the process of how social support impacts well-being. The researchers sought to test their model of the buffering effect by using the established relationship between stress and symptomology to test if social support would moderate the relationship between stress and psychological distress symptoms. The results of the study provided evidence that in times of stress, support may be able to buffer the effects of stress given the right conditions (Cohen & Wills, 1985). Stress is buffered through socially rewarded roles, sense of predictability

and stability, and knowledge that others can provide resources in times of need (Cohen & Wills, 1985).

Stress buffering also helps individuals to thrive through adversity (Feeny & Collins, 2015). The ability to thrive through adversity could serve as a potentially beneficial mechanism for coping with the negative experiences within chilly climates. Walton and colleagues (2015) tested this concept in their recent study on STEM interventions. Their study utilized social belonging intervention and affirmation training interventions for students in an engineering program. Women in the study showed improvements in their GPAs, which is an outcome variable that can be affected by environmental stress. The results indicated that women experiencing stress from marginalization and lack of belonging in STEM environments may benefit from interventions that present difficulties in their academic program as manageable (Walton, 2015).

During times of continuous high stress, individuals can develop a sense of helplessness because of their inability to cope with the situation (Cohen & Wills, 1985). Stress typically arises when the situation is challenging and when there are insufficient resources to help cope with the situation (Lazarus, 1996). Considering the high level of stress associated with the graduate school experience, it is not uncommon for graduate students to begin to show symptomology of anxiety, depression, and general psychological distress. Combined with the loneliness of the chilly climate and feelings of not belonging, the stress of graduate school can impact the psychological well-being for many graduate students, especially those with intersectional identities such as women of color. When loneliness acts as a stressor for ethnic minority women in STEM graduate

programs a lack of perceived support from their program of study can contribute to an inability to cope with the situations which can ultimately lead to decisions to leave their program of study.

Social Support

Social support is defined as the emotional or instrumental support found within an individual's social network with close others (Dunkel-Schetter, Folkman, & Lazarus, 1987). Social support has been shown to help individuals navigate challenging academic environments such as in STEM (London, 2005; Reisberg, Raelin, Bailey, Hamann, Whitman & Pendleton, 2011). Social support is reported to be a coping strategy for both undergraduate and graduate ethnic minority students (Dunkel-Schetter & Lobel, 1990; Joseph, 2012; Peña-Calvo, Inda-Caro, Rodríguez-Menéndez & Fernández-García, 2016). The results of a recent study on social support for women in STEM majors showed that perceived support received was a significant predictor of sense of belonging in their STEM major (London, Rosenthal, Levy & Lobel, 2011).

Social support comes from a variety of sources for students including family, friends, peers, significant others, advisors, and formal support programs. Within the literature on social support, researchers have questioned whether the source of support makes a difference in the buffering ability of social support. Lee and Goldstein (2016) found evidence that the stress buffering of support on loneliness only worked with friend support. Rodriguez and colleagues (2003) found similar results in that social support from friends proved to contribute slightly more than family support. Other studies have found that family support buffers the associations between stress on psychological well-being (Crockett et al., 2007) and is important to the well-being of adults in college (Lee,

Dik, & Barbra, 2016). The present study looks at both global social support, support from friends, family and significant others, as well as family social support specifically. Family social support is being investigated specifically as it has emerged as a common theme for women of color in STEM graduate programs (Johnson, 2008; Joseph, 2012; Sosnowski, 2002).

Qualitative studies investigating student's coping strategies identified social support as a main way to cope with the stress of graduate school (Sosnowski, 2002; Joseph, 2012). A recent study found that eight out of twelve graduate students interviewed stated that their families provided them with social support (Johnson, 2008). Information gathered from the interviews supported the hypothesis that the listening, advice, and lack of judgment from parents helped students to cope with the stress of academic and personal responsibilities (Johnson, 2008).

In one study of social support for women of color in STEM graduate programs, personal accounts suggest that lack of social support was a factor in their adjustment to their academic environment. Joseph's (2012) study on women's experiences in STEM graduate programs provides insight into the experiences of stress related to minority status for women of color and the impact it had on their feelings of belonging in the program. The study on the first two years of graduate school for two African American women highlights interactions with white peers and faculty members, navigating the chilly environment, and maintaining a sense of self, as common points of adjustment for these women. The author found that for the two participants, there was a lack of interactions based on shared values and similar outlooks on life with their white peers, which lead to a lack of assurance of wellness (Joseph, 2012). Without the social support

from peers within the program, they battled feelings of lack of belongingness in the program which could affect psychological well-being for the student.

Social support has also proven to be an important aspect of positive adjustment for Latino college student population. A model for Latino health proposed that social support can serve as a moderator between stress and adjustment behavior (Vega, Hough, & Miranda 1985). Particularly for Latino individuals, familism is reported to be a core cultural value that contributes to a more positive mental health status (Marin & Marin, 1991). Rodriguez et al. (2003) conducted a study testing the buffering theory for the Latino population by using both friend and family support to moderate the relationship between stress and positive adjustment. The results indicated that in line with findings in similar literature, friend and family support contributed to well-being (Rodriguez et al., 2003).

Family social support is also viewed as a source of cultural capital that contributes to academic success for ethnic minority students. A study investigating persistence of engineering students of color sought to understand what forms of community cultural wealth contributed to student persistence (Samuelson & Litzler, 2016). In interviews both male and female Latino/Latina and African American highlighted the fact that family members motivated them. One student noted that statements from his parent's support in the form of verbal motivation and reassurance of math and science skills helped him to continue in his major (Samuelson & Litzler, 2016). Family social support or familial capital helps to shape many components of individual persistence including emotional, moral, motivational and educational factors (Samuelson & Litzler, 2016). For individuals from collectivist cultural orientations, which are often linked to ethnic minority

individuals, motivations and goals are often tied to group and community needs (Markus & Kitayama, 1991) thus explaining the strong influence family support can have on well-being.

Within the literature on STEM education a theme of parental social support emerged. In a study of minority female and male students, one student cited the important role of her mother in understanding discrimination:

“She’s a scientist . . . I asked her about different stuff, like what are some challenges I’m going to have to face if I want to get into that field. And she tells me that, of course, people might view women as inferior, but you just have to keep going with it and you have to prove it instead of just saying it.” (Grossman & Porche, 2014, p.711)

In a study of qualitative study of minority women in STEM graduate programs, many of the women revealed the emotional support they received from their parents. The quote from the study participant highlights the importance of verbal encouragement in building a sense of STEM belonging for minority women.

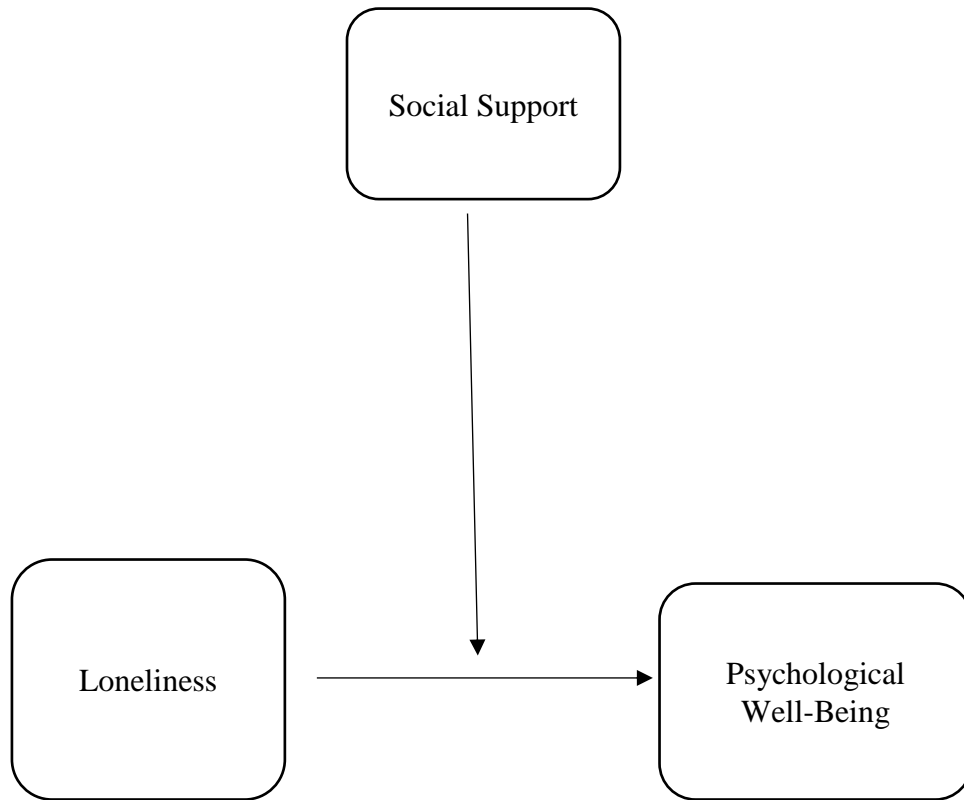
“So she has always been there for me. She’s always the strong one. She’s always saying, ‘We can do anything!’ My dad is like that too. My dad says, ‘a guy can do that, you can do that too!’ Both of them have always been supportive. They’re like, ‘Engineering for guys, yah right! Girls can do it too,’” (Sosnowski, 2002, p.84).

The present study hypothesizes that social support from family members can help to buffer the negative associations between loneliness and psychological well-being. Although most recent literature focuses on aspects of instrumental or tangible support

from advisors and peers, this study investigated perceived support from external sources, specifically family, friends, and significant others. The current study measures the amount of perceived social support from friends, family, and significant others in order to compare amounts of perceived support from each of those sources as moderators.

Figure 1

Social Support Moderation Model



Present Study

The present study aimed to identify the association between social support from various sources (friends, family, and significant others) and psychological well-being for students in STEM graduate programs with a particular focus on minority women. This study questions whether social support can buffer the negative associations between loneliness and psychological well-being for STEM graduate students and whether this relationship differs on the bases of gender and ethnic minority status.

The following are the research questions and associated hypotheses that were tested in the present study:

Research Question #1: How are loneliness and social support related to psychological well-being for STEM graduate students?

H1a: Loneliness and psychological well-being will be negatively associated.

H1b: Global social support will be positively associated with psychological well-being.

H1c: Family social support will be positively associated with psychological well-being.

Research Question #2: Does social support from different relationships moderate the associations between loneliness and psychological well-being?

H2a: Global social support will moderate the negative associations between loneliness and psychological well-being.

H2b: Family social support will buffer the negative association between loneliness and psychological well-being.

Research Question #3: Is the buffering effect of social support on the negative association between loneliness and PWB the same by gender or ethnic minority status?

H3a: Global social support will moderate the relationship between loneliness and psychological well-being differently for women and men, such that the associations between global social support and PWB will be positive and more pronounced for women who are lonely.

H3b: Family social support will moderate the relationship between loneliness and psychological well-being differently for women and men, such that the associations between family social support and PWB will be positive and more pronounced for women who are lonely.

H3c: Global social support will moderate the relationship between loneliness and psychological well-being differently for ethnic minority status and non-ethnic participants, such that the associations between global social support and PWB will be positive and more pronounced for ethnic minorities who are lonely.

H3d: Family social support will moderate the relationship between loneliness and psychological well-being differently for ethnic minority status and non-ethnic participants, such that the associations between family social support and PWB will be positive and more pronounced for ethnic minorities who are lonely.

Research Question #4: Are there differences in the amount of social support that female minority STEM graduate students receive from different social relationships (friends, family, and significant other)?

H3: For minority women in the study, perceived social support from family will be higher than perceived support from friends and significant others.

Research Question #5: Do ethnic minority women experience more loneliness than other participants in the sample?

H4: Minority women will have the highest level of loneliness when compared to men and non-ethnic minority women.

CHAPTER 2

METHODOLOGY

Participants

The sample consisted of 205 masters and doctoral graduate students in STEM, including 109 female participants, 93 male participants, and 3 participants who chose not to identify their gender. Ages ranged from 20-52 with 50% of the sample being 25 years old or younger. A self-report of race/ ethnicity indicated that the sample self-identified as 61% White/Caucasian, 6.7% Hispanic/Latino, 2.1% Black/African American, 26.7 % Asian/Asian American, and 3.1% Other. For the purpose of this study, the minority group consisted of participants who self-identified as non-white including: Asian/Asian American, Hispanic/Latino, Black/African American, and Other. The sample include 51 non-minority men, 68 non-minority women, 39 minority men and 36 minority women. Twenty-two of the study participants reported that they were international students. Eighty percent of those who had identified as international students were classified as ethnic minority participants. Participants reported a variety of STEM programs of study. The top areas of study reported from participants in the study included: Biomedical Engineering, Computer science, Material Science, and Chemistry fields. For complete demographic information, see table 2.

Procedure

Participants were recruited through email advertisements and word of mouth. An advertisement for the study (IRB #STUDY00005203) was distributed through electronic listservs for STEM graduate programs at PWI's, HBCU's and MSIs. A list of top minority degree producing universities in the United States was used to search for

program/department emails. Department chairs and administrative assistants were contacted to distribute a request for research participants. Approximately 155 departments were contacted via email to distribute the study. In order to participate, students had to meet the following requirements: 1) Be at least 18 years of age, 2) be a current masters or doctoral student in a science, technology, engineering, or mathematics related field, and 3) have completed at least 9 credit hours of graduate coursework at time of completing the survey. Participants were recruited from public and private higher education institutions across the United States. As the target population of the study was minority women, efforts were made to oversample this population.

Students who were interested in completing the study were directed to click on the Qualtrics study link to complete the survey. The study took about 10-15 minutes to complete.

As an incentive for completing the study, participants had the opportunity to provide their emails for a raffle for one of ten \$20-dollar amazon gift cards. Participants were informed that their survey responses would not be connected to the email they provided, if they opted to participate in the raffle. In order to ensure that participant's confidentiality was maintained through a Qualtrics feature allowing responses to be kept separate from emails. At the end of the survey, participants were asked if they were interested in completing the raffle. If they selected "Yes" they were directed to the next screen where they entered their emails. If they selected "No" they were directed to a screen that thanked them for completing the survey.

Measures

This study utilized a demographic questionnaire and three instruments: The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988), UCLA Loneliness Scale (ULS-8; Hays, Dimatteo), and the Psychological Well-Being Schedule (GWBS; Dupuy, 1978). The average completion time for the complete survey packet was approximately 15 minutes.

Demographic questionnaire. The demographic questionnaire solicited information from participants about gender, age, ethnicity, nationality, highest level of parent's education for either parent (some high school, high school diploma/GED, some college, bachelor's degree, graduate level degree), family socio-economic status, current income level, year in program, type of program/major, marital status, amount of family contact and number of graduate level hours completed (see Appendix C). Please see Table 2 for demographic information.

Loneliness. The UCLA Loneliness Scale-8 (ULS-8; Hays & Dimatteo, 1987) is a self report measure of general loneliness. The scale has been used to measure loneliness by assessing the deficiency of an individual's social contact (Hays & Dimatteo, 1987) (See Appendix E). The ULS was originally designed to be a 20 item measure (Russell, Peplau, & Ferguson, 1978) but for the purposes of minimizing response burden in the present study, the 8 item version was used. The items are rated on a 4-point scale ranging from "I never feel this way" to "I often feel this way". A participant's score on the scale is calculated by adding up the sum of the responses to each of the 8 items. Two items were reverse coded in the scoring of this instrument. A higher score on the ULS indicates greater perceived loneliness experienced by the participant. The scale contains items such as "There is no one I can turn to" and "I feel isolated from others". For the purposes of

this study, participants were asked to think of the items in the context of their experiences in their program of study.

The short versions of the scale have been proven to be reliable and valid measures for the college population. Hays and colleagues (1987) reported a Cronbach's alpha of .84 for the 8-item scale used in a comparison study between the ULS-20 and ULS-4. Item discrimination validity was measured by comparing correlations of ULS scales to the correlations of measures of life satisfaction, alienation, and social anxiety. The 8-item short form of the ULS performed similarly to the 20-item version of the scale in regards to item discriminant validity. The Cronbach's alpha for the scale in the present study was .84. Reliability for minority participants in the sample was .76 and .86 for non-minority participants. Reliability for men in the sample was .85 and was .84 for women in the sample.

Psychological well-being. The General Well-Being Schedule (GWBS; Dupuy, 1978) is a widely used scale measuring psychological well-being. The General Well-Being Schedule is an 18 item measure that includes 6 dimensions of mental health and psychological well-being including: anxiety, depression, positive well-being, self-control, vitality, and general health that is used to assess participants psychological well-being. (Dupuy, 1978) (See Appendix F). The first 14 questions are rated on a 6 point Likert scale with 1 (strongly agree) and 6 (strongly disagree) and the other 4 questions are rated on a scale using anchored adjectives. The anchored adjectives include: not concerned at all vs. very concerned, very relaxed vs. very tense, no energy at all/ listless vs very energetic/ dynamic, and very depressed vs. very cheerful. The scale contains items such as "Have you been waking up fresh and rested?" and "Has your daily life been full of

things that were interesting to you?” (Dupuy, 1978). The items are separated onto 6 different adjustment factors including: freedom from health concern, worry, distress, energy level, satisfying interesting life, cheerful vs depressed mood, relaxed vs. tense/anxious, and emotional-behavioral control. Nine of the items are reverse scored and then added to the scores of the other items to obtain the participants total score. The total score ranges from 0-110. A lower score on the measure indicates more psychological distress and a higher score represented higher psychological well-being.

The measure has been shown to be reliable and valid in measuring psychological well-being in underrepresented ethnic minority individuals with Taylor and colleagues (2003) reporting test–retest reliability for their population of African American women of coefficients ranging from 0.68 to 0.85 and high internal consistency (Cronbach’s $\alpha = 0.92$). The measure showed moderate reliability in the present sample (Cronbach’s $\alpha = 0.76$). Reliability for minority participants in the sample was .70 and .78 for non-minority participants. Reliability for men in the sample was .80 and .73 for women in the sample.

Social support. The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988) is a self-report measure that was given to participants to assess the amount of the individual’s perceived amount of social support from friends, family, and significant others (see Appendix D). The scale contains three subscales measuring perceived social support from friends, family and significant others. The items are rated on a Likert scale with 1 indicating “very strongly disagree” and 7 indicating “very strongly agree”. A higher score of the MSPSS indicates higher level of perceived social support. The total scale is scored by adding the sum of all 12 items and then dividing by 12. The total scale score was used as a measure of global

social support. The subscale scores are calculated by adding each of the 4 items within each subscale and dividing by 4. The scale has proven to be a valid and reliable for the college population (Zhou, Zhu, Zhang, Cai, 2013). Cronbach's alpha for the scale in the present study is .89. The friend, family, and significant other subscales showed high reliabilities of .88, .87, .92 respectively.

Data Preparation

A total of 234 responses were collected through the online survey. After removing 29 cases where the participant did not complete any information after the demographic survey, 205 cases remained. Missingness within the imported data was examined through descriptive data. Missingness was assessed for the demographic variables of ethnicity and gender. The gender variable was missing three cases (1% of the total sample) and the ethnicity variable was missing ten cases (5% of the total sample). Analysis of the scales used in the study showed between 8-11 missing cases amongst the scales. Given the low number of missingness, list wise deletion was used for analysis that included missing values. After list wise deletion during the two hierarchical regression analysis, 190 cases were used in the analysis.

Prior to testing the moderation models, the data was examined to determine if it met the assumptions of multiple regression. A Shapiro-Wilk's test was performed to determine whether the dependent variable, psychological well-being, was normally distributed in the population. The test of normality revealed that the dependent variable was non-normally distributed. After examining the data for outliers, one outlier was removed from the data; the Shapiro Wilk's test indicated the data was normally distributed $W(.989) = .11, p < .05$. The data was checked for multicollinearity between

the predictor variables by examining the VIF statistic. All of the main level predictor variables had a VIF of greater than 1 and less than 10 indicating that there was no multicollinearity amongst variables, which means that the predictor variables are not highly correlated. The loneliness and global social support variables were centered, prior to creating the interaction terms that were tested in the hierarchical regression models (Little, Card, Bovaird, Preacher & Crandall, 2007). When examining the correlations between the predictors and the dependent variables, global social support showed a weak positive correlation with psychological well-being ($r = .26, p < .01$).

Casewise diagnostics were examined to detect outliers in the data. An examination of the P-P Plot of standardized residuals showed normality in the data. While the residual statistics showed a range of -3.3 to 2.1, the Cook's distance was not greater than 1, suggesting normality within the data. After 1 outlier was removed from the data set the residual statistics were within a normal range, again suggesting normality within the data.

In order to test whether or not global social support would moderate the association between loneliness and psychological well-being, a hierarchical regression analysis was conducted using SPSS (see Figure 1). A hierarchical regression was also used to test whether or not family social support would moderate the associations between loneliness and psychological well-being. Separate interactions of gender or ethnicity with the independent variable, dependent variable were added to the hierarchical regression to determine if sub-group differences exist. Significant three-way interactions were further explored using Dawson and Richter (2006) slope differences test.

CHAPTER 3

RESULTS

Research Question #1: How are loneliness and social support related to psychological well-being for STEM graduate students?

Correlational Analyses

Hypothesis 1a: There will be a negative correlation between loneliness and psychological well-being.

Zero-order correlations among study variables were examined using Pearson bivariate correlations (see Table 1). In alignment with Hypothesis 1a, loneliness and psychological well-being were negatively correlated, $r = -.64, p < .01$, such that higher levels of loneliness were associated with lower psychological well-being. The hierarchical regression analysis showed that loneliness negatively predicted psychological well-being ($b = -.63, p < .001$). Therefore, the hypothesis was supported.

Hypothesis 1b: There will be a positive correlation between global social support and psychological well-being.

In alignment with Hypothesis 1b, there was a positive correlation between global social support and psychological well-being, $r = .26, p < .01$, such that higher global social support was associated with higher well-being. Thus, the hypothesis was supported.

Hypothesis 1c: Family social support and psychological well-being will be positively correlated.

In alignment with Hypothesis 1c, family social support and psychological well-being were positively correlated, $r = .19$, $p < .01$, such that higher family social support was associated with higher well-being. Therefore, the hypothesis was supported.

These results indicate that the correlations between the primary predictor variable, loneliness, with psychological well-being, represented a medium effect size (Cohen, 1988). The correlation between the hypothesized moderators, global or family social support, and psychological well being were representative of a small effect size (Cohen, 1998).

Table 1

Summary of Intercorrelations, Means, Standard Deviations, and Cronbach's Alpha for Loneliness, Global Social Support, and Psychological Well-being as a Function of Gender

	1	2	3	4	5	6	M	SD	α
1. Loneliness		-.31*	-.37*	-.09	-.29*	-.65**	18.08	4.86	.85
2. GSS	-.55**		.81**	.71**	.85**	.18	5.04	.89	.89
3. FR-SS	-.54**	.79**		.41**	.59**	.28**	5.55	.98	.89
4. FA-SS	-.35**	.73**	.35**		.35**	.06	5.39	1.14	.84
5. SO-SS	-.40**	.78**	.52**	.27**		.11	5.46	1.49	.93
6. PWB	-.62**	.34**	.29**	.27**	.20*		81.64	11.39	.80
M	19.11	5.15	5.57	5.35	5.83	77.37			
SD	4.88	.912	1.16	1.38	1.31	10.63			
α	.84	.89	.85	.89	.92	.73			

Notes: Information for the female is below the diagonal line. Information for the male participants is above the diagonal line.

PWB= psychological well-being; GSS= global social support; FR-SS= friend social support; FA-SS= family social support; SO-SS= significant other social support

** $p < .01$ (two-tailed)

* $p < .05$ (two-tailed)

Table 2

Summary of Intercorrelations, Means, Standard Deviations, and Cronbach's Alpha for Loneliness, Social Support, and Psychological Well-being as a Function of Minority vs Non-Minority

	1	2	3	4	5	6	M	SD	α
1. Loneliness		-.41	-.46	-.23	-.31	-.65	18.39	4.99	
2. GSS	-.57		.80	.77	.83	.22	5.14		
3. FR-SS	-.45	.75		.48	.54	.28	5.61	1.03	
4. FA-SS	-.28	.55	.04		.40	.13	5.43	1.19	
5. SO-SS	-.42	.69	.57	-.08		.13	5.66	1.43	
6. PWB	-.55	.38	.25	.34*	.12		79.85	11.22	
M	19.77	4.39	5.31	5.08	5.63	76.80			
SD	4.22	.84	1.25	1.57	1.32	10.56			
α	.76	.82	.90	.91	.90	.70			

29

Notes: Information for the minority participants is below the diagonal line. Information for the non-minority participants is above the diagonal line. The non-minority group includes minority men, non-minority men, and non-minority women. PWB= psychological well-being; GSS= global social support; FR-SS= friend social support; FA-SS= family social support; SO-SS= significant other social support

** $p < .01$ (two-tailed)

* $p < .05$ (two-tailed)

Research Question #2: Does social support from different relationships moderate the associations between loneliness and psychological well-being?

Moderation analyses

Two nine step hierarchical multiple regressions were conducted for all participants in the sample ($N = 190$). In step 1 of the regression that included global social support (Table 5), loneliness, ethnicity, gender, and global social support were entered. In step 2, the two-way interaction of social support and loneliness was entered. In step 3, the two-way interaction of ethnicity and loneliness was entered. In step 4, the two-way interaction of gender and loneliness was entered. In step 5, the two-way interaction of ethnicity and social support was entered. In step 6, the two-way interaction of gender and social support was entered. In step 7, the three-way interaction of gender, loneliness and social support was entered. In step 8 the three-way interaction of ethnicity, loneliness, and social support was entered. In step 9, the four-way interaction of gender, ethnicity, loneliness, and social support was entered. For analysis of the model using family social support as the moderator (Table 6), the same nine step hierarchical multiple regression model was conducted for all participants in the sample ($N = 190$) with family social support replacing global social support in steps 1, 2, 5, 6, 7, 8 and 9.

Hypothesis 2a: Global Social Support as a Moderator in the Associations between Loneliness and Psychological Well-being

It was hypothesized that global social support would moderate the negative associations between loneliness and psychological well-being.

The hierarchical regression for global social support revealed that the main effects at step 1 explained 42.3% of the variance $F(4, 185) = 33.95, p < .001$. In the first step,

loneliness negatively predicted psychological well-being ($b = -.63, p < .001$). Model 8 showed an increase of 3.2% in R^2 . Model 9 did not produce any change in R^2 and the added four-way interaction term between gender, ethnicity, loneliness, and social support was not significant. Therefore, model 8 was used for further analysis. When all 11 variables were entered into the regression model at stage 8, the independent variables accounted for 47% of the variance in psychological well-being. Given that the interaction of global social support and loneliness was not significant, hypothesis 2a was not supported.

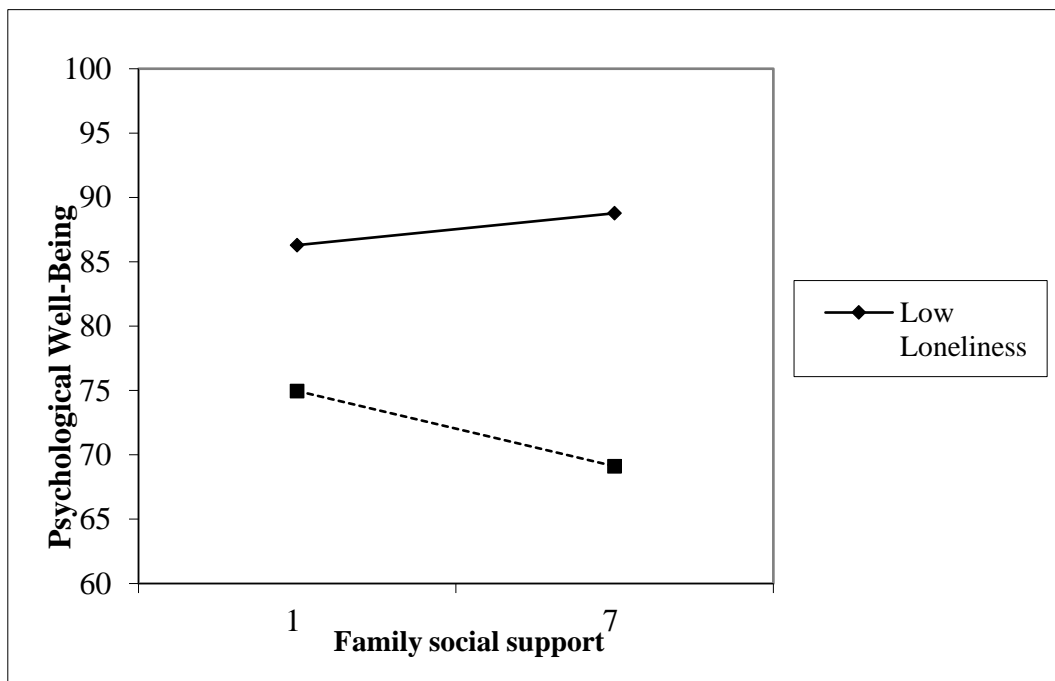
Hypothesis 2b: Family Social Support as a Moderator in the Associations between Loneliness and Psychological Well-being

It was hypothesized that family social support will buffer the negative association between loneliness and psychological well-being.

The hierarchical regression with family social support revealed that the main effects at step 1 explained 42.5% of the variance $F(4, 185) = 34.14, p < .001$. Similar to the previous model, only loneliness negatively predicted psychological well-being in the first step ($b = -.62, p < .001$). Model 8 showed an increase of 5% in R^2 from the original model. Model 9 only produced a .01 change in R^2 and the added four-way interaction term between gender, ethnicity, loneliness, and family support was not significant, therefore model 8 was used for further analysis. When all 11 variables were entered into the regression model at stage 8, the predictor variables accounted for 47.5% of the variance in psychological well-being. The interaction of family social support and loneliness was significant.

To further explore this result, the interaction was plotted and examined for significant differences between slopes according to the process as described by Dawson and Richter (2006). In the prediction of psychological well-being by family social support, the slope for participants with low loneliness differed significantly from participants with high loneliness, $t(190) = -2.170, p < .05$. (Figure 2).

Figure 2. Interaction Plot of Loneliness and Family Social Support



Notes: UCLA loneliness scale scores ranged from 11-32. Psychological well-being scores ranged from 51-103. Family social support scores ranged from 1-7 within the present study. Higher scores represented greater loneliness, higher psychological well-being and more perceived family social support.

These results suggest that family social support makes the most difference for participants with high loneliness. These results indicate that family social support did

moderate the negative associations between psychological well-being for a portion of the participants, thus hypothesis 2b was partially supported.

Research Question #3: Is the buffering effect of social support on the negative association between loneliness and PWB the same by gender or ethnic minority status?

Hypothesis 3a: Global Social Support and Gender as Moderators in the Associations between Loneliness and Psychological Well-being

It was hypothesized that global social support will moderate the relationship between loneliness and psychological well-being differently for women and men, such that the associations between global social support and PWB will be positive and more pronounced for women who are lonely.

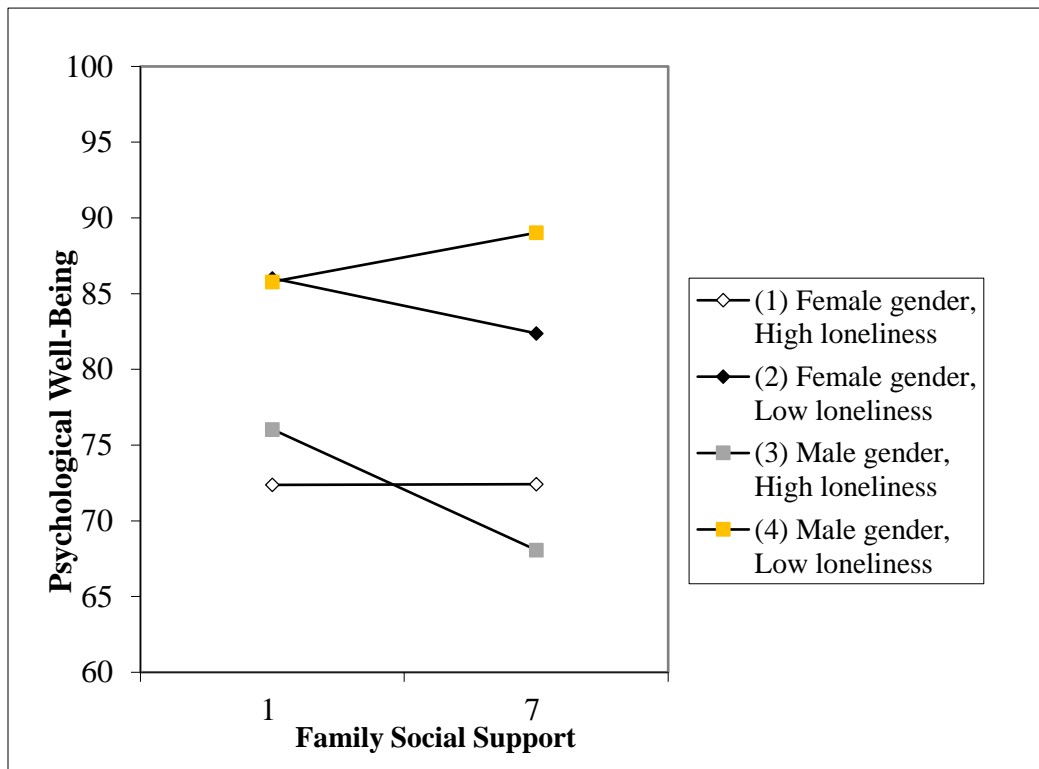
While the interaction of gender, loneliness, and global social support showed borderline statistical significance in model 8 ($p = .05$), further analysis did not reveal any statistically significant differences on the slope differences test. This suggests there is no difference by gender in the association of loneliness, social support, and psychological well-being. Since the interactions including gender showed no difference in the association of these variables, hypothesis 3a was not supported.

Hypothesis 3b: Family Social Support and Gender as Moderators in the Associations between Loneliness and Psychological Well-being

It was hypothesized that family social support will moderate the relationship between loneliness and psychological well-being differently for women and men, such that the associations between family social support and PWB will be positive and more pronounced for women who are lonely.

In step 8, the 3-way interaction of gender, loneliness, and family support was significant, $p < .01$. Further analysis of the gender, loneliness and family support interaction showed that for males in the study, those with high loneliness and high family support had lower psychological well-being than those with high loneliness and low family support, while female participants had the same well-being at high and low family support ($t = 1.95, p = .05$). The slope differences test also revealed that the slope for low lonely men differed from the slope for high lonely men ($t = -2.14, p < .05$). As family social support increased, psychological well-being increased for low lonely men but for high lonely men, psychological well-being decreased as family social support increased (Figure 3).

Figure 3. Interaction Plot of Gender, Loneliness and Family Social Support



Notes: Family social support sub-scale scores range from 1-7 and psychological well-being scores ranged from 51-103 in the current sample.

These results indicate that for men family social support worked in the opposite direction of a buffer such that higher family social support, in the case of higher loneliness, was related to lower psychological well-being; thus hypothesis 3b was not supported. In addition, the results of the low lonely vs. high lonely men slope differences test revealed that differences exist within the same gender, dependent on the level of loneliness.

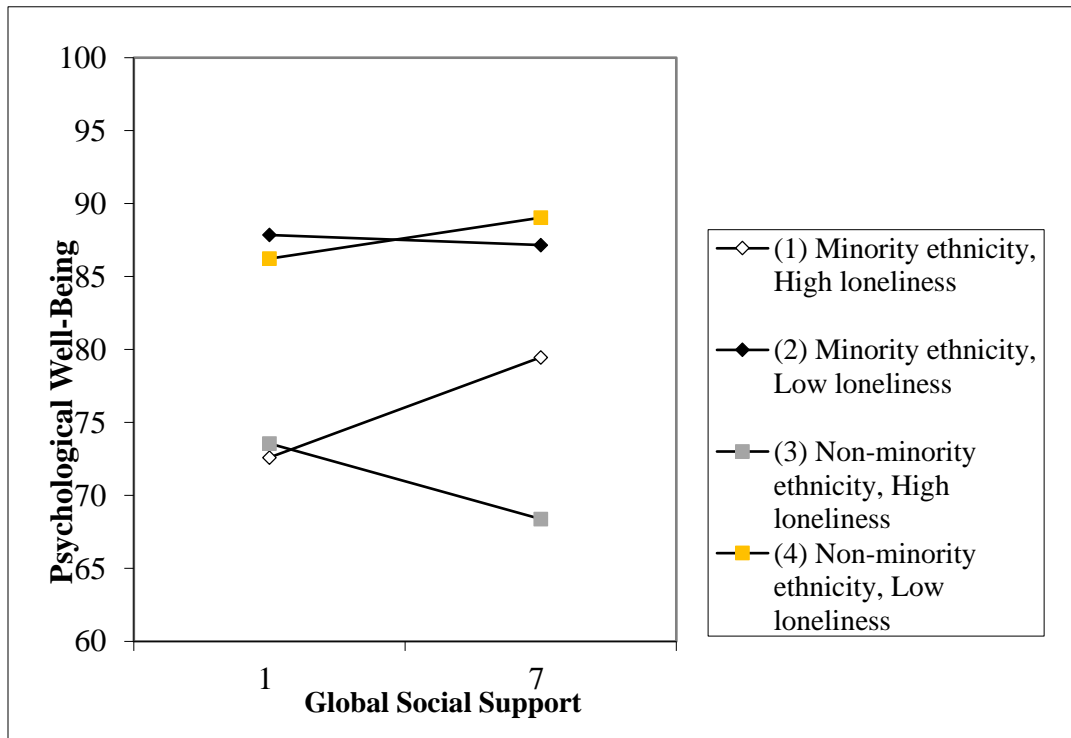
Hypothesis 3c: Global Social Support and Ethnicity as Moderators in the Associations between Loneliness and Psychological Well-being

It was hypothesized that global social support will moderate the relationship between loneliness and psychological well-being differently for ethnic minority status and non-ethnic participants, such that the associations between global social support and PWB will be positive and more pronounced for ethnic minorities who are lonely.

The interaction of ethnicity, loneliness, and social support with psychological well-being was statistically significant ($p < .005$). In the prediction of psychological well-being by social support, the slope for minority participants with high loneliness differed significantly from the slope for non-minority participants with high loneliness, $t(190) = 2.95, p < .05$. These results indicate for minority participants, that those who had high loneliness and high global social support had higher psychological well-being than those who had high loneliness and low global social support. The relationship was different for non-minority participants, showing that those who had high loneliness and high global social support had lower psychological well-being than those who had high loneliness

and low global social support. These results indicate that higher global social support acted as a buffer for minority participants, but not for non-minority participants. (Figure 4)

Figure 4. Interaction Plot of Ethnicity, Loneliness and Global Social Support



Notes: Global social support sub-scale scores range from .92-6.46 and psychological well-being scores ranged from 51-103 in the current sample.

These results suggest that global social support does moderate the association between loneliness and psychological well-being and that, in the instance of high loneliness, global social support buffer works for minority participants whereas for non-minority participants, psychological well being decreased as support increased.

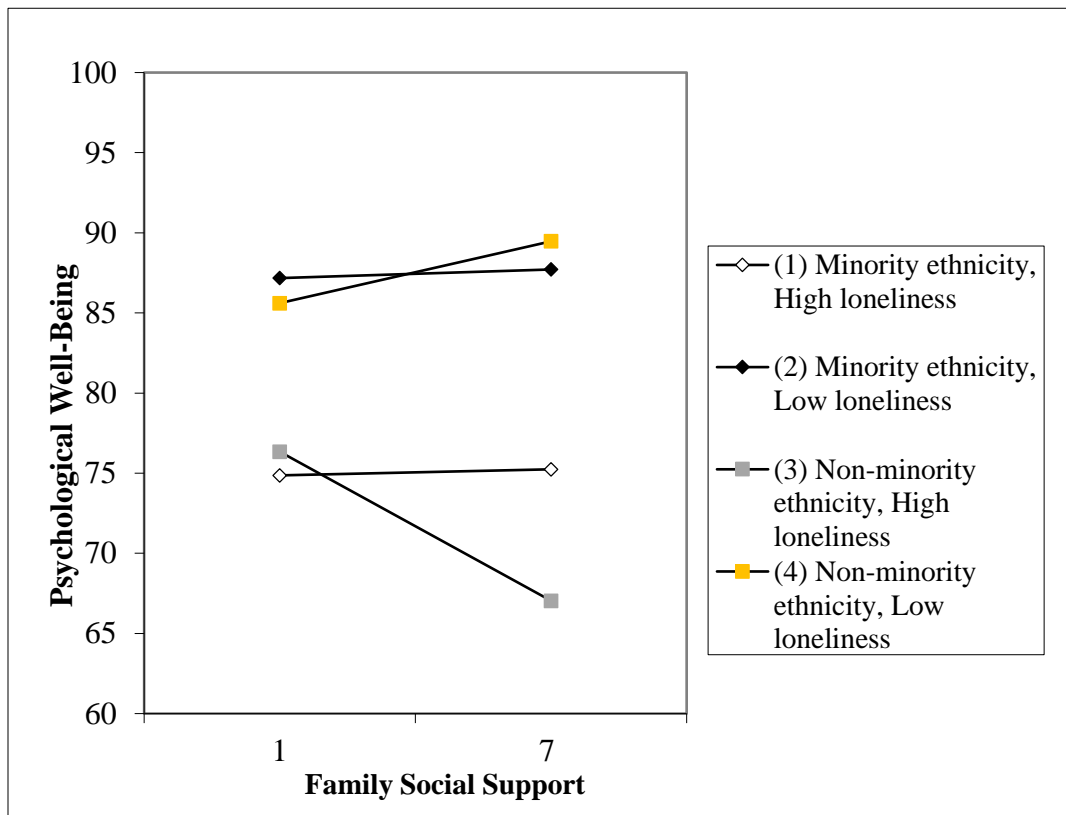
Associations between the variables were more positive for minority participants, thus hypothesis 3c was supported.

Hypothesis 3d: Family Social Support and Ethnicity as Moderators in the Associations between Loneliness and Psychological Well-being

It was hypothesized that family social support will moderate the relationship between loneliness and psychological well-being differently for ethnic minority status and non-ethnic participants, such that the associations between family social support and PWB will be positive and more pronounced for ethnic minorities who are lonely.

The 3-way interaction of ethnicity, loneliness, and family support was significant, $p < .01$. Further analysis of the ethnicity, loneliness and family support interaction revealed that in the prediction of psychological well-being by family social support, the slope for minority participants with high loneliness differed significantly from non-minority participants with high loneliness, $t(190) = 2.79, p < .01$. In cases of high loneliness, psychological well-being remained consistent for minority participants as family support increased, whereas for non minority participants psychological well-being decreased as family support increased. (Figure 5)

Figure 5. Interaction Plot of Ethnicity, Loneliness and Family Social Support



Notes: Family social support sub-scale scores range from 1-7 and psychological well-being scores ranged from 51-103 in the current sample.

Although the moderation relationship between loneliness, psychological-well being, and social support was different based on ethnic minority status, the variables were not associated in the hypothesized direction, thus hypothesis 3d was not supported.

Hypothesis 5: Minority women will have the highest level of loneliness when compared to men and non-ethnic minority women.

Group Differences Analyses

Between-group differences in study variables were investigated using independent sample t-tests. An independent samples t-test was conducted to compare loneliness scores for minority women (group 2) and non-minority women, minority men, non-minority men (group 1). There was not a statistically significant difference between the scores for loneliness for group 1 ($M = 18.39$, $SD = 4.99$) and group 2 ($M = 19.77$, $SD = 4.22$); $t(200) = 1.57$, $p = .125$. Two additional independent sample t-tests were conducted to compare loneliness scores based on gender and ethnic minority status. The gender comparison showed that there was not a statistically significant difference between the scores for men ($M = 18.09$, $SD = 4.85$) and women ($M = 19.11$, $SD = 4.88$). The comparison based on minority vs non-minority participants showed that there was not a statistically significant difference between the scores for minority participants ($M = 18.85$, $SD = 4.41$) and non-minority participants ($M = 18.30$, $SD = 5.12$). The hypothesis that minority women in the sample would experience the most loneliness was not supported.

CHAPTER 4

DISCUSSION

Women in science, technology, engineering and mathematics (STEM) face numerous barriers within their graduate program environment that contribute to feelings of stress, isolation, and lack of belongingness. The experience of loneliness and having difficulty in belonging can contribute to psychological distress. Social support from friends, family, and significant others has been shown to serve as a protective factor in the relationship between stress produced by loneliness and psychological well-being (Cohen, 2004; Cohen & Wills, 1985).

This study investigated the role of social support for STEM graduate students in the relationship between loneliness and psychological well-being using a hierarchical multiple regression (Cohen & Cohen, 2003). Global social support, defined as total perceived support from friends, family, and significant other, did not moderate the association between loneliness and psychological well-being. Family social support partially moderated the associations between loneliness and psychological well-being, such that family social support was a buffer for participants with less loneliness. Results also indicated that global social support buffering was different for minority and non-minority participants, such that global social support served as a more positive and pronounced buffer for lonely minority participants. The relationship between family social support, loneliness, and psychological well-being was different for men and women as well as for minority and non-minority participants.

The study variables were correlated in the hypothesized directions. The correlations are zero-order correlations that do not take other variables into account.

Loneliness was negatively correlated with psychological well-being. Global social support was positively correlated with psychological well-being. Family support was also positively correlated with well-being. These results suggest that higher levels of social support are associated with higher psychological well-being, while loneliness was associated with lower psychological well-being. Similar findings of the relationship between these variables have been found in numerous studies. Findings from studies on the social support buffering hypothesis show support for a positive correlation between support and psychological well-being (Cohen & Wills, 1985; Cohen, 1988; Cohen, 2004), and negative correlations between stressors and well-being (Broadhead et al., 1983; Wheaton, 1985). Loneliness specifically, has been shown to be associated with negative physical and mental health outcomes including decreased psychological well-being (Hawkey & Cacioppo, 2010). This study is one of the first to look at loneliness within one's academic program and its association with psychological well-being for subgroups of students within STEM graduate programs. Loneliness is an important construct to examine in the context of graduate student well-being given that social isolation has been associated with attrition from graduate programs (Ali & Kohun, 2007).

Global Social Support as a Moderator

Minority participant who had high loneliness and high global support had better psychological well-being than those who had high loneliness but low support. These results emphasize the importance of social support in protecting psychological well-being from loneliness. The findings of the global social support model are consistent with current literature exploring the role of social support for STEM students (London et. al, 2005; Rice et. al, 2013; Rodriguez et. al, 2003). The literature on minority student's

experience in STEM fields emphasizes the benefits of social support in a variety of ways. Espinosa (2011) found both peer group interaction and involvement in STEM-related clubs contributed to persistence for minority women. In a study of minority men in STEM, results indicated that finding a way to belong, either through clubs, organizations, or relationships, helped to establish a sense of belonging within their academic program that influenced participant's success in STEM fields (Strayhorn, 2015). Results indicated that there was no difference between men and women in the relationship between loneliness, global social support, and psychological well-being. The non significant results of the global social support model that included both gender and ethnicity in the interaction could suggest that the relationship between social support and psychological well-being are impacted more strongly by minority status than gender or the intersection of those identities. A strength of this study is that the use of multiple moderators allowed for exploration of more complex relationships among the study variables.

Family Social Support as a Moderator

In line with prior literature, the family support buffering hypothesis was supported (Corona, Campos & Chen, 2017; Crockett et. al, 2007). The analysis of differences in the buffering effect by gender and ethnicity revealed an interesting phenomenon, suggesting that gender, ethnicity and level of loneliness are important factors to consider when examining the role of family social support. For men and non-minority with high loneliness, having higher family support was related to having lower psychological well-being, suggesting that having high amounts of family support exacerbated the negative association between loneliness and psychological well-being. For lonely women, psychological well-being did not change as family support increased. While the

unexpected direction of these results do not align with prior empirical findings suggesting that increased family social support is a predictor of emotional adjustment (Hurtado, 1996), these results do highlight the complex dynamics of family support. The results also highlight the importance of considering level of loneliness for participants, as there is a differences for less lonely participants, compared to participants with high loneliness when it comes to family social support.

This finding could indicate that for lonely male and non-minority participants, higher family social support also means more family responsibilities that in turn lead to more symptoms of psychological distress. Studies on experiences of graduate students indicate that inter-role conflict can increase stress due to expectations and demands between student and family roles (Johnson, Batia, & Haun, 2008). Barth and colleagues (2016) found that in their sample of STEM majors, both men and women valued romantic relationships within their life as more important than career goals. If graduate students in STEM place greater emphasis on preserving family relationships and tending to family responsibilities, then these pressures, in combination with academic related pressures, could negatively impact psychological well-being. Future studies could investigate the relationship between family responsibilities and family social support, and differences in psychological well-being for STEM graduate students.

Increased family support and its negative relationship with psychological well-being for lonely male and non-minority participants could be related to educational expectations of the participant's family. Forty-three percent of participants had at least one parent who had a graduate degree at the masters or doctoral level. Given that a strong predictor of graduate degree completion is having parents with graduate level education,

it is important to understand what family social support looks like for individuals with parents with and without graduate level degrees. It is possible that having increased family support also comes with increased pressure to perform and higher educational expectations, from parents who already have a graduate degree. Results gleaned from a recent study on Asian graduate students in STEM programs showed qualitative evidence that many students followed similar educational and career paths as their parents and in turn often felt burdened by family pressures to succeed in their field (Le & Gardner, 2010). While data was not collected on what types of degree/occupation the participant's parents possessed, this is a potential area for future research.

Source of Support

The results did not confirm the hypothesis that family social support was the greatest source of support for minority women in the sample. The greatest source of support for minority women in the sample was from significant others. This result could be influenced by the amount of contact participants have with their families. Twenty-six percent of the sample reported having “None” or “Not Much” contact with their family. As significant others may be in closer physical proximity or have more frequent contact with students as they are progressing through their program, they may provide the most day-to-day social support for their partners.

Results indicated that significant other social support was the greatest source of support for minority women in the sample when compared to support from friends and family, based on responses to the different social support sub-scale items. While research on the role of partner support for STEM graduate students is still emerging, literature on partner support suggests that reciprocal support from a romantic partner can help offset

negative outcomes due to stress (Gleason, Lida, Bolger & Shrout, 2003). Findings suggest that women in STEM seek out partners who are supportive of their educational goals and career paths (Barth, Dunlap, & Chappetta, 2016). This finding could also be representative of a developmental shift where family support provides a distinctively different function than friends or romantic partners as students move from the undergraduate to graduate level (Farley & Davis, 1997). While this result appears to contradict the demographic results indicating that 80% of minority women self identified as “single, never married,” it could be a limitation of the relationship status response options.

Differences in Loneliness

The hypothesis that minority women would be the loneliest when compared to the rest of the study participants, was not confirmed. A test of between group differences revealed that there was no difference in loneliness between the participants in the study. When comparing loneliness for men and women in the sample, results indicated that there was no difference between the new group. These results are consistent with findings of a few studies on differences between men and women, based on samples of college students (Ilhan, 2012; Stoliker & Lafreniere, 2015). Although the hypothesis was not confirmed, future research solely investigating minority women could reveal possible within group differences based on different ethnicities.

Limitations and Future Directions

As research on minority women in STEM fields is still in the beginning stages, there are limitations when studying this unique group. Minority women in STEM graduate programs are a small population, with only 8.5% of master’s degrees and 4.5%

of doctoral degrees awarded to minority women (NSF, 2017). When research becomes more specific and focuses on studying minority women in STEM graduate programs, the possible sample size decreases significantly. As this is a small population, the majority of current research has utilized qualitative methods. The few quantitative studies featuring this population have focused on identifying gender based differences and therefore have failed to address the lack of minority women represented in the sample. Researchers conducting quantitative studies, similar to the present study, may face issues of a small sample size. Although Asian American women are not considered to be as underrepresented as other ethnic minority groups, data shows they are still underrepresented at higher levels within STEM (Ong et al., 2011) and therefore, they were included in the minority group analysis in this study. In order to avoid issues of sample size within this study, the data collected included responses for domestic and international students. While there may be similarities in the experience of international and domestic students, the results of this study may not recognize the important differences in the experience of belongingness in the programs, due to the fact that international students often experience cross cultural boundaries in their graduate socialization process (Le & Gardner, 2010). Future studies may consider investigating loneliness experienced by female international students in STEM graduate programs.

Response bias could be another limitation of this study. Given that most students reported low loneliness and higher psychological well-being scores, this could indicate that students who experience more loneliness, or psychological distress, did not complete the study. The data for this study was collected towards the middle of the academic semester for many schools, meaning that other contextual variables could have impacted

which students chose to participate in the study. Future recruitment efforts may directly target students who are seeking out resources to reduce academic or social distress such as university counseling centers and advising offices. Department emails for participant recruitment were gathered through a list of top minority producing universities. This could impact response bias as the programs at these schools could be more informed about minority retention strategies and are more aware of program environmental factors that impact minority student attrition. This data collection limitation must be taken into account when considering the representativeness of this sample.

Given the cross-sectional design of this study, it is difficult to draw inferences about how these variables interact over time and what effects each of the variables have on each other. It could be that social support is more influential or beneficial at different points in a graduate student's career. Future researchers may consider using structural equation modeling to investigate different sources of social support in a longitudinal study. A longitudinal study exploring how the amount of perceived social support from different sources changes as a student progress through his/her academic program could provide more evidence to the developmental differences of social support for the graduate student population.

There are some limitations with the scale used to measure social support. While the Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet, & Farley, 1988) has been used in numerous studies to examine the amount of perceived social support from friends, family, and significant others, the scale does not differentiate between instrumental and emotional support. Further analysis of the types of support that

students are receiving could give better insight into which forms of support are more essential in protecting psychological well-being against loneliness.

The scale options on the marital status demographic questionnaire proved to be a limitation of this study. It is possible that women who were in a romantic relationship, but not married, self-identified as “single”. In future studies that investigate the role of significant other social support, it would be beneficial to expand the relationship status response options. Another future direction would be to explore the buffering role of significant other social support within a population of minority women graduate students who have had a romantic partner throughout their time in graduate school.

Another limitation of research on minority female students is that the majority of literature on social support for ethnic minority students focuses on the undergraduate population. While undergraduate and graduate students of color experience many of the same barriers in obtaining their respective degrees, graduate women may encounter a higher level of isolation solely based on a small number of overall students enrolled in the program or engaged in a particular lab (Mattern & Redunzel, 2015). Although the scales in this study have been shown to be reliable and valid measures with undergraduate minority women, the use of scales developed for a younger sample may not be applicable to experiences of the graduate population. Also, measuring the variable of family support could prove to be insignificant for this population. While evidence shows there is a relationship between family social support for undergraduate populations, this could be different for a group of women that are more established and independent from their parents both financially and emotionally. The results of this study highlight the need to further explore developmental differences in the role of family

social support as a buffer in the relationship between loneliness and psychological well-being.

Implications for Mental Health Counseling

In efforts to support women in STEM graduate programs, mental health counselors may suggest coping resources to women experiencing stress due to feelings of not belonging. Resources such as ASU *Career*WISE offer an online psycho-education tool that has been shown to increase coping self-efficacy for graduate women in science and engineering related fields (Bernstein, Bekki, Smith, & Harrison, 2013). Encouraging students to utilize campus resources such as university counseling services, and health services is another suggestion that mental health providers can offer students to help them cope with the stress and isolation of graduate school. The literature on graduate student attrition and retention also suggests that increasing involvement in campus activities and clubs, building faculty relationships, and enhancing social support networks can be beneficial to graduate student psychological well-being (Strayhorn, 2015; Espinosa, 2011; Bolt, 2004; Lawson & Fuehrer, 1989).

Conclusion

This study contributes to the literature exploring the experience of minority women in STEM graduate programs as well as the literature on social support for this population. The results of this study suggest that social support can buffer the negative associations between stressful experiences, such as loneliness, and psychological well-being for particular populations of graduate students in STEM programs. The study highlights the evidence within recent literature that emphasizes the importance of social support networks, particularly, partner support, in a minority woman's graduate school

experience. These findings could provide a starting point in further exploring the possibility of a developmental shift where partner support becomes more influential than family or friend support once STEM students move from the undergraduate to graduate level. Research expanding on this study could further explore the gender and ethnicity differences in experiences of loneliness and social support by examining similar factors and how they change over time. Counselors and mental health professionals can also take the factors explored in this study into consideration when working with graduate students' psychological distress symptoms in response to loneliness and social isolation.

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APPENDIX A
IRB APPROVAL

EXEMPTION GRANTED

[Bianca Bernstein](#)

[CISA: Counseling and Counseling Psychology](#)

480/965-2920

bbernstein@asu.edu

Dear [Bianca Bernstein](#):

On 11/14/2016 the **Error! Hyperlink reference not valid.** reviewed the following protocol:

Type of Review:	Error! Hyperlink reference not valid.
Title:	A Study of the Relationship Between Social Support and Psychological Well-Being for STEM graduate students.
Investigator:	Bianca Bernstein
IRB ID:	STUDY00005203
Funding:	Name: Graduate Education
Grant Title:	
Grant ID:	
Documents Reviewed:	<ul style="list-style-type: none"> • Grant Application, Category: Sponsor Attachment; • GPSA research grant award email, Category: Sponsor Attachment; • study instruments , Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • script, Category: Recruitment Materials; • IRB application final, Category: IRB Protocol; • Consent final, Category: Consent Form;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 11/14/2016. In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

APPENDIX B
INFORMED CONSENT

My name is Mercedes Anderson and I am a graduate student under the direction of Dr. Bianca Bernstein in the Counseling Psychology doctoral program at Arizona State University. I am conducting a research study to explore the relationship between social support and well-being for graduate students in science, technology, engineering, and mathematics related fields. This study seeks to inform future research and practices related to the retention of graduate students in STEM fields.

I am inviting masters and doctoral level student participation, which will involve a brief online questionnaire and will take approximately 10-15 minutes to complete. To participate, you must be a masters or doctoral level student in a science, technology, engineering, or mathematics related field (you must have completed at least 9 hours of graduate level study to be eligible).

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time by exiting the survey window, there will be no penalty, for example, it will not affect your academic standing in any way or grade in any course. You must be 18 or older to participate in the study.

There are no foreseeable risks or discomforts to your participation. You will have the chance to be entered into a raffle to win one of ten \$20 Amazon gift cards upon completion of the survey. The email address that you provide in order to be entered into the raffle will be completely independent from, and unable to be linked to, your survey responses.

Your responses will be anonymous and confidential. The results of this study may be used in future reports, presentations, or publications but your name will not be used. Any results that are used will only be shared in the aggregate form.

If you have any questions concerning the research study, please contact the researchers, Mercedes Anderson at mcande13@asu.edu or Bianca L. Bernstein, Ph.D. at bbernstein@asu.edu. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

By continuing with the survey you are confirming that you are at least 18 years of age, currently a masters or doctoral level graduate student in a science, technology, engineering, or mathematics related program, have completed at least 9 credit hours of graduate coursework, and agree to be part of the study. If you wish to decline, you may do so by exiting this page on your web browser.

APPENDIX C
DEMOGRAPHIC INFORMATION

1. What is your gender?
 - Female
 - Male
 - Prefer not to disclose
2. What is your current age? _____ years old
3. What is your ethnicity
 - White/Caucasian
 - Hispanic/ Latino
 - Black/ African American
 - Native American or American Indian
 - Asian/ Pacific Islander
 - Other, please specify _____
 - Prefer not to disclose
4. Are you an international student?
 - Yes
 - No
 - If Yes, please specify your nationality
5. Mother's highest level of education
 - Some high school
 - High school diploma/ GED
 - Some College
 - Bachelor's degree
 - Graduate level degree (Master's or Doctoral)
 - Not applicable
6. Father's highest level of education
 - Some high school
 - High school diploma/ GED
 - Some College
 - Bachelor's degree
 - Graduate level degree (Master's or Doctoral)
 - Not applicable
7. Please specify your current degree program
 - Master's
 - Doctoral
 - Other _____
8. How many years of graduate school have you completed? _____
9. Please specify your program name _____
10. Please indicate the number of hours of graduate coursework you have completed so far _____
11. What is your marital status

- Single, never married
 - Married or domestic partnership
 - Widowed
 - Divorced
 - Separated
 - Would rather not say
12. What is your parent(s) household income in U.S. Dollars
- Under 10,000
 - 10,000-19,999
 - 20,000-29,999
 - 30,000-49,999
 - 50,000-74,999
 - 75,000-99,999
 - Over 100,000
 - Would rather not say
13. What is your current household income in U.S. Dollars
- Under 10,000
 - 10,000-19,999
 - 20,000-29,999
 - 30,000-49,999
 - 50,000-74,999
 - 75,000-99,999
 - Over 100,000
 - Would rather not say
14. How much contact have you had with your family within the last month
- None
 - Not much
 - Quiet a bit
 - A great deal

APPENDIX D

UCLA LONELINESS SCALE

INSTRUCTIONS: Indicate how often each of the statements below is descriptive of you in the context of your academic program.

1. I lack companionship
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way
 - N- I never feel this way
2. There is no one I can turn to
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way
 - N- I never feel this way
3. I am an outgoing person
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way
 - N- I never feel this way
4. I feel left out
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way
 - N- I never feel this way
5. I feel isolated from others
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way
 - N- I never feel this way
6. I can find companionship when I want it
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way
 - N- I never feel this way
7. I am unhappy being so withdrawn
 - O- I often feel this way
 - S- I sometimes feel this way
 - R- I rarely feel this way

- N- I never feel this way

8. People are around me but not with me

- O- I often feel this way
- S- I sometimes feel this way
- R- I rarely feel this way
- N- I never feel this way

APPENDIX E

MULTIDIMENSIONAL SCALE OF PERCEIVED SOCIAL SUPPORT

Instructions: We are interested in how you feel about the following statements. Think about the amount of social support you have received from friends, family, and significant others WITHIN THE LAST MONTH.

Read each statement carefully. Indicate how you feel about each statement. If the item is not applicable to you, please leave it blank

1. There is a special person who is around when I am in need

- 1-Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

2. There is a special person with whom I can share my joys and sorrows.

- 1- Very Strongly Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

3. My family really tries to help me

- 1- Very Strongly Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

4. I get the emotional help and support I need from my family

- 1- Very Strongly Disagree
- 2 – Strongly Disagree4
- 3- Mildly Disagree
- 4- Neutral

- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

5. I have a special person who is a real source of comfort to me.

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

6. My friend(s) really try to help me

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

7. I can count on my friend(s) when things go wrong

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

8. I can talk about my problems with my family

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

9. I have a friends with whom I can share my joys and sorrows.

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree

- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

10. There is a special person in my life who cares about my feelings.

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

11. My family is willing to help me make decisions.

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

12. I can talk about my problems with my friend(s)

- 1- Very Strong Disagree
- 2 – Strongly Disagree
- 3- Mildly Disagree
- 4- Neutral
- 5- Mildly Agree
- 6- Strongly Agree
- 7- Very Strongly Agree

APPENDIX F
GENERAL WELL-BEING SCHEDULE

1. How have you been feeling in general (*DURING THE PAST MONTH*)

- 1- In excellent spirits
- 2- In very good spirits
- 3- In good spirits mostly
- 4- I have been up and down in spirits
- 5- In low spirits mostly
- 6- In very low spirits

2. Have you been bothered by nervousness or your “nerves”? (*DURING THE PAST MONTH*)

- 1- Extremely so- to the point where I could not work or take care of things
- 2- very much so
- 3- quite a bit
- 4- some-enough to bother me
- 5- a little
- 6- not at all

3. Have you been in firm control of your behavior, thoughts, emotions OR feelings? (*DURING THE PAST MONTH*)

- 1- Yes, definitely so
- 2- Yes for the most part
- 3- Generally so
- 4- Not too well
- 5- No, and I am somewhat disturbed
- 6- No, and I am very disturbed

4. Have you felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile? (*DURING THE PAST MONTH*)

- 1- Extremely so- to the point where I could not work or take care of things
- 2- very much so
- 3- quite a bit
- 4- some-enough to bother me
- 5- a little
- 6- not at all

5. Have you been under or felt you were under any strain, stress, or pressure? (*DURING THE PAST MONTH*)

- 1- Yes- almost more than I could bear or stand

- 2- Yes- quite a bit of pressure
- 3- Yes- some- more than usual
- 4- Yes-some- but about usual
- 5- Yes- a little
- 6- Not at all

6. How happy satisfied, or pleased have you been with your personal life? *DURING THE PAST MONTH*)

- 1- Extremely happy- could not have been more satisfied or pleased
- 2- Very happy
- 3- Fairly happy
- 4- Satisfied- pleased
- 5- Somewhat dissatisfied
- 6- Very satisfied

7. Have you had any reason to wonder if you were losing your mind, or losing control over the way you act, talk, think, feel, or of your memory? (*DURING THE PAST MONTH*)

- 1- Not at all
- 2- Only a little
- 3- Some- but not enough to be concerned or worried about
- 4- Some and I have been a little concerned
- 5- Some and I am quite concerned
- 6- Yes, very much so and I am very concerned

8. Have you been anxious, worried, or upset? (*DURING THE PAST MONTH*)

- 1- Extremely so- to the point of being sick or almost sick
- 2- Very much so
- 3- Quite a bit
- 4- Some- enough to bother me
- 5- A little bit
- 6- Not at all

9. Have you been waking up fresh and rested? (*DURING THE PAST MONTH*)\

- 1- Everyday
- 2- Most everyday
- 3- fairly often
- 4- Less than half the time
- 5- Rarely

- 6-None of the time

10. Have you been bothered by any illness, bodily disorder, pains, or fears about your health? (*DURING THE PAST MONTH*)

- 1- All of the time
- 2- Most of the time
- 3- A good bit of the time
- 4-Some of the time
- 5- A little of the time
- 6- None of the time

11. Has your daily life been full of things that were interesting to you? (*DURING THE PAST MONTH*)

- 1- All of the time
- 2- Most of the time
- 3- A good bit of the time
- 4-Some of the time
- 5- A little of the time
- 6- None of the time

12. Have you felt down-hearted and blue? (*DURING THE PAST MONTH*)

- 1- All of the time
- 2- Most of the time
- 3- A good bit of the time
- 4-Some of the time
- 5- A little of the time
- 6- None of the time

13. Have you been feeling emotionally stable and sure of yourself? (*DURING THE PAST MONTH*)

- 1- All of the time
- 2- Most of the time
- 3- A good bit of the time
- 4-Some of the time
- 5- A little of the time
- 6- None of the time

14. Have you felt tired, worn out, used up, or exhausted? (*DURING THE PAST MONTH*)

- 1- All of the time
- 2- Most of the time
- 3- A good bit of the time
- 4- Some of the time
- 5- A little of the time
- 6- None of the time

For each of the four scales below, note that the words at each end of the 0 to 10 scale describe opposite feelings. Circle any number along the bar which seems closest to how you have generally felt DURING THE PAST MONTH.

15. How concerned or worried about your HEALTH have you been? (DURING THE PAST MONTH)

1	2	3	4	5	6	7	8	9	10
Not concerned at all									Very concerned

16. How RELAXED or TENSE have you been? (DURING THE PAST MONTH)

1	2	3	4	5	6	7	8	9	10
Very relaxed									Very tense

17. How much ENERGY, PEP, VITALITY have you felt? (DURING THE PAST MONTH)

1	2	3	4	5	6	7	8	9	10
No energy AT ALL, listless									Very energetic, dynamic

18. How DEPRESSED or CHEERFUL have you been? (DURING THE PAST MONTH)

1	2	3	4	5	6	7	8	9	10
Very depressed									Very cheerful

APPENDIX G

TABLE 3

Table 3

Demographic characteristics of sample

Variable	Non-minority		Minority		Total				
	Men N = 51	Women N = 68	Men N = 39	Women N = 36	N=194				
Marital Status	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Single, never married	37	72.5	49	72.1	38	97.4	29	80.6	153
Married or Domestic Partnership	12	23.5	17	25.0	1	2.6	7	19.4	37
Widowed	0	0	1	1.5	0	0	0	0	1
Divorced	1	2.0	1	1.5	0	0	0	0	2
Separated	1	2.0	0	0	0	0	0	0	1
Contact with Family	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
None	0	0	1	1.5	0	0	1	2.8	2
Not much	21	41.2	11	16.2	6	15.4	9	25.0	47
Quite a bit	19	37.3	34	50.1	16	41.0	10	27.8	79
A great deal	11	21.6	22	32.4	17	43.6	16	44.4	66
Ethnicity	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
White/European American	51	100	68	100	0	0	0	0	119
Asian/Asian American	0	0	0	0	29	74.4	23	63.9	52
Hispanic/Latino(a)	0	0	0	0	7	17.9	6	16.7	13
Other	0	0	0	0	2	5.1	2	5.6	4
Black/African American	0	0	0	0	1	2.6	5	13.9	6
Prefer not to disclose	0	0	0	0	0	0	0	0	0
Parent's Household Income	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Under \$10,000	1	2.0	1	1.5	6	15.4	8	22.2	16
\$20,000 - \$29,000	1	2.0	3	4.4	8	20.5	7	19.4	19
\$30,000 - \$49,999	5	9.8	4	5.9	6	15.4	4	11.1	19
\$50,000 - \$74,999	7	13.7	6	8.8	3	7.7	2	5.6	18
\$75,000 - \$99,999	8	15.7	10	14.7	4	10.3	4	11.1	26
< \$100,000	26	51.0	31	45.6	7	17.9	8	22.2	72
Would rather not say	3	5.9	13	19.1	5	12.8	3	8.3	24
Current Household Income	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Under \$10,000	5	9.8	4	5.9	11	28.2	7	19.4	27
\$20,000 - \$29,000	25	49.0	26	38.2	17	43.6	15	41.7	83
\$30,000 - \$49,999	11	21.6	14	20.6	7	17.9	6	16.7	38
\$50,000 - \$74,999	5	9.8	7	10.3	0	0	1	2.8	13
\$75,000 - \$99,999	1	2.0	7	10.3	1	2.6	2	5.6	11
< \$100,000	1	2.0	7	10.3	0	0	2	5.6	10
Would rather not say	3	5.9	3	4.4	3	7.7	3	8.3	12

Mother's Highest Level of Education	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Some high school	0	0	1	1.5	2	5.1	5	13.9	8
High school diploma/ GED	6	11.8	4	5.9	6	15.4	0	0	16
Some college	11	21.6	9	13.2	5	12.8	8	22.2	33
Bachelor's degree	22	43.1	28	41.2	10	25.6	13	36.1	73
Graduate level degree	12	23.5	26	38.2	16	41.0	10	27.8	64
Father's highest level of education	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Some high school	0	0	2	2.9	2	13.9	5	13.9	9
High school diploma/ GED	5	9.8	4	5.9	3	8.3	3	8.3	15
Some college	5	9.8	6	8.8	4	5.6	2	5.6	17
Bachelor's degree	21	41.2	22	32.4	15	25.0	9	25.0	67
Graduate level degree	20	39.2	34	50.0	15	47.2	17	47.2	86
Graduate Student Gender	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	
Female	0	0	68	100	0	0	36	100	104
Male	51	100	0	0	39	100	0	0	90

APPENDIX H

TABLE 4

Table 4

Mean, Standard Deviation, Range, and Cronbach's Alpha of Measures

Measure	Mean	SD	Range	Cronbach's Alpha
Loneliness	18.64	4.88	8-31	.84
PWB	79.31	11.16	51-103	.76
GSS	5.10	.90	.92-6.46	.89
FR-SS	5.56	1.0	1-7	.88
FA-SS	5.37	1.27	1-7	.87
SO-SS	5.65	1.40	1-7	.92

Note: GSS=Social Support Scale; PWB= Psychological Well-Being Scale; FR-SS=Friend Social Support Sub-Scale; FA-SS=Family Social Support Sub-Scale; SO-SS=Significant Other Social Support Sub-Scale.

APPENDIX I

TABLE 5

Table 5

Summary of Global Social Support Hierarchical Regression Analysis predicting

Psychological Well-Being

Variable	β	t	sr^2	R	R^2	ΔR^2	ΔF
Step 1				.65	.42	.	
Loneliness	-.62	-9.99***	.00				
Ethnicity	.04	.81	.41				
Gender	-.10	-1.85	.06				
GSS	.00	.03	.97				
Step 2				.65	.42	.01	6.31
Loneliness	-.62	-9.89***	.00				
Ethnicity	.03	.66	.50				
Gender	-.09	-1.71	.08				
GSS	-.00	-.02	.98				
GSS*Loneliness	.07	1.33	.18				
Step 3				.65	.43	.00	4.51
Loneliness	-.65	-8.85***	.00				
Ethnicity	.06	.626	.53				
Gender	-.10	-1.76	.08				
GSS	-.01	-.08	.93				
GSS*Loneliness	.08	1.41	.15				
Ethnicity*Loneliness	.05	.86	.38				
Step 4				.65	.43	.00	3.11
Loneliness	-.72	-7.51***	.00				

Ethnicity	.03	.59	.55				
Gender	-.09	-1.73	.08				
GSS	.01	.07	.94				
GSS*Loneliness	.08	1.49	.13				
Ethnicity*Loneliness	.06	.97	.33				
Gender*Loneliness	.09	1.07	.28				
Step 5				.66	.44	.01	2.09
Loneliness	-.77	-7.62***	.00				
Ethnicity	.03	.615	.53				
Gender	-.09	-1.67	.09				
GSS	-.09	-1.02	.30				
GSS*Loneliness	.12	1.97*	.05				
Ethnicity*Loneliness	.11	1.54	.12				
Gender *Loneliness	.09	1.13	.25				
Ethnicity* GSS	.13	1.50	.13				
Step 6				.66	.44	.00	2.07
Loneliness	-.77	-7.24***	.00				
Ethnicity	.03	.61	.54				
Gender	-.09	-1.67	.09				
GSS	-.10	-.78	.43				
GSS *Loneliness	.12	1.82	.06				
Ethnicity* Loneliness	.11	1.53	.12				
Gender * Loneliness	.09	1.04	.29				
Ethnicity*GSS	.13	1.47	.14				
Gender *SS	.01	.09	.92				

Step 7				.66	.44	.00	1.49
Loneliness	-.77	-7.25***	.00				
Ethnicity	.03	.58	.56				
Gender	-.07	-1.12	.26				
GSS	-.12	-.95	.34				
GSS*Loneliness	.04	.40	.69				
Ethnicity*Loneliness	.10	1.35	.17				
Gender *Loneliness	.10	1.05	.29				
Ethnicity* GSS	.12	1.30	.19				
Gender*SS	.01	.12	.90				
Gender*Loneliness*GSS	.10	.97	.33				

Step 8 .68 .47 .02 .006

5

Loneliness	-.73	-6.92***	.00
Ethnicity	.11	1.77	.07
Gender	-.04	-.65	.51
GSS	-.03	-.24	.80
GSS*Loneliness	-.16	-1.31	.19
Ethnicity*Loneliness	.13	1.73	.08
Gender *Loneliness	.07	.75	.45
Ethnicity*GSS	.12	1.39	.16
Gender*SS	-.05	-.46	.64
Gender*Loneliness*GSS	.21	1.94*	.05
Ethnicity*Loneliness*GSS	.24	2.90***	.00

Step 9 .68 .47 .00 1.26

Loneliness	-.73	-6.84***	.00
Ethnicity	.11	1.77	.07
Gender	-.04	-.65	.51
GSS	-.03	-.25	.80
GSS*Loneliness	-.15	-1.11	.26
Ethnicity*Loneliness	.13	1.72	.08
Gender*Loneliness	.07	.76	.44
Ethnicity*GSS	.12	1.28	.20
Gender* SS	-.05	-.44	.65
Gender*Loneliness*GSS	.20	1.58	.11
Ethnicity*Loneliness*GSS	.23	1.97*	.05
Gender*Ethnicity*Loneliness*GSS	.01	.12	.90

Note: N=190; GSS= Global Social Support; *p < .05, **p < .01, ***p< .001

APPENDIX K

TABLE 6

Table 6

Summary of Family Social Support Hierarchical Regression Analysis predicting

Psychological Well-Being

Variable	β	t	sr^2	R	R^2	ΔR^2	ΔF
Step 1				.65	.42		
Loneliness	-.62	-10.75***	.00				
Ethnicity	.05	.91	.35				
Gender	-.10	-1.85	.06				
GSS	.03	.65	.51				
Step 2				.65	.42	.00	6.77
Loneliness	-.61	-10.68***	.00				
Ethnicity	.04	.84	.40				
Gender	-.09	-1.73	.08				
FASS	.03	.56	.57				
FASS*Loneliness	.04	.75	.45				
Step 3				.65	.42	.00	4.50
Loneliness	-.64	-9.32***	.00				
Ethnicity	.04	.80	.42				
Gender	-.10	-1.78	.07				
FASS	.02	.50	.61				
FASS*Loneliness	.04	.84	.40				
Ethnicity*Loneliness	.05	.78	.43				
Step 4				.65	.43	.01	2.99
Loneliness	-.72	-7.67***	.00				

Ethnicity	.04	.74	.45				
Gender	-.09	-1.71	.08				
FASS	.04	.66	.50				
FASS*Loneliness	.06	1.04	.29				
Ethnicity*Loneliness	.06	.92	.35				
Gender*Loneliness	.10	1.22	.22				
Step 5				.66	.44	.01	2.06
Loneliness	-.75	-7.64***	.00				
Ethnicity	.04	.75	.45				
Gender	-.09	-1.68	.09				
FASS	-.05	-.62	.53				
FASS*Loneliness	.07	1.28	.20				
Ethnicity*Loneliness	.08	1.22	.22				
Gender *Loneliness	.10	1.27	.20				
Ethnicity* FASS	.12	1.52	.13				
Step 6				.66	.44	.00	2.06
Loneliness	-.75	-7.81***	.00				
Ethnicity	.04	.75	.45				
Gender	-.09	-1.66	.09				
FASS	-.05	-.40	.68				
FASS *Loneliness	.07	1.18	.23				
Ethnicity* Loneliness	.08	1.21	.22				
Gender * Loneliness	.10	1.25	.21				
Ethnicity*FASS	.12	1.50	.13				
Gender *FASS	-.00	-.02	.97				

Step 7				.67	.45	.01	.85
Loneliness	-.73	-7.56***	.00				
Ethnicity	.04	.76	.44				
Gender	-.07	-1.34	.17				
FASS	-.15	-1.14	.25				
FASS*Loneliness	-.12	-1.06	.28				
Ethnicity*Loneliness	.07	1.00	.31				
Gender *Loneliness	.09	1.16	.24				
Ethnicity* FASS	.12	1.53	.12				
Gender*FASS	.04	.43	.66				
Gender*Loneliness*FASS	.23	2.11*	.03				
Step 8				.68	.47	.02	.21
Loneliness	-.70	-7.38***	.00				
Ethnicity	.07	1.29	.19				
Gender	-.06	-1.14	.25				
FASS	-.10	-.82	.41				
FASS*Loneliness	-.28	-2.25*	.02				
Ethnicity*Loneliness	.09	1.29	.19				
Gender *Loneliness	.08	.95	.34				
Ethnicity*FASS	.10	1.26	.20				
Gender*FASS	.02	.18	.85				
Gender*Loneliness*FASS	.29	2.64***	.00				
Ethnicity*Loneliness*FASS	.20	2.70***	.00				
Step 9				.69	.47	.00	1.27
Loneliness	-.69	-7.11***	.00				

Ethnicity	.07	1.24	.21
Gender	-.06	-1.10	.27
FASS	-.11	-.87	.38
FASS*Loneliness	-.32	-2.09*	.03
Ethnicity*Loneliness	.08	1.24	.21
Gender*Loneliness	.07	.85	.39
Ethnicity*FASS	.11	1.32	.18
Gender* FASS	.02	.18	.85
Gender*Loneliness*FASS	.33	2.26*	.02
Ethnicity*Loneliness*FASS	.24	1.89*	.05
Gender*Ethnicity*Loneliness*FASS	-.05	-.41	.68

Note: N=190; FASS= Family Social Support; *p < .05, **p < .01, ***p < .001