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Women in Science, Technology, Engineering, and Mathematics (STEM) Fields: The Importance of the Need to Belong and Self-Esteem on the Intention to Leave a Job

Jung Eun Lee
San Jose State University

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WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS
(STEM) FIELDS: THE IMPORTANCE OF THE NEED TO BELONG
AND SELF-ESTEEM ON THE INTENTION TO LEAVE A JOB

A Thesis

Presented to

The Faculty of the Department of Psychology

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Jung Eun Lee

August 2013

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WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS
(STEM) FIELDS: THE IMPORTANCE OF THE NEED TO BELONG
AND SELF-ESTEEM ON THE INTENTION TO LEAVE A JOB

by

Jung Eun Lee

APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

SAN JOSÉ STATE UNIVERSITY

August 2013

Dr. Gregory J. Feist	Department of Psychology

Dr. Ronald F. Rogers	Department of Psychology

Dr. Sean Laraway	Department of Psychology

ABSTRACT

WOMEN IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) FIELDS: THE IMPORTANCE OF THE NEED TO BELONG AND SELF-ESTEEM ON THE INTENTION TO LEAVE A JOB

by Jung Eun Lee

The purpose of the study was to predict individual intentions to leave science, technology, engineering, and mathematics (STEM) field jobs. Psychological predictors were gender, the need to belong, self-esteem, perceived personal discrimination, and perceived group discrimination. We used the Amazon Mechanical Turk to recruit participants and Survey Monkey to conduct an online survey. Participants were 174 men and women who worked or studied in STEM fields. Two-step hierarchical linear regression analyses were performed to analyze the data. As a result, we found that all predictors mentioned above accounted for the variance in the intention to leave a job. Self-esteem and perceived personal discrimination were critical predictors for men in STEM fields; self-esteem and perceived group discrimination were critical predictors for women in STEM fields. For women, interestingly, the interaction effect of the need to belong and self-esteem added an additional variance in predicting the intention to leave a job. The need to belong buffered the effect of self-esteem on the intention of STEM women to leave a job. Thus, it might be that STEM women with low self-esteem are more likely to change a job if their need to belong is not fulfilled.

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Introduction

Women are still underrepresented in science, technology, engineering, and mathematics (STEM) fields (Hewlett et al., 2008; National Science Foundation [NSF], 2004, 2010). Although women constituted about 40% of those with graduate degrees and post-doctoral fellowships in science and engineering in 2006, only 27% of workers in STEM fields were women in 2007 (NSF, 2010). An unbalanced gender composition in STEM fields has been a long-standing issue in the economy and education of the United States. Not only the rate of attrition but also the absolute difference is of concern. Over 52% of women with technical jobs quit their occupations, which was double the turnover rate of men in 2007 (Hewlett et al., 2008)

To understand gender disparity, researchers have explored reasons for and solutions to the underrepresentation of women in STEM fields (U.S. Department of Commerce Economics and Statistics Administration, 2011a, 2011b). Specifically, researchers have investigated the causes for the loss in gender-balanced workforce benefits for STEM industries and attractive job opportunities for women (Costello, 2012; U.S. Congress Joint Economic Committee, 2012). The first benefit of a gender-balanced workforce for STEM industries is innovation, which is achieved by combining knowledge, experience, and skills among diverse employees (Dosi, 1982; Quintana-Garcia & Benavides-Velasco, 2008). In a previous study about gender and innovation, gender diversity of a team positively associated with innovative works because the gender diversity increased interactions between different types of competency and knowledge within a firm (Østergaard, Timmermans, & Kristinsson, 2009).

As a result of a gender-balanced workforce, potential female workers fill the shortage in the workforces of STEM fields and STEM occupations, providing economic benefits to future female workers (U.S. Congress Joint Economic Committee, 2012). First, according to the report from U.S. Congress Joint Economic Committee (2012), the U.S. education system has failed to produce STEM workers to meet the growing need of STEM industries. In 1985, 24% of bachelor's degrees were awarded in STEM majors in U.S. four-year universities; in 2009, only 18% of bachelor's degrees and 14% of master's degrees were awarded in STEM majors in U.S. four-year universities, respectively (U.S. Congress Joint Economic Committee, 2012). Second, STEM industries have suffered from a lack of trained workers, despite the positive expectation of the confident STEM job market in the future (U.S. Congress Joint Economic Committee, 2012). Specifically, while the projected employment rate in the general job market might increase by 10% from 2008 to 2018, the employment rate of STEM subdisciplines is predicted to expand by 20% to 30%, implying a significant potential for employment (Costello, 2012). In addition, average salaries of STEM workers have been higher compared to non-STEM workers, and average salaries of female STEM workers have been higher compared to female non-STEM workers in the United States.

According to Langdon, McKittrick, Beede, and Doms (2011), in 2009, women had overall median annual earnings of \$35,633 (USD) whereas some STEM women's median annual earnings ranged from \$41,091 (USD) for engineering technicians to \$71,944 (USD) for electrical engineers. Although STEM women's earnings were higher compared to the average earnings for women, STEM women's earnings were still 14%

lower than STEM men's earnings. This 14% gender gap was smaller compared to the 21% gender gap in non-STEM fields (Langdon et al., 2011). There is no doubt that the STEM industries have created abundant and compelling occupations that promise higher salaries and more opportunities compared to other industries.

Nevertheless, women who successfully navigated STEM fields and earned degrees in STEM fields often found themselves considering turnover soon after the onset of their careers in male-dominated STEM fields (Hewlett et al., 2008; NSF, 2004, 2010). This early turnover intention led us to examine individual experiences in STEM fields. The intention to leave a job has been called turnover intention, which refers to individuals' estimated probability that they would leave their organization permanently in the near future (Vandenberg & Nelson, 1999). Intention to leave a job has been repeatedly shown to be the most immediate predictor of eventual turnover behaviors in previous studies (Bluedorn, 1982; Igarria & Greenhaus, 1992; Moore, 2000). Even though some researchers argued that the intention to leave a job had a weak relationship with quitting behaviors (Steel, Shane, & Griffeth, 1990), a subsequent longitudinal study showed a significant association between the intention to leave a job and actual turnover behaviors (Sager, 1991).

Employee turnover is a major problem for organizations, as turnover is often extremely costly for the employer, particularly in occupations which offer higher education and extensive on-the-job training (Cascio, 1982). Additionally, for STEM industries, turnover of trained employee is a critical problem because turnover involves not only the loss of personnel, knowledge, and skills, but also the loss of business

opportunities (Moore & Burke, 2002). Without any doubt, STEM industries showed a higher turnover tendency compared to non-STEM industries. For example, in 2001, information technology (IT) firms lost 15% of workers while non-IT companies lost 4% of their workers (Information Technology Association of America, 2002).

Therefore, the current study investigates the psychological predictors of intention to leave a job of STEM workers to increase our understanding about STEM individuals and gender disparity in STEM fields. Our predictors are the need to belong, self-esteem, perceived personal discrimination, and perceived group discrimination. However, before reviewing the literature regarding the predictors, we review overall gender-disparity research on women's underrepresentation in math- and science-intensive fields to provide the framework for the current research.

Gender Disparity Research

Researchers from diverse academic fields and government agencies have investigated gender disparity in science, math abilities, and achievements (Ceci & Williams, 2010a, 2010b). Researchers in the psychology of science, for example, have examined gender differences in scientific thoughts, behaviors, and achievement (Feist, 2011, 2012). This literature emphasized the role of aptitude differences in math and science as well as psychological and cultural factors that influence gender differences in science and math (Feist, 2011). Feist (2012), for instance, wrote "... one of the more contentious and polemical questions in the psychology of science concerns the role that gender plays in science in general, and in scientific and mathematical abilities and

achievements in particular” (p. 62). He concluded that gender could sometimes predict mathematical and scientific behaviors and abilities.

The gender difference in cognitive development and scientific performance was one of the most argumentative topics in the study of gender disparity (Williams & Ceci, 2007). Some researchers found that men and women did not differ in innate math and science abilities (NSF, 2009). For example, both boys and girls did not begin exhibiting gender differences in math and science achievements until the eighth grade (Post-Kammer & Smith, 1985). Other researchers, however, found that boys possessed advanced math and science abilities early in life, and a greater number of boys and men were at the highest and lowest ends of cognitive and math ability distributions (Ceci & Williams, 2010a, 2010b; Harper et al., 2007). That is, compared to girls, boys are more likely to score at the lowest and highest end on standardized math tests. In summary, the proposition that the gender difference in cognitive development and math and science abilities is innate, has been argumentative. Moreover, these inconsistent findings have led to another explanation for the underrepresentation of women in STEM fields, namely preference differences.

Preference differences. Gender disparity in science and math abilities and the gender difference in career choice may stem from preference differences. Baron-Cohen (2003), for example, proposed that women were oriented more toward people, and men were oriented more toward objects. Specifically, Baron-Cohen’s idea was that women might be predisposed to learn about people and emotional interactions, whereas men might be predisposed to learn about objects and mechanical interactions.

Some indirect evidence related to this argument stems from unequal gender distributions in physical science, in which an individual studies objects, but not in social science, in which an individual studies people (Feist, 2012). Men continue to outnumber women in the physical sciences but not in the social sciences. For example, in a study of career outcomes in male and female finalists of the Westinghouse competition in math, science, and technology, both male and female finalists were equally likely to obtain bachelor and doctoral degrees (Feist, 2006). However, 69% of men pursued physical science, computer science, math, or engineering degrees, whereas only 46% of women pursued the STEM degrees (Feist, 2006). Indeed, in 1995, men and women showed unequal gender distributions in psychology, with women outnumbering men (NSF, 1999). Specifically, 73% of undergraduate psychology degrees were awarded to women in 1995 (NSF, 1999).

In fact, psychology and other social science fields are subfields of science in which math and cognitive abilities are necessary, although maybe to a lesser extent compared to the physical sciences. Also, empirical research has not fully supported the men-object and women-people preference hypothesis. For instance, girls and boys showed similar levels of interest in mathematics during their high school and undergraduate years (Long, 2001). Thus, the differences in preference appear to come later in life.

Therefore, the idea that the cultural and environmental factors influence gender disparity in math and science abilities and achievements has grown more persuasive. Researchers have suggested that gender disparity might relate to non-biological factors,

such as psychological, motivational, and environmental factors (Feist, 2012; Spelke, 2005). Spelke (2005) stated that over generalizing a few specific cognitive test results (e.g., a mental rotation test) as evidence of an outstanding engineer or mathematician was problematic. Instead, many factors, such as preferences, motivations, and success expectations, affected a decision to study physics or to become a mathematician (Spelke, 2005).

Environmental Threats: Minority Status and STEM Fields' Stereotypes

Environmental conditions affecting women's experiences in STEM fields have been underestimated (Murphy, Steele, & Gross, 2007). Male-dominated and masculine features in STEM environments might be threats to women, and women in STEM fields might have negative experiences resulting from such threats. Murphy et al. (2007) and Cheryan, Plaut, Davies, and Steele (2009) investigated the effects of women's underrepresentation and masculine stereotypes of STEM fields. They suggested that environmental features of STEM fields--like masculinity--might decrease STEM women's sense of belonging and interest in technical fields.

Murphy et al. (2007) hypothesized that women's minority status in STEM fields might have intimidated women's identity as STEM members. To test their hypothesis, they showed two different 7 min-long conference videos depicting approximately 150 people with either a ratio of 3 men to 1 woman (gender-unbalanced video) or a ratio of 1 man to 1 woman (gender-balanced video) to male and female university students. Murphy et al. collected physiological threat responses, such as a cardiac inter-beat interval and a finger pulse amplitude, while participants watched a video. They also

collected survey data, such as a sense of belonging, desire to participate in the conference, and a recall task about stereotypical objects in the experiment room, after participants watched a video.

The collected data supported the hypothesis that women's minority status was a threat to STEM women. For instance, in the gender-unbalanced conference video condition, female students showed threat responses, such as a high cardiac interbeat interval and a high finger pulse amplitude. Moreover, these female students reported lower levels of sense of belonging, lower participation desire, and more stereotypical STEM objects, such as Star Trek posters, computer programming books, computer software boxes, and computer game CD cases, compared to the female students in the gender-balanced conference video condition. Murphy et al. (2007) argued that these results to mean that women were acutely aware of their minority status and experienced threats in the gender-unbalanced condition. In the aftermath of the threatening experiences, the female students' sense of belonging and intentions to participate in the conference decreased.

In a similar vein, Cheryan et al. (2009) suggested that women's interest and sense of belonging to computer science might have decreased because of stereotypical objects, such as Star Trek posters, computer programming books, computer software boxes, and computer game CD cases, in a computer science department. Cheryan et al. showed that women in the experiment room decorated with the above listed stereotypical objects were less interested in computer science compared to women in the other experiment room decorated with non-stereotypical objects, such as nature posters and furniture. According

to Cheryan et al., these stereotypical objects worked as situation cues that alerted women to the possible psychological threat to their social identity as members of a computer science department. They found that stereotypical objects decreased STEM women's interest in joining a group in a computer science department.

Moreover, other researchers suggested that the lack of female role models might be a threat to women related to women's career decisions (Sadker & Sadker, 1994; Stout, Dasgupta, Hunsinger, & McManus, 2011). Because of the lack of female role models in STEM fields, STEM women's interest in science and mathematics might decrease. For example, high school girls intrinsically made an association between science and boys because they rarely saw female scientists in textbooks (Sadker & Sadker, 1994). Conversely, exposure to female STEM experts was likely to enhance women's self-efficacy, domain identification, and commitment to pursue STEM careers (Stout et al., 2011).

In summary, threatening STEM environments such as stereotypical features within STEM environments (e.g., Murphy et al., 2007), women's minority status (e.g., Cheryan et al., 2009), and the lack of female role models (e.g., Sadker & Sadker, 1994; Stout et al., 2011), might steer women away from entering STEM fields. These threatening environmental characteristics might push women to leave STEM jobs. Moreover, these environmental threats might relate to psychological threats that increase STEM women's intention to leave a job. That is, in these difficult circumstances, STEM women might experience a decreased sense of belonging and self-esteem along with

other psychological obstacles induced by negative stereotypes about women and women's math and science abilities.

Psychological Threats: Discrimination, Stigma, and Stereotype Threats

Women in STEM fields have experienced discrimination, stigma, and stereotype threats, all of which are examples of psychological threats (Crosby, 1982; Eccles, 1987; Fouad et al., 2010; Logel, Walton, Spencer, Iserman, & Hippel, 2009; Rosenbloom, Ash, Dupont, & Coder, 2008; Seymour, 1995; Stout et al., 2011; Walton & Cohen, 2007). We argue that these psychological threats might relate to STEM women's intention to leave a job (Birbaumer, Lezano, Ponzellini, Tolar, & Wagner, 2007; Lichtenstein et al., 2009; Seymour, 1995; Steele, James, & Barnett, 2002).

The first psychological threat that women might experience in STEM fields is gender discrimination, defined as "an unjustifiable negative behavior directed at a person on the basis of his or her sex" (Nelson, 2006, p. 199). Steele et al. (2002) found that women in STEM fields were more likely to report thinking about changing their majors because of their experiences of discrimination.

Some researchers have focused on psychological factors that could explain the reasons for which STEM women leave STEM jobs. These researchers have suggested that STEM women might experience rejections through discrimination and, as a result, recognize that their need to belong to STEM fields is not being fulfilled (Carvallo & Pelham, 2006; Crosby, 1982; Richman & Leary, 2009; Steele et al., 2002). When rejections occur in social interactions, the need to avoid emotional suffering tends to force withdrawals from these interactions (Baumeister & Leary, 1995). Also, a rejected

individual might realize that his or her belonging motivation is not being fulfilled in the social interactions (Baumeister & Leary, 1995). In the case of STEM women, women who experience discrimination might be more likely to recognize that their belonging motivation is not being fulfilled in STEM fields. Then, this unfulfilled need to belong of STEM women might help explain, at least partially, intention to leave a job (Walton & Cohen, 2007).

Richman and Leary (2009) studied individual reactions to threats linked to social acceptance and belonging. They investigated diverse forms of rejections, such as discrimination, ostracism, betrayal, and stigmatization, as well as the motivational model that explained the occurrence of different reactions in stigmatized individuals who were targets of rejections. They suggested that individuals reacted to the threats because of the motivation to be valued and accepted by other people. Additionally, Zadro, Williams, and Richardson (2004) found negative influences of ostracism on belonging motivation. In their experimental study, they simulated incidents of ostracism in the online computer game called Cyberball, an analogue of a ball-tossing game with a computer player (Williams, Cheung, & Choi, 2000). Participants who experienced ostracism by a computerized player reported lower levels of belonging motivation compared to non-ostracized participants. Both abovementioned studies reported relatively strong associations among rejection experiences, psychological threats experiences, and the need to belong.

The next psychological threat that STEM women may experience is stigma, which is defined as an attribute that extensively discredits an individual, reducing him or

her “from a whole and usual person to a tainted, discounted one” (Goffman, 1963, p. 3). We argue that the stigma that STEM women experience might relate to the changes in self-esteem (Crocker & Major, 1989; Eccleston & Major, 2006; Major, Kaiser, McCoy, 2003; Major, Quinton, & Schmader, 2003; Schmitt & Branscombe, 2002). Our reasoning starts with the findings that STEM women’s stigma is based on the stereotype that women have lower levels of abilities in math and science compared to men. This stigmatization might lead women to feel devalued as group members in STEM fields, which can result in decreased self-esteem (Crocker & Major, 1989; Eccleston & Major, 2006; Major, Kaiser et al., 2003; Major, Quinton et al., 2003; Schmitt & Branscombe, 2002).

Subsequently, math and science inability stereotype of STEM women is also linked to a phenomenon called a stereotype threat. A stereotype threat refers to a social psychological predicament that evolves from a negative stereotype, which negatively affects performance (Steele & Aronson, 1995). A stereotype threat is an example of psychological threat that STEM women might experience. Some researchers have found that women’s math and science performances decrease because of a stereotype threat when they are being evaluated (Logel et al., 2009; Mendoza-Denton, Shaw-Taylor, Chen & Chang, 2009; Steele & Aronson, 1995; Stoet & Geary, 2012).

Applied to math abilities, women’s math performance decreases when a math test is described as a diagnostic intelligence test or when the test is taken with male participants. Women’s math performance decreases because women are well aware of the gender stereotype that women have lower ability in math compared to men. That is,

if women perform poorly on a math test, they may fear that others would attribute their poor performance to their gender. This fear is a source of a stereotype threat which relate to decreases in math performance. Many researchers have consistently reported the negative effect of a stereotype threat on women's math and science performances (e.g., Derks, Inzlicht, & Kang, 2008; Jones et al., 1984). STEM women's math and science performance might decline in the presence of a stereotype threat, and poor performances might result in decreased self-esteem (Logel et al., 2009; Mendoza-Denton et al., 2009; Steele & Aronson, 1995; Stoet & Geary, 2012). Therefore, we suggest that STEM women's unfulfilled need to belong and decreased self-esteem might predict the intention to leave a job.

In summary, we reviewed literature about environmental threats, such as stereotypes of STEM fields (Murphy et al., 2007), women's minority status (Cheryan et al., 2009), the lack of role models (Sadker & Sadker, 1994; Stout et al., 2011), and their negative influences on the need to belong and self-esteem of STEM women. In addition, we reviewed literature on psychological threats, such as discrimination, stigma, and stereotype threats, and their negative influences on the need to belong (Carvallo & Pelham, 2006; Richman and Leary, 2009; Steele et al., 2002; Walton & Cohen, 2007) and self-esteem (Crocker & Major, 1989; Eccleston & Major, 2006; Major, Kaiser et al., 2003; Major, Quinton et al., 2003; Schmitt & Branscombe, 2002).

The Need to Belong

The need to belong is a significant predictor of women's intention to leave STEM jobs, and it has been emphasized as an important factor of success and retention in STEM

fields (Dasgupta, 2011; Good, Rattan, & Dweck, 2012; Inzlicht & Good, 2006; Walton & Cohen, 2011). The need to belong is the motivation to have positive, constant, and meaningful interactions and relationships with other people (Baumeister & Leary, 1995). It has many names: the need to belong, belongingness motivation, the motive to be accepted by others, and the desire to be relationally valued among others (Leary & Allen, 2011). People ask themselves “do I belong?” in deciding whether to enter, continue, or abandon relationships (Walton & Cohen, 2007). For socially stigmatized individuals, certainly, this question may be visited and revisited (Walton & Cohen, 2007). Strong reactions may occur when others threaten his or her need to belong through rejection, ostracism, stigmatization, and other signs, which indicate that others do not have interest in building relationships (Leary & Allen, 2011). Moreover, individuals who belong to disadvantaged groups find themselves in situations where their abilities are in doubt, for instance, in high-stakes academic or professional environments, the need to belong is likely to play an important role (Dasgupta, 2011).

The need to belong might influence behaviors and career choices (Baumeister & Leary, 1995; MacDonald & Leary, 2005). For example, Richman, vanDellen, and Wood (2011) argued that the need to belong was an important indicator of prosperous careers among female professors who successfully pursued their STEM careers. They also reported that positive experiences with female role models, family support, and social support had a strong association with the need to belong. Moreover, Carvallo and Pelham (2006) found that women had a tendency to minimize the extent of personal discrimination experiences because of desire to fulfill the need to belong in relationships

(e.g., Crosby, 1982; Quinn, Roese, Pennington, & Olson, 1999). Carvallo and Pelham explained this finding by the fact that people might fail to appreciate the degree to which they have been the victims of discrimination because acknowledging discrimination represented a threat to people's need to belong.

Additional supporting evidence about the need to belong and other psychological factors comes from previous studies on the experiences of racially discriminated individuals. For instance, Walton and Cohen (2007, 2011) examined the significance of belonging in a study of African-American students who were stigmatized in academic fields. Walton and Cohen (2007) found that racially stigmatized students who experienced the lack of social connections in a computer science department also experienced decreased feeling of belonging. In their consequent study, Walton and Cohen (2011) showed the positive effect of a brief social-belonging intervention conducted with African-American students. Minority students who suffered constantly from unfulfilled belonging in academic settings and experienced constant exposure to negative stereotypes, reported improved academic and health outcomes after receiving a brief social-belonging intervention. Walton and Cohen found that the social-belonging intervention effectively fulfilled minority individuals' need to belong and enhanced overall well-being in threatening environments.

Therefore, we hypothesize that the need to belong of STEM women to STEM fields might be insufficiently fulfilled because of environmental threats (Cheryan et al., 2009; Murphy et al., 2007) and psychological threats (Crosby, 1982; Eccles, 1987; Fouad et al., 2010; Logel et al., 2009; Rosenbloom et al., 2008; Seymour, 1995; Stout et al.,

2011; Walton & Cohen, 2007). We also hypothesize that the unfulfilled need to belong might relate to the intention to leave a job (Richman et al., 2011; Steele et al., 2002; Stout et al., 2011). In detail, we predict that STEM women might report higher levels of the need to belong compared to STEM men because their need to belong to STEM fields might not be fulfilled. When the need to belong is not fulfilled (i.e., when someone is rejected), levels of the need to belong increase, and when the need to belong is fulfilled (i.e., when someone is accepted), levels of the need to belong decrease (Baumeister & Leary, 1995; Carvallo & Pelham, 2006).

In addition, we examine how personal and group discrimination relate to the need to belong and the intention to leave a job (Carvallo & Pelham, 2006; Crosby, 1982; Quinn et al., 1999). For instance, Carvallo and Pelham (2006) showed that participants who reported a high need to belong (unsatisfied) reported a decrease in personal discrimination but an increase in group discrimination. This phenomenon has been called the personal-group discrimination discrepancy (Carvallo & Pelham, 2006; Taylor, Wright, Moghaddam, & Lalonde, 1990). The discrepancy between personal and group discrimination occurs when stigmatized group members minimize the extent to which they have personally experienced discrimination and maximize the extent to which they have suffered group discrimination as members of minority groups, such as a group of females, African-Americans, disabled persons, or immigrants (Taylor et al., 1990). Taylor et al. (1990) found that participants who reported low levels of the need to belong (satisfaction) report increases in personal discrimination but decreases in group discrimination. This result implies that an individual who could not fulfill his or her need

to belong might want to be accepted by others and report an increased desire to belong. Then, he or she might report high group discrimination but low personal discrimination.

Therefore, we predicted that STEM women would report higher levels of the need to belong than would STEM men. We also expected STEM women to report high levels of group discrimination but low levels of personal discrimination along with a high need to belong because they might have a strong desire to be accepted by other STEM individuals.

Self-Esteem

Self-esteem refers to a feeling of personal self-worth (Crocker & Major, 1989). Self-esteem has been one of the most studied individual characteristics in personality psychology over the past several decades (Baumeister, 1999). Low self-esteem is associated with a broad assortment of personal and social problems; high self-esteem is associated with dramatic improvements in many aspects of human life (Baumeister, 1999). In fact, previous researchers found that individuals with high self-esteem had a greater persistence in spite of failure, suggesting that self-esteem facilitated resilience (Shrauger & Rosenberg, 1970). Additionally, self-esteem correlated with job satisfactions (Greenhaus & Badin, 1974). However, individuals with low self-esteem were vulnerable to the psychological effects indicated by mood swings and affective reactions, which related to psychological problems, unemployment, and maladaptive behaviors (Campbell, Chew, & Scratchley, 1991; Silverston, 1991; Waters & Moore, 2002).

In the current research, we investigate self-esteem of STEM women and its relationship with other factors in predicting the intentions to leave a job. According to the previous research, STEM women might experience changes in self-esteem because of discrimination, stigma, and stereotype threats (Crocker & Major, 1989; Eccleston & Major, 2006; Major, Kaiser et al., 2003; Major, Quinton et al., 2003; Schmitt & Branscombe, 2002). Moreover, self-esteem was related to turnover intentions, job satisfaction, organizational commitment, motivation, and performances (Pierce & Gardner, 2004). Similarly, Gardner and Pierce (2001) found a negative relationship between self-esteem and turnover intentions. Specifically, employees who believed that their companies view them as important had a tendency to report low levels of turnover intentions.

Thus, we hypothesize that the changes in self-esteem among STEM women might relate to the intention to leave a job. In terms of the direction for self-esteem, two patterns emerged. Some researchers found that STEM women had higher self-esteem than did STEM men (Carvallo & Pelham, 2006; Crocker & Major, 1989; Hoyt, Aguilar, Kaiser, Blascovich, & Lee, 2007; Major, Kaiser et al., 2003; Sechrist & Delmar, 2009), while others reported that STEM women had lower self-esteem than did STEM men (Anthony, Wood, & Homes, 2007; Leary & Allen, 2011; Leary & Baumeister, 2000; Leary, Tambor, Terdal, & Downs, 1995).

Some researchers suggest that stigmatized individuals might have higher self-esteem compared to non-stigmatized individuals because they attribute the negative feedback about their performance to others' prejudiced attitude against them (Carvallo &

Pelham, 2006; Crocker & Major, 1989; Hoyt et al., 2007; Major, Kaiser et al., 2003; Sechrist & Delmar, 2009). For example, women who blamed others for prejudice often had higher self-esteem compared to women who did not blame others (Major, Kaiser et al., 2003). Similarly, Carvallo and Pelham (2006) found that women participants often made prejudiced attributions when they tried to protect their own self-esteem from their counterparts' negative feedback.

According to this perspective, self-esteem of STEM women would be high because women might try to attribute negative feedbacks and poor performances to gender discrimination (e.g., Crocker, Voelkl, Testa, & Major, 1991; Major, Kaiser et al., 2003). Even though self-esteem may have a protective effect and allow STEM women to have higher self-esteem than do STEM men, some theorists argue that STEM women may have lower self-esteem than do STEM men.

The Need to Belong and Self-Esteem Interaction

Researchers who proposed the sociometer theory of self-esteem suggested that STEM women might have lower self-esteem compared to STEM men (Anthony et al., 2007; Leary & Allen, 2011; Leary & Baumeister, 2000; Leary et al., 1995). In the sociometer theory, self-esteem works as a subjective monitor to support the individual's relational evaluation—the degree to which other people regard their relationships with the individual to be valuable, important, or close (Leary & Baumeister, 2000). That is, self-esteem monitors the quality of interpersonal relationships and motivates behaviors that help the person maintain a minimum level of acceptance by other people (Leary & Downs, 1995). Leary and Baumeister (2000) explained that “high self-esteem reflected

the perception that an individual was a valued person for groups and close relationships, whereas low self-esteem reflected the perception that his or her eligibility for social inclusion was low” (p. 9).

According to the sociometer theory, when an individual fulfills his or her belonging motivation, self-esteem increases; when an individual does not fulfill his or her belonging motivation, self-esteem decreases. Furthermore, individuals with high self-esteem feel that they are being valued by others, while individuals with low self-esteem doubt their relational value in current and in future relationships (Anthony et al., 2007; Leary et al., 1995). Anthony et al. (2007), for example, tested the sociometer theory’s assumption that low self-esteem might be due to an unfulfilled need to belong. They compared women with high self-esteem and women with low-self esteem in two different social acceptance conditions (an obvious-acceptance condition and an ambiguous-acceptance condition). They found significant correlations between self-esteem and acceptance conditions. Women with low self-esteem were interested in joining the obvious-acceptance group. However, women with high self-esteem did not show preferences regarding the group they intended to join. They were less likely to consider how others treated women compared to women with low self-esteem (Anthony et al., 2007). According to the sociometer theory, self-esteem of STEM women would be low because of an unfulfilled need to belong, and their need to belong would be high because it would be unfulfilled (e.g., Carvallo & Pelham, 2006).

In summary, two different perspectives emerged regarding self-esteem of STEM women. The first finding indicated that women might have high self-esteem compared to

men because women tried to protect their self-esteem while attributing others' negative feedback to group discrimination against women (e.g., Crocker et al., 1991; Major et al., 2003). The second finding was that women might report lower self-esteem compared to men because women have not been valued or desired in STEM fields (Anthony et al., 2007; Leary & Allen, 2011; Leary & Baumeister, 2000; Leary et al., 1995).

Hypotheses

Based on the previous reasoning and findings, we made the following predictions:

1. Gender, the need to belong, self-esteem, personal discrimination, and group discrimination will explain the variance in the intention to leave a job for both male and female STEM workers.
  - 1a. For STEM women, the need to belong, self-esteem, personal discrimination, and group discrimination will explain the variance of their intention to leave a job.
  - 1b. For STEM men, the need to belong and self-esteem will explain the variance of their intention to leave a job.
2. The interaction between the need to belong and self-esteem of STEM women will explain an additional variance in their intention to leave a job over and above the need to belong, self-esteem, personal discrimination, and group discrimination alone.

Method

Participants

Sampling procedure. We used purposive sampling as a type of nonprobability sampling to recruit the predefined participant group that was hard to address by random sampling. The predefined participants in this research were men and women who work

or study in STEM fields. To reach this specific population, we used the Amazon Mechanical Turk.

Amazon mechanical turk (MTurk). The MTurk (www.mturk.com) boasts a large, diverse workforce consisting of over 100,000 users from over 100 countries who complete tens of thousands of tasks daily (Pontin, 2007). A requester creates a Human Intelligence Task (HIT). Then, a worker selects an available HIT and completes the HIT using a computer or the Internet (i.e., surveys, experiments, writings, etc.). Some HITs are basic templates, technical scripts, psychological experiments, translations, or external online surveys (e.g., Survey Monkey). A worker gets a short description about a HIT in a list (see Appendix A). In addition, a worker gets detailed information on the web page that is linked to the list through the title of the HIT (see Appendix B). A worker reviews an updated HIT list at his or her convenience and participates in a task of interest. Burmester, Kwant, and Gosling (2011) reported that MTurk data met an acceptable psychometric reliability standard.

A potential participant moves to an informed consent page on the Survey Monkey web page (www.surveymonkey.com). When he or she agrees with the informed consent, a screening procedure begins (see Appendix C). We used a few screening questions to select STEM scientists and engineers and to avoid a possible deception about fields of work or study reported by potential participants (see Appendix D). For example, potential participants were not told that target participants were STEM scientists and engineers. Instead, they were asked to select their field from an occupation list. Only a potential participant who selected the STEM field was allowed to proceed to the

following questionnaires. Anyone who selected the non-STEM occupation was directed away from the survey. We used the standard occupational classification by the U.S. Department of Labor to build the list of STEM occupations in the screening question (U.S. Department of Labor, 2010; see Appendix E). The qualified occupations were computer and mathematics, architecture, engineering, life science, and physical science. The other screening questions were age (that a worker was over 18 years old), and English (that a worker used English as the first or second language). Finally, among the 711 MTurk workers who clicked the survey link and started the recruiting process, only 174 participants selected STEM jobs and were able to complete the screening procedure and the online survey (see Appendix F). We collected data for two weeks.

Participant characteristics. Participants were 120 STEM men and 54 STEM women. The demographic characteristics are presented in Table 1. The average male respondent was a 29.78-year-old STEM employee (or self-employed) or STEM student. About 48% of males lived in North America and about 49% of males lived in South Asia. The average female respondent was a 29.84-year-old STEM employee (or self-employed) or STEM student. About 52% of females lived in North America and about 45% of females lived in South Asia or East Asia.

Table 1

Demographic Characteristics

	Male <i>N</i> = 120		Female <i>N</i> = 54	
	<i>N</i>	(%)	<i>N</i>	(%)
Job Status				
Employed	53	(44.2)	24	(44.4)
Self-Employed	20	(16.7)	8	(14.8)

Out of Work > 1Year	1	(0.8)	2	(3.7)
Out of Work < 1Year	2	(1.7)	4	(7.4)
Graduate Student	20	(16.7)	7	(13.0)
College & University Student	24	(20.0)	9	(16.7)
Fields of Work or Study				
Computer & Mathematics	51	(42.5)	25	(46.3)
Architecture	3	(2.5)	0	-
Engineering	51	(42.5)	15	(27.8)
Life Science	8	(6.7)	9	(16.7)
Physical Science	7	(5.8)	5	(9.3)
Work History				
Less than 1year	10	(8.3)	4	(7.4)
1 year	12	(10.0)	5	(9.3)
2 years	11	(9.2)	7	(13.0)
3 years	13	(10.8)	0	-
4 years	16	(13.3)	9	(16.7)
5 years	14	(11.7)	10	(18.5)
6 years	5	(4.2)	3	(5.6)
7 years	6	(5.0)	1	(1.9)
8 years	8	(6.7)	1	(1.9)
9 years	2	(1.7)	3	(5.6)
10 years	4	(3.3)	0	-
More than 10 years	19	(15.8)	11	(20.4)
Education				
Grade school or Less	1	(0.8)	0	-
High school or GED	6	(5.0)	2	(3.7)
College or Associate Degree	20	(16.7)	10	(18.5)
Bachelor	63	(52.5)	26	(48.1)
Master	30	(25.5)	14	(25.9)
Doctoral	0	-	2	(3.7)
Language (English is)				
First language	74	(61.7)	35	(64.8)
Second language	46	(38.3)	19	(35.2)
Location				
North America	55	(45.8)	28	(51.9)
South America	1	(0.8)	1	(1.9)
East Asia	2	(1.7)	3	(5.6)
South Asia	59	(49.2)	21	(38.9)
Europe	2	(1.7)	1	(1.9)
Middle East	1	(0.8)	0	-

Ethnicity				
American Indian or Alaskan Native	3	(2.5)	0	-
Asian or Asian American	66	(55.0)	31	(57.4)
Black or African American	1	(0.8)	1	(1.9)
Hispanic or Latino	1	(0.8)	5	(9.3)
White or European American	42	(35.0)	15	(27.8)
Other	7	(5.8)	2	(3.7)
Relationship Status				
Single	70	(58.3)	19	(35.2)
Married	39	(32.5)	26	(48.1)
Divorced, Separated, or Widowed	1	(0.8)	1	(1.9)
Engaged	3	(2.5)	3	(5.6)
Cohabiting	7	(5.8)	5	(9.3)

Note. - = No data available, Listwise option used for analyses.

Measures

The need to belong. We measured a belonging motivation with the revised 10-item scale, The Need to Belong Scale (NTB; Leary, Kelly, Cottrell, & Schreindorfer, 2007; see Appendix G). This revised scale includes 10 items, such as “If other people don’t seem to accept me, I don’t let it bother me,” and “My feelings are easily hurt when I feel that others do not accept me.” Items were measured on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*). An item expressing a low level of the need to belong was reverse scored so that higher scores reflected a higher level of the need to belong. The high level of need to belong represents an unfulfilled belonging.

The Need to Belong Scale’s inter-item reliability was high in this research, $\alpha = .80$. The result is consistent with previous results. For example, Cronbach’s alphas generally exceed .80 (Kelly, 1999; Leary, 1997; Leary & Cottrell, 2001). In addition, other researchers have used this scale in their studies (e.g., Carvallo & Pelham, 2006; De

Cremer & Leonardelli, 2003; Pickett, Gardner, & Knowles, 2004; Walker, Green, Richardson, & Hubertz, 1996). According to Leary et al. (2007), discriminant validity of the Need to Belong Scale was seen in its relationship to similar but different constructs, affiliation tendencies (i.e., affiliation motivation, sociability, extraversion). Specifically, Leary et al. found that statistically significant but relatively low correlations between the Need to Belong Scale with Need for Affiliation, $r = .26, p < .01$ (Jackson, 1967), Sociability, $r = .32, p < .001$ (Cheek & Buss, 1981), and Extraversion of NEO-FFI, $r = .16, p < .05$ (Costa & McCrae, 1992).

Self-esteem. We measured self-esteem using the Rosenberg Self-Esteem Scale (Rosenberg, 1965; see Appendix H). This scale included 10 items, such as “On the whole, I am satisfied with myself,” and “I take a positive attitude toward myself.” Items were measured on a 4-point scale (1 = *disagree* to 4 = *strongly agree*). Rosenberg (1965) reported an acceptable internal consistency, $\alpha = .80$. We also found a similar high internal consistency, $\alpha = .83$.

Moreover, the test-retest reliability for the two-week interval of the Rosenberg Self-Esteem was .85, whereas the seven-month interval between the two testing periods was .63 (Silber & Tippet, 1965; Shorkey & Whiteman, 1978). Crandall (1973) found the significant convergent and discriminant validity with Coopersmith’s Self-Esteem Inventory (Coopersmith, 1967).

Self-reported discrimination. We measured a self-reported discrimination using the 4-item Perceptions of Personal Discrimination (PPD) and the 4-item Perceptions of Group Discrimination (PGD; Carvallo & Pelham, 2006; see Appendix I). Participants

answered on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*). Carvallo and Pelham modified the Perceived Discrimination Scale by Sechrist, Swim, and Mark (2003) which included both PPD and PGD scales to assess the discrepancy between personal and group discrimination. The personal-group discrimination discrepancy theory suggests that a stigmatized group member might minimize the extent to which he or she has personally experienced discrimination (Taylor et al., 1990). This minimizing tendency of personal discrimination has been replicated in many studies (e.g., Carvallo & Pelham, 2006; Crosby, 1982; Quinn et al., 1999). Thus, we also used both PPD and PGD scales to avoid possible misinterpretations about discrimination experiences of STEM individuals.

Example items of the PPD included “Prejudice against my gender group has affected me personally,” and “I have personally experienced gender discrimination.” The example items of the PGD included “Prejudice against my gender group has affected the average female (male),” and “The average female (male) has experienced gender discrimination.” In our study, PPD’s internal reliability was high, $\alpha = .95$, and PGD’s internal reliability was also high, $\alpha = .97$. In another study, internal reliabilities of PPD and PGD were high with both having α of .92 (Carvallo & Pelham, 2006).

The intention to leave a job. We measured the intention to leave a STEM job using the Staying-or-Leaving Index (SLI; Bluedorn, 1982; see Appendix J). Original items of the SLI were modified to accommodate the purpose of the present research. The SLI consisted of two sets of four questions each. The first set asked about the likelihood of still working or studying in the field in which a participant worked or studied over

various time spans (e.g., 3 months from now, 6 months from now, 1 year from now, and 2 years from now). The first set of SLI followed the screening question asking about a participant's current field of work or study. When a participant selected a STEM job, he or she proceeded to answer the first set of SLI. The other four questions asked about the likelihood of quitting the STEM job or study during the above four different time spans. Example questions included "How do you rate your chances of still working or studying in the field you just answered," and "How would you rate your chances of quitting the current field's job or study in the next three months?" A participant rated his or her chances of leaving on a 7-point scale (1 = *Terrible* to 7 = *Excellent*).

The four questions were reverse-scored before all eight questions were summed to produce the SLI score. Higher scores indicated a greater intention to leave STEM fields' job or study. The SLI's internal reliability was high, $\alpha = .87$, in the current study. Bluedorn (1982) found high reliabilities in five different samples, ranging from $\alpha = .87$ to $\alpha = .95$. He also found convergent validity with other similar measures ranging from $r = .48$ to $r = .91$.

Background information. Information regarding a participant's age, gender, education, ethnicity, physical location, marital status, occupation or major, years in the current job or the current STEM major, and a general job (or major) satisfaction were collected to understand the demographic background of participants (see Appendix K).

Procedure

An MTurk worker began the study by reading a short description of the present research in the list of available HITs and the detailed description page. The detailed

description included participation requirements, screening processes, the possibility of disqualification, the instruction for completing the online survey, and compensation. Participation depended on an MTurk worker's voluntary decision. When an MTurk worker clicked the survey link, a new window opened with the informed consent on the Survey Monkey website. Then, a potential participant needed to answer a few screening questions after the informed consent. When a potential participant passed all screening questions, he or she proceeded to respond to the subsequent survey questions until the completion of the survey. If a potential participant failed to pass the screening process, he or she would reach the disqualifying page that provided the reason for terminating the current survey. No monetary compensation was given to a potential participant who failed the screening process.

A participant completed the online survey in approximately 10-15 min. A participant could quit the survey anytime. A 'quit' button appeared on top of each survey page. A participant completed the online survey in the following topic order: the Staying-or-Leaving Index (Set 1), The Need to Belong, the Rosenberg Self-Esteem, Perceptions of Personal Discrimination, Perceptions of Group Discrimination, The Staying-or-Leaving Index (Set 2), and Demographic Questionnaire. At the end of the online survey, a participant was asked to create a five-digit code consisting of five different numbers to receive compensation (e.g., 45368). Then, a participant returned to the MTurk website and reported the code. The final step was pressing the 'submit' button. A participant who successfully completed the entire processes received a monetary compensation of the \$ 0.50 (USD) one week after they completed the survey.

At the end of the survey, the email address of the researcher was provided with a thank you message. A group-level result was shared with participants who sent a request email within approximately two months of completing the survey.

Results

The primary goal of this study was to predict the intention to leave a job by considering five predictors (i.e., gender, the need to belong, self-esteem, personal discrimination, and group discrimination). The second goal was to investigate an interaction effect of the need to belong and self-esteem on the intention to leave a job. To achieve these goals, we performed a series of hierarchical linear regression analyses.

Descriptive Statistics

Table 2 shows means and standard deviations for all non-demographic variables.

Table 3 shows Pearson correlation coefficients.

Table 2

Means and Standard Deviations in Males and Females

	All	Male	Female
	<i>N</i> = 155	<i>N</i> = 106	<i>N</i> = 49
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
The Intention to Leave a Job	20.68 (9.03)	21.14 (9.53)	19.69 (7.84)
The Need To Belong	31.16 (6.72)	30.76 (6.76)	32.02 (6.63)
Self –Esteem	19.85 (4.75)	19.72 (4.72)	20.12 (4.85)
Personal Discrimination	12.70 (6.72)	11.25 (6.04)	15.86 (7.09)
Group Discrimination	15.33 (6.85)	12.99 (6.20)	20.39 (5.33)

We found that STEM women's intention to leave a job was negatively related to their self-esteem, $r = -.39, p < .01$, and to group discrimination, $r = -.39, p < .01$. For STEM men, the intention to leave a job was negatively related to their self-esteem, $r = -.46, p < .01$, positively related to personal discrimination, $r = .52, p < .01$, and positively related to group discrimination, $r = .41, p < .01$.

Table 3

Pearson Correlation Coefficients in Males and Females

Male / Female	Intention to Leave a Job	The Need to Belong	Self- Esteem	Personal Discrimi- nation	Group Discrimi- nation	Interaction
Intention to Leave a Job	-	.18	-.46**	.52**	.41**	-.24*
The Need to Belong	<u>.01</u>	-	-.24*	.08	-.04	.64**
Self- Esteem	<u>-.39**</u>	<u>-.08</u>	-	-.40**	-.29**	.58**
Personal Discrimi- nation	<u>.02</u>	<u>-.31*</u>	<u>-.22</u>	-	.74**	-.26**
Group Discrimi- nation	<u>-.39**</u>	<u>-.23</u>	<u>.03</u>	<u>.40**</u>	-	-.27**
Interaction	<u>-.30*</u>	<u>-.68**</u>	<u>.67**</u>	<u>-.39**</u>	<u>-.16</u>	-

Note. Correlations of STEM male, $N = 106$, presented above the diagonal, and of STEM female, $N = 49$, presented below the diagonal. Interaction = The Need to Belong by Self-Esteem.

* $p < .05$. ** $p < .01$. *** $p < .001$., two-tailed.

Planned Analyses

All sample regression statistics. We hypothesized that gender, the need to belong, self-esteem, personal discrimination, and group discrimination would predict the individual intention to leave a STEM job. To test the hypothesis, we performed a series

of hierarchical linear regression analyses. In the first step of the regression analysis, we added five predictors: gender, the need to belong, self-esteem, personal discrimination, and group discrimination. In the second step, we added an interaction of the need to belong and self-esteem to examine whether the interaction term explained a significant amount of the variance in the intention to leave a job over and above the predictors in the first step.

In support of Hypothesis 1, we found that all five predictors showed a statistically significant main effect in predicting the intention to leave a job. The five predictors together accounted for 26% of the intention to leave a job, $F(5, 150) = 10.34, p < .001$ (see Table 4).

Table 4

All Participants Hierarchical Linear Regression Coefficients

Predictors	β		p
	Step 1	Step 2	
Gender	-.15		.07
Need to Belong	.08		.27
Self-Esteem	-.34		< .001
Personal Discrimination	.27		.01
Group Discrimination	-.01		.94
Need to Belong × Self-Esteem		-.91	.06
R^2	.26	.28	
ΔR^2		.02	
F	10.34 ^{***}	9.40 ^{***}	.

Note. Dependent Variable: The intention to leave a job, $N = 154$.

* $p < .05$. ** $p < .01$. *** $p < .001$., two-tailed.

Specifically, self-esteem, $\beta = -0.34$, $p < .001$, and personal discrimination, $\beta = 0.27$, $p = .01$, contributed significantly to the intention to leave a job with all samples. However, the interaction of the need to belong and self-esteem in the entire sample did not contribute significantly to the intention to leave a job. Gender, the need to belong, self-esteem, personal discrimination, group discrimination, and the interaction term together accounted for 28% of the intention to leave a job, $F(6, 149) = 9.40$, $p < .001$.

Female regression statistics. The hypothesis 1a was that STEM women's need to belong, self-esteem, personal discrimination, and group discrimination would predict their intention to leave a job. In the hypothesis 2, we hypothesized that the interaction between STEM women's self-esteem and need to belong would explain an additional variance in their intention to leave a job. To test these hypotheses, we conducted a hierarchical linear regression analysis with STEM women's data (see Table 5). We added STEM women's need to belong, self-esteem, personal discrimination, and group discrimination in the first step to hold them constant and the need to belong and self-esteem interaction in the second step.

As a result, we found that need to belong, self-esteem, personal discrimination, and group discrimination of STEM women together accounted for 32% of the variance in the intention to leave a job of STEM women, $F(4, 44) = 5.09$, $p = .002$. Among predictors, group discrimination, $\beta = -0.44$, $p = .003$, and self-esteem, $\beta = -0.37$, $p = .01$, contributed significantly to the intention to leave a job. We found that the STEM women with low self-esteem and the STEM women with less group discrimination were more likely to have a strong intention to leave their job.

Moreover, the interaction between the need to belong and self-esteem accounted for 6% additional variance in the intention to leave a job of STEM women, $F(1, 43) = 4.41, p = .04$. To analyze the interaction effect of the need to belong with self-esteem on the intention to leave a job, we created a scatter plot graph. The nature of strength in the relationship between the self-esteem and the intention to leave a job changed depending upon the level of need to belong (See Table 5 and Figure 1).

Table 5

Hierarchical Linear Regression Coefficients in Males and Females

Predictors	Male			Female		
	β		p	β		p
	Step 1	Step 2		Step 1	Step 2	
The Need to Belong	.09		.30	-.10		.47
Self-Esteem	-.28		.002	-.37		.01
Personal Discrimination	.34		.01	.09		.55
Group Discrimination	.08		.52	-.44		.003
Need to Belong × Self-Esteem		-.56	.25		-.32	.04
R^2	.36	.37		.32	.38	
ΔR^2		.008	.25		.06	.04
F	14.07***	1.33		5.09**	4.41*	

Note. Dependent variable: The intention to leave a job, Male, $N = 106$, Female, $N = 49$.

* $p < .05$. ** $p < .01$. *** $p < .001$., two-tailed.

The relationship between self esteem and leaving intention was more negative among women with high need to belong compared to women with low need to belong. The need to belong might buffer the effect of self-esteem on the intention to leave a job.

The main effect of the need to belong was not statistically significant. However, the result supported hypothesis 2 that the interaction of the need to belong and self-esteem of STEM women may explain an additional variance in the intention to leave a job over and above the variables in the first step of the regression analysis.

Figure 1. The Interaction Effect of the Need to Belong (NTB) and Self-Esteem on the Intention to Leave a Job for STEM women

Male regression statistics. To compare STEM women's result to STEM men's result, we conducted a hierarchical linear regression analysis for STEM men. We added need to belong, self-esteem, personal discrimination, and group discrimination of STEM

men in the first step and the need to belong and self-esteem interaction of STEM men in the second step. We found that four predictors accounted for 36% of the variance in the intention to leave a job of STEM men, $F(4, 101) = 14.07, p < .001$ (see Table 5). The interaction of the need to belong with self-esteem of STEM men accounted for 1% of an additional variance in the intention to leave a job, which was not statistically significant, $F(1, 100) = 1.33, p = .25$. Overall, the interaction regression model of STEM men accounted for 37% of the intention to leave a job, $F(5, 100) = 11.55, p < .001$. Among predictors, self-esteem, $\beta = -0.28, p = .002$, and personal discrimination, $\beta = 0.34, p = .01$, contributed significantly to the intention to leave a job of STEM men.

Discussion

The current research began with the question of why girls and women are underrepresented in STEM fields. To investigate this issue, we hypothesized that environmental threats from being in a STEM field and psychological threats from discrimination, stigma, and stereotype experiences negatively influence the need to belong, self-esteem, and perceived discrimination of STEM women and thus increase the intention to leave a STEM job.

The findings were interesting. First, we found that the regression model of the intention to leave a job with four predictors supported our hypotheses. Gender, personal or group discrimination experience and lowered self-esteem contributed to the intention of STEM individuals to leave their job in the overall sample. Even though the contribution of each factor differed in the regression model, we concluded that the psychological factors predicted the intention to leave a job (Hypothesis 1).

Next, the contribution of self-esteem and perceived group discrimination were significant in the intention to leave a job for STEM women (Hypothesis 1a). For STEM men, however, self-esteem and perceived personal discrimination were significant predictors (Hypothesis 1b). We believe these results relate to the personal-group discrimination discrepancy phenomenon in that stigmatized group members tend to minimize personal discrimination experience compared to group discrimination experience to increase a chance of being accepted by members in the field to which they belonged (Taylor et al., 1990).

Moreover, STEM women with low self-esteem and low group discrimination had a greater tendency to report the intention to leave their job (Hypothesis 1a). The result was different from that predicted by our hypothesis that a high level of group discrimination would predict a high level of intention to leave a job. This finding might result from cultural differences between South Asian countries and North American countries because about 50% of STEM women in our study lived in South Asia where the caste system has survived (e.g., Ciotti, 2010; Grill & Stewart, 2011; International Dalit Solidarity Network, 2009).

The STEM women in South Asia may experience discrimination due to the caste system, which is a hierarchical social stratification system. The segregation of the caste system limits one's occupational opportunities based on social status (International Dalit Solidarity Network, 2009). The caste system limits women's roles to household care and child rearing and blocks access to educational opportunities, trainings, and resources (Grill & Stewart, 2011). Thus, the significant association between low group

discrimination and high intention to leave a job might reveal social obstacles that STEM women in South Asia face (Adsul & Kamble, 2008). However, the influence of the social barriers for STEM women is beyond the scope of the present research, and future researchers need to investigate this topic.

For STEM men, self-esteem and personal discrimination were significant predictors of the intention to leave a job (Hypothesis 1b). The STEM men with low self-esteem and high personal discrimination reported a greater tendency to leave a job. The interesting result was that men's personal discrimination experience was a critical factor that contributed to their intention to leave a job. A possible clue that helps explain the relation between personal discrimination and the intention to leave a job is that about 40% of male participants reported English as their second language. Thus, some male participants were foreign-born employees or members of immigrant families. If some STEM men were immigrants, they may have experienced personal discrimination due to their ethnicities, cultural differences, or language barriers (Shin, 2006; Zeng & Xie, 2004). Further investigations could provide more explanations about personal discrimination of STEM men.

The next finding concerned the interaction between the need to belong and self-esteem, but it was significant only in women (Hypothesis 2). The interaction between the need to belong and self-esteem of STEM women explained an additional variance in the intention to leave a job over and above either factor alone. The association between self-esteem and the intention to leave a job was stronger for women who had an unfulfilled need to belong than for women who had a fulfilled need to belong. Thus, we suggest that

the STEM women with low self-esteem tend to leave their jobs more often when they could not fulfill their need to belong in STEM fields. In addition, the significant interaction effect of self-esteem and the need to belong may relate to sociometer theory.

Sociometer Theory and the Protecting Role of the Self-Esteem Theory

In our study, when STEM women had an unfulfilled need to belong and low self-esteem, the intention to leave a job increased. In other words, the effect of self-esteem on the intention to leave a job was stronger when the need to belong was at a high level rather than a low level. The interaction between self-esteem and the need to belong might be supporting evidence for the sociometer theory.

In terms of the relatively high levels of self-esteem of STEM women that Crocker and Majors (1989) found in stigmatized individuals, our result also showed a similar tendency. According to Crocker and Major, stigmatized individuals (e.g., women, African-Americans, other minorities) tend to report higher self-esteem compared to their counterparts (e.g., men, European-Americans, other majorities) because stigmatized individuals might use self-esteem to protect themselves from discrimination. In our study, self-esteem of STEM women was slightly higher compared to self-esteem of STEM men, although the difference was not statistically significant.

Meanwhile, our result regarding the gender difference in the intention to leave a job was contrary to our hypothesis that STEM women would report higher levels of the intention to leave a job compared to STEM men. STEM men in our study reported a strong desire to leave their current STEM jobs. We believed that this result might relate to the previous finding that STEM workers, including males, tend to leave their job more

frequently compared to non-STEM workers in other industries (e.g., Shropshire & Kadlec, 2012). Thus, future researchers need to investigate this issue, as it may lead to problems in STEM industries.

Limitations

As with all studies, the current study had some limitations. First, many predictors of turnover intentions were not included in the present study. For example, previous studies consistently found job satisfaction and organizational commitment as significant psychological determinants of employee turnover intentions (for an overview, see Cohn, 2000; George & Jones, 1996). In addition, job factors (e.g., job demand, role conflict, supervisor, and co-worker social support) and organizational factors (e.g., corporate fit, rewards, work and family balance) were significantly related to turnover intentions in previous research (Carayon, Schoepke, Hoonakker, Haims, & Brunette, 2006). For STEM individuals, career training and development opportunities were important predictors (Igbaria & Wormley, 1992). Therefore, future researchers need to add more predictor to account for their influence to turnover intentions.

Second, using the Amazon Mechanical Turk (MTurk) sample has its benefits as well as weaknesses. A benefit of using MTurk and administering the survey via the World Wide Web that we collected data from around the world in a relatively short period. This created some doubts about whether the MTurk sample represented a general population, even though there was evidence of proper reliabilities (Burmester et al., 2011). For example, about half of participants lived in South Asia; cultural differences might have confounded our results. Future researchers need to consider the possible

confounding variables when they recruit participants using the Internet. The other weakness of the MTurk sample was that characteristics of MTurk workers were not fully discovered. This online labor market service is a brand new system. We have not uncovered users' characteristics in the current research. Future researchers need to study the MTurk users to improve the quality of studies.

Another limitation was the relatively small sample size. The total STEM participants equaled 174 of which 54 participants were women. A larger sample would increase statistical power. In addition, most STEM women were either Asian or White. With various ethnicities including African-American and Hispanic women in STEM fields, future researchers could suggest more meaningful explanations about the gender disparity in STEM fields.

Implications

In our regression model for women, the need to belong turned out to be a significant moderator of the relation between self-esteem and the intention to leave a job rather than a critical predictor of the intention to leave a job. The need to belong appeared to buffer the influence of self-esteem on STEM women's turnover intention. Because of this result, we proposed that interventions aimed at increasing the feelings of belonging for STEM women might be effective in terms of buffering the influence of low self-esteem on the intention to leave a job (Chesler & Chesler, 2002). In addition, we believe that the intervention aimed at increasing the need to belong might be beneficial because the level of the need to belong would be changed by extrinsic resources and

efforts (Holleran, Whitehead, Shmader, & Mehl, 2011; Stout et al., 2011; Walton & Cohen, 2011).

Therefore, we suggest that an educational intervention with women role models might increase STEM women's self-esteem and reduce the intention to leave STEM majors. For example, Stout et al. (2011) tested the stereotype inoculation model and found that when women encountered other women who were experts in STEM fields, women expressed positive implicit identifications with STEM disciplines, exerted effort on difficult math tests, and felt efficacious about their abilities and future performance. Introducing STEM women role models to girls and women might help increase the feelings of connectedness between women experts and the self, which in turn promotes self-esteem and self-efficacy and increases the opportunities to choose STEM careers in the future (Dasgupta, 2011; Stout et al., 2011).

Moreover, social psychological interventions led by STEM companies might reduce discrimination and prejudice from a longitudinal perspective. It is difficult to reduce discrimination and prejudice because they are subtle, implicit, and connected to stereotypes. However, by creating an egalitarian atmosphere (e.g., equal work opportunities, equal promotion benefits, equal salaries) and by creating micro team cultures that give various identities to workers in STEM fields, STEM companies and organizations could offer indirect support to STEM women (Cohen, Garcia, Apfel, & Master, 2006; Holleran et al., 2011; Logel et al., 2009; Lyness & Thompson, 2000; Walton & Cohen, 2007, 2011)

Future Directions

Future researchers need to retest the current regression model with more heterogeneous samples from off-line places, such as STEM companies and universities, to overcome the limitation of the MTurk sample. In addition, future researchers could include detailed demographic information in the main analyses. We did not examine differences in different demographic groups (e.g., ethnicity, location, work history, education, relationship status) because these factors exceeded the scope of the current research.

Moreover, we did not consider developmental aspects of careers. Future researchers need to consider collecting more detailed career behaviors and history, such as the reasons and goals for the intention for staying or leaving STEM careers. It is necessary to also investigate STEM men's career attitude and behaviors because they comprise the other half of STEM fields, and their intention and attitude might influence on STEM environments and STEM women.

We suggest that the MTurk and online survey have considerable potentials for psychology research. They are economical and efficient. Even though the present study has some limitations, we offer valuable evidence for STEM workers that discrimination coupled with the need to belong and self-esteem influence the intention to leave a job.

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Appendix A

Amazon Mechanical Turk HIT List

The screenshot shows the Amazon Mechanical Turk interface. At the top, there are tabs for 'Your Account', 'HITS', and 'Qualifications'. The 'HITS' tab is selected, showing '187,829 HITS available now'. Below the tabs, there are filters for 'All HITS', 'HITS Available To You', and 'HITS Assigned To You'. A search bar is present with 'Find HITS containing' and a dropdown for 'that pay at least \$ 0.00'. The main section is titled 'All HITS' and shows '1-10 of 10731 Results'. The first HIT is 'Classify Arabic Tweets Dialects SEE REVISED HIT' by 'Chris Callison-Burch'. Red annotations are as follows: 'A' points to the HIT title, 'B' points to the requester name, 'C' points to the 'Reward' field, and 'D' points to the 'Time Allotted' field.

HIT Title	Requester	HIT Expiration Date	Time Allotted	Reward	HITS Available
Classify Arabic Tweets Dialects SEE REVISED HIT	Chris Callison-Burch	Aug 4, 2013 (7 weeks 6 days)	60 minutes	\$0.00	23531
Search: Keywords on Google.com (US)	CrowdSource	Jun 10, 2014 (52 weeks)	16 minutes	\$0.08	14998
Classify Arabic Tweets Dialects (No Qualification)	Chris Callison-Burch	Aug 22, 2013 (10 weeks 2 days)	60 minutes	\$0.05	11392
Find Listing Information Associated with a Telephone Number	Rob Deming	Jun 11, 2013 (1 day 8 hours)	60 minutes	\$0.02	10000

A: Title of the current research (Attitude & Gender Toward Science)

B: The name of the current researcher (Feist Lab)

C: Compensation (\$ 0.50, USD)

D: Duration of the task (20 min)

Appendix B

Amazon Mechanical Turk Research Description Page

Participate in a survey about gender and attitudes toward science			
Requester: Feist Lab	Reward: \$0.5 per HIT	HITs available: 0	Duration: 15 Minutes
Qualifications Required: Location is US , HIT Approval Rate (%) for all Requesters' HITs greater than or equal to 90			
HIT Preview			
Thank you for your interest. We are conducting an academic survey research about gender and attitudes of a certain group of people. To participate in, a qualification procedure is required. If you took the present survey before, please don't take it again. - Step 1: Click the survey link below. Before accepting the hit, please follow the link below to ensure that you can access the survey. If you do not follow the steps, we have to reject your assignment. Please follow below steps. - Step 2: You will be asked to report your Mturk Worker ID. Please copy and paste it into the box provided in the survey question. - Step 3: You will be asked to answer a few screening questions following the informed consent. <u>If you are not eligible for this study, you will be directed away from the survey.</u> - Step 4: Complete the online survey. The whole process will take about 15 minutes. Randomly answering questions will be detected and will result in rejection of the HIT. - Step 5: Once you have completed the survey you will be asked to make and report your code. Make sure that you need to remember the code and report it into the text box below. Only the participant who reports one's Mturk ID and the code in the survey and here will get paid accordingly. - Step 6: Press the submit button. Thank you. <u>Click Here to Start the HIT</u> <u>Completion Step: Please enter the code for your compensation.</u>			

Appendix D

Survey Monkey Screening Question

www.surveymonkey.com/s.aspx?PREVIEW_MODE=DO_NOT_USE_THIS_LINK_FOR_COLLECTION&sm=NnGloqyRdV3DEW99IekUqI4FJVlz8dEkb8Vp3M

San José State UNIVERSITY

Exit this survey

4. What is your field of work or study? (e.g. if you are an accountant in Google, your field of work is business & finance)

1. Management
2. Business & Finance
3. Computer & Mathematics
4. Architecture
5. Engineering
6. Life Science
7. Physical Science
8. Social Science
9. Community & Social Services
10. Law
11. Education, Training, & Library
12. Arts, Design, Entertainment, Sports, & Media
13. Healthcare Practitioners, & Technician
14. Healthcare Support
15. Protective Service
16. Food Preparation & Serving
17. Building & Grounds Cleaning & Maintenance
18. Personal Care & Service
19. Sales & Related

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Appendix E
United States Department of Labor
Standard Occupational Classification and Coding Structure

The occupations in the SOC are classified at four levels of aggregation to suit the needs of various data users: major group, minor group, broad occupation, and detailed occupation. Each lower level of detail identifies a more specific group of occupations. The 23 major groups, listed below, are divided into 97 minor groups, 461 broad occupations, and 840 detailed occupations.

(23 major groups)

1. Management
2. Business and Financial Operations
- 3. Computer and Mathematical (Qualified)**
- 4. Architecture and Engineering (Qualified)**
- 5. Life, Physical, and Social Science (Qualified)**
6. Community and Social Services
7. Legal
8. Education, Training, and Library
9. Arts, Design, Entertainment, Sports, and Media
10. Healthcare Practitioners and Technical
11. Healthcare Support
12. Protective Service
13. Food Preparation and Serving Related
14. Building and Grounds Cleaning and Maintenance
15. Personal Care and Service
16. Sales and Related
17. Office and Administrative Support
18. Farming, Fishing, and Forestry
19. Construction and Extraction
20. Installation, Maintenance, and Repair
21. Production
22. Transportation and Material Moving
23. Military Specific

Note. Computer & Mathematics, Architecture, Engineering, Life Science, Physical Science are qualified STEM fields to participate in this research.

Appendix F

Survey Question Example (SLI) and Quit Button

www.surveymonkey.com/s.aspx?PREVIEW_MODE=DO_NOT_USE_THIS_LINK_FOR_COLLECTION&sm=NnGloqyRdV3DEW991e...
San José State UNIVERSITY

Exit this survey

6. How do you rate your chances of still working or studying for the field you just answered

	Terrible	Bad	Not So Good	So-So	Good	Very Good	Excellent
1. 3 months from now	☒	☐	☐	☐	☐	☐	☐
2. 6 months from now	☒	☐	☐	☐	☐	☐	☐
3. 1 year from now	☒	☐	☐	☐	☐	☐	☐
4. 2 years from now	☒	☐	☐	☐	☐	☐	☐

Prev Next

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Appendix G
The Need to Belong Scale
NTB

For each of the statements below, indicate the degree to which you agree or disagree with the statement by writing a number in the space beside the question using the scale below:

- 1 = Strongly disagree
- 2 = Moderately disagree
- 3 = Neither agree nor disagree
- 4 = Moderately agree
- 5 = Strongly agree

- _____ 1. If other people don't seem to accept me, I don't let it bother me.
- _____ 2. I try hard not to do things that will make other people avoid or reject me.
- _____ 3. I seldom worry about whether other people care about me.
- _____ 4. I need to feel that there are people I can turn to in times of need.
- _____ 5. I want other people to accept me.
- _____ 6. I do not like being alone.
- _____ 7. Being apart from my friends for long periods of time does not bother me.
- _____ 8. I have a strong need to belong.
- _____ 9. It bothers me a great deal when I am not included in other people's plans.
- _____ 10. My feelings are easily hurt when I feel that others do not accept me.

Note. Leary, M. R., Kelly, K. M., Cottrell, C. A., & Schreindorfer, L. S. (2007). *Individual differences in the need to belong: Mapping the nomological network*. Unpublished manuscript, Department of Psychology, Duke University, Durham, NC.

Appendix H
The Rosenberg Self-Esteem Scale
RSE

Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle SA. If you agree with the statement, circle A. If you disagree, circle D. If you strongly disagree, circle SD.

1.	On the whole, I am satisfied with myself.	SA	A	D	SD
2.*	At times, I think I am no good at all.	SA	A	D	SD
3.	I feel that I have a number of good qualities.	SA	A	D	SD
4.	I am able to do things as well as most other people.	SA	A	D	SD
5.*	I feel I do not have much to be proud of.	SA	A	D	SD
6.*	I certainly feel useless at times.	SA	A	D	SD
7.	I feel that I'm a person of worth, at least on an equal plane with others.	SA	A	D	SD
8.*	I wish I could have more respect for myself.	SA	A	D	SD
9.*	All in all, I am inclined to feel that I am a failure.	SA	A	D	SD
10.	I take a positive attitude toward myself.	SA	A	D	SD

Note. Scoring: SA=3, A=2, D=1, SD=0. Items with an asterisk are reverse scored, that is, SA=0, A=1, D=2, SD=3. Sum the scores for the 10 items. The higher the score, the higher the self-esteem.

Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

Appendix I
 Perception of Personal Discrimination and Perception of Group Discrimination
 PPD & PGD

Please indicate the degree to which you agree or disagree with the statement.

Strongly Agree (7) / Moderately Agree (6) / Slightly Agree (5) / Neither Agree Nor Disagree (4)
 / Slightly Disagree (3) / Moderately Disagree (2) / Strongly Disagree (1)

a. Perceptions of Personal Discrimination

1. Prejudice against my gender group has affected me personally
2. I have personally experienced gender discrimination
3. I have often been treated unfairly because of my gender
4. Because of gender discrimination, I have been deprived of opportunities that are available to women (men)

b. Perceptions of Group Discrimination

1. Prejudice against my gender group has affected the average female (male)
2. The average female (male) has experienced gender discrimination
3. The average female (male) has often been treated unfairly because of her gender
4. Because of gender discrimination, the average female has been deprived of opportunities that are available to men (women)

Note. Carvallo, M., & Pelham, B. W. (2006). When friends become friends: The need to belong and perceptions of personal and group discrimination. *Journal of Personality and Social Psychology*, 90, 94-108.

Appendix J
The Staying-or-Leaving Index
SLI

[First set]

The following responses should be used in answering the next four questions. Circle the appropriate number

Excellent (7) / Very Good (6) / Good (5) / So-So (4) / Not So Good (3) / Bad (2) / Terrible (1)

*How do you rate your chances of still working or studying for the field you just answered

1. Three months from now (date)
2. Six months from now (date)
3. One year from now (date)
4. Two years from now (date)

At another place in the questionnaire, not immediately following questions 1-4, the next set of four questions should be located.

[Second set]

The following responses should be used in answering the next four questions.

Excellent (7) / Very Good (6) / Good (5) / So-So (4) / Not So Good (3) / Bad (2) / Terrible (1)

*How would you rate your chances of

5. Quitting the current field's job or study in the next three months (by date)
6. Quitting the current field's job or study sometime in the next six months (by date)
7. Quitting the current field's job or study sometime in the next year (by date)
8. Quitting the current field's job or study sometime in the next two years (by date)

Note: We modified a question for the present research. Scoring: The first four questions are reversed scored (7=1, 6=2, etc.). All eight questions are then summed to produce the total score. Thus the higher the score, the greater the respondent's intention of leaving the STEM fields.

Appendix K
Demographic Questionnaire

1. Are you? Male / Female
2. How old are you? (   ) years old
3. Where do you live?
  - North America (Canada, Mexico, USA)
  - South America
  - East Asia (China, Japan, Korea)
  - South Asia (Other Asia)
  - Europe
  - Africa
  - Middle East
4. What is the highest level of education you have completed?
  - Grade school or less (Grade 1-8)
  - High school graduate or GED
  - Some college or Associates degree (A.A./A.S.)
  - Bachelor's level degree (B.A./B.S.)
  - Master's level degree
  - Doctoral degree or higher
5. How many years you have been in the field you just answered? (   ) years
6. What's your relationship status?
  - Single (Never been married)
  - Married
  - Divorced, separated, or widowed
  - Engaged
  - Cohabiting (A member of an unmarried couple)
7. What's your ethnicity?
  - American Indian/ Alaskan Native
  - Asian/ Asian American
  - Black/ African American
  - Hawaiian/ Other Pacific Islander
  - Hispanic/ Latino (Latina)
  - White/ European or European American
  - Other
8. Please indicate the degree to which you satisfied your job or major (5-point Likert type scale, 1 = Strongly Dissatisfied to 5 = Strongly Satisfied)