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RECONCEPTUALIZING WOMEN'S STEM EXPERIENCES: BUILDING A THEORY OF POSITIVE MARGINALITY

by

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ABSTRACT

RECONCEPTUALIZING WOMEN'S STEM EXPERIENCES: BUILDING A THEORY OF POSITIVE MARGINALITY

Valerie N. Streets
Old Dominion University, 2016
Director: Dr. Debra A. Major

Since the 1980s, disciplines such as psychology and sociology have discussed the construct of positive marginality. Positive marginality describes the perception that belonging to a non-dominant cultural or demographic group can be advantageous rather than oppressing. To date, research on positive marginality has explored the construct in a qualitative manner across a number of demographic groups (e.g., Jewish women in social sciences, African American women in predominantly Caucasian workplaces). Because women are largely underrepresented in science, technology, engineering, and mathematics (STEM) fields, the current research examined positive marginality in a STEM context. This research advances the existing understanding of positive marginality through two studies. Study 1 tested the psychometric properties of a new measure of positive marginality. A qualitative pilot study informed the generation of a measure of positive marginality which was administered to a sample of 105 sophomore and junior STEM majors (Study 1A) and a sample of 433 women working in STEM occupations (Study 1B). Exploratory factor analyses were conducted in Study 1A and 1B as well as a confirmatory factor analysis in Study 1B to test a hypothesized 3-factor structure of positive marginality. Results of Study 1 supported a single-factor structure of positive marginality. Study 2 identified and assessed a partial nomological network of the unidimensional construct among women working in STEM occupations. Specifically, a sample of 313 women working in

STEM occupations were surveyed at two time points on hypothesized antecedents and outcomes of positive marginality. Structural equation modeling suggested support for core self-evaluations, need for achievement, and domain identification as antecedents of positive marginality; career satisfaction and persistence intentions were supported as outcomes of positive marginality for women in STEM. Together, these studies provide support for the relevance of positive marginality to women pursuing STEM careers and demonstrate the relationship between positive marginality and individual differences and career outcomes. Implications for theory, practice, and future research are discussed.

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This dissertation is dedicated to Miles for his never ending love and support. (Miles is my dog.)

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CHAPTER I

INTRODUCTION

Retention in science, technology, engineering, and mathematics (STEM) is a prominent issue facing the nation, as a competitive U.S. economy is dependent upon a thriving STEM workforce (PCAST, 2012). Although the preparation of a STEM workforce is a general concern, the issue is largely a gendered one. Despite representing about seventy percent of U.S. college students, women earn just 45 percent of STEM undergraduate degrees (PCAST, 2012). More troubling is the trend showing that the number of undergraduate degrees earned by women has been declining in a number of sciences (NSF, 2013). For example, the proportion of computer science degrees earned by women fell from 42 percent in 2000 to 12 percent in 2012 (NSB, 2012). Such underrepresentation is amplified in the workplace, as women make up roughly half of the U.S. workforce but under 25 percent of the STEM workforce (White House Council on Women and Girls, 2012); this number drops to about 20 percent when social sciences (e.g., psychology) are excluded (BLS, 2014). Thus, retention of women in STEM fields is especially critical. Consequently, the identification of levers for improving women's retention in STEM disciplines is a crucial research need.

Much of the extant research has focused on explaining women's attrition from STEM (i.e., why women leave STEM fields; Blickenstaff, 2005; Singh et al., 2013). While such research has contributed to an explanation of the STEM gender gap, an understanding of women's STEM retention would contribute to a fuller picture of STEM participation. Thus, the current research focused on positive experiences specific to women persisting in STEM fields to advance our understanding of retaining women in STEM. Specifically, the current research developed a theory of *positive marginality*, which was posited as an explanatory mechanism in women's STEM persistence by exploring career variables that are closely linked to persistence behaviors. Study 1 operationally defined positive marginality through the development and initial validation of a measure. Study 2 further validated and pursued a nomological net of positive marginality to develop a theory surrounding the construct.

CHAPTER II

STUDY 1: OPERATIONALIZING POSITIVE MARGINALITY

Marginalization is often considered to be synonymous with social exclusion (Silver, 1994). Marginality was identified as a status that fails to fit in with mainstream culture (Park, 1928). It reflects a stigma that is attached to an aspect of one's identity. In other words, a marginalized individual possesses or displays a trait that attracts the attention of others and impedes the development of relationships with others (Goffman, 1963). This stigmatized identity overrides one's individuality and relegates them to be judged on the basis of characteristics that are stereotypical of the demographic group to which they belong (Unger, 2000). Such disindividuation becomes increasingly apparent as the underrepresentation of the stigmatized group increases (Kanter, 1977). Individuals are often perceived, by themselves and others, in terms of the social identity that is most stigmatized in their current setting. For example, women pursuing math in college are outnumbered by their male classmates and are generally perceived merely as women rather than as individuals or math students (Murphy, Steele, & Gross, 2007).

Marginality has both structural and psychological components for those who experience it. Structural components refer to one's position within a social system and often relate to exclusion. Marginalized individuals subscribe to two conflicting identities; in other words, such individuals belong to two different groups that are not perceived as compatible. For example, a woman mathematician belongs to a group perceived as feminine (i.e., women) as well as a group participating in a culture regarded as masculine (i.e., mathematics). Commonly, because of such conflicts, marginalization results in isolation from both groups, as he or she is not perceived as a legitimate member of either (Mayo, 1982). A woman engineer may struggle to befriend her male colleagues because she is different but may also struggle to form close relationships with other women, as she may not be seen as feminine enough due to her occupation. Psychological components of marginalization represent the internalization of one's social position or status. Simply put, psychological components revolve around lacking a sense of belonging in a given domain (Mayo, 1982). Thus, a woman engineer may not only experience a lack of inclusion from her male colleagues but she may interpret that as a signal that she does not belong in her field of work. In addition to the psychological consequences of marginalization, professional barriers such as limited access to resources and lacking acclaim and recognition are also associated with a stigmatized social identity (Mayo, 1982).

Members of marginalized groups develop a shared understanding of how their group is viewed by the dominant culture. This shared understanding typically includes awareness of being devalued by others, knowledge of prominent stereotypes regarding their identity, and recognition of the risk of discrimination (Crocker, Major, & Steele, 1998). Despite a shared understanding of marginalization, the nature of the situation has a large role in determining how stigmatized an individual feels (Major & O'Brien, 2005). For example, women taking a math test are keenly aware of their marginalized status because they are in a situation that highlights negative stereotypes toward them (e.g., that women lack mathematical competence; Spencer, Steele, & Quinn, 1999). Individual differences also mitigate the effect of stigma such that stigma sensitivity (i.e., the expectation that one will be rejected or treated on the basis of group membership; Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002; Pinel, 2002), group identification (i.e., the extent to which the stigmatized identity is central to the individual's self-concept; Sellers & Shelton, 2003), and domain identification (i.e., the importance placed on the domain in which one is negatively stereotyped; Steele, Spencer, & Aronson, 2002) increase one's awareness and experience of marginalization.

In dealing with marginalization, one has a few options. A stigmatized person may interpret their negative experiences as a signal of their own shortcomings (Ruggiero & Major, 1998). An individual may also recognize the stigma he or she faces but denounce its relevance to them by disidentifying with the marginalized group (Unger, 2000). For example, a woman who wishes to avoid stigma in a STEM field may evade femininity in her own identity. However, another possibility is to acknowledge the stigma and adopt a positive orientation toward one's marginalization (i.e., positive marginality; Mayo, 1982). Positive marginality is demonstrated when an individual is aware of the stigma he or she faces but instead focuses on and internalizes the positive aspects of being in a minority.

The emphasis of the current research was on the extent to which positive marginality is experienced among women in STEM fields and the role of that construct in shaping STEM experiences. Because women are underrepresented in STEM (White House Council on Women and Girls, 2012), they are in a position where their gender is made salient, thereby highlighting their marginality. Additionally, STEM fields are regarded as masculine domains in which women are not expected to succeed (Oswald, 2008), further escalating the marginalization of women. A woman in STEM may demonstrate positive marginality, for instance, by focusing on her increased access to scholarships and grant funding relative to that of men, or the opportunity to pave the way for future women to get involved in the field.

Defining Positive Marginality

Prior literature examining marginalized groups has considered race (Collins, 1989), occupation or industry (Mayo, 1982), religion (Unger, 2000), and sexual orientation (Hall &

Fine, 2005). In each instance, evidence of positive marginality has emerged. Positive marginality is the concept that belonging to a non-dominant cultural or demographic group can be advantageous rather than oppressing. Individuals who experience positive marginality typically recognize that the barriers they face are the result of structural processes (e.g., discrimination) and not of one's personal inadequacy (Mayo, 1982).

Positive marginality has been demonstrated by socially stigmatized individuals who view it as permissible to act outside of established social norms (Unger, 1998). Although research on the construct is limited and qualitative in nature, a positive orientation toward marginality has been linked to increased employee satisfaction and effectiveness (Cotton, 1977). However, most of the theory surrounding positive marginality is focused on the identification of key components and manifestations of the construct. Positive marginality is experienced by individuals who identify with their stigmatized or marginalized identity and understand the importance of that identity in their lives (Unger, 2000). Furthermore, marginalized individuals must perceive their own ability to choose an identity rather than have it determined for them (Unger, 1998). For example, women in STEM fields can choose a feminine identity while performing well professionally rather than adopting more masculine traits to conform to majority group colleagues. Minorities experiencing positive marginality do not feel that they are on the margin of two cultures, but instead feel that they are active participants in both cultures. Moreover, people in such positions report having an upper-hand in that they truly understand the culture of both groups to which they belong, whereas others around them are familiar only with the dominant culture and know little about marginalized individuals (i.e., the nondominant group; Alfred, 2001). Thus, these individuals feel that they can fully participate in the given domain whereas those who only belong to the dominant culture cannot. For example, a woman engineer may feel advantaged in that she knows how to relate to women and engineers alike, while her male colleagues only enjoy such an insider status with engineers in general.

In 1998, Unger identified steps to translate one's sense of inferiority or stigma into positive marginality. These steps included recognizing and embracing the reality that aspects of one's identity are salient, acknowledging the legitimacy of one's competing or conflicting identities, and recognizing structural roots of injustice and assuming some responsibility for change. Similarly, Alfred (2001) explored positive marginality among African American women faculty members and proposed three tenets of the construct: rejection of external definitions (i.e., utilizing one's status to actively create new ways of defining or perceiving her identity), creative marginality (i.e., believing that it is a privilege to be marginal), and cultural identity (i.e., feeling better prepared than their majority counterparts because they have had to overcome obstacles). Both authors positioned these components as dimensions of positive marginality. Thus, in operationalizing positive marginality in the current research, a multidimensional measure was developed and tested. Because the extant literature posits multiple dimensions of positive marginality, a qualitative pilot study was conducted to better establish the dimensions of the construct and to contextualize it to women in STEM.

The Pilot Study

Because positive marginality has neither been applied to the context of women's underrepresentation in STEM nor assessed in a quantitative manner in the extant literature, qualitative data were sought as a foundation for measure development. A series of individual and small-group interviews were conducted with women approaching graduation from a STEM major at large Southeastern university. A total of thirteen women were interviewed from nine different STEM majors (i.e., biology, biochemistry, civil engineering, computer engineering, computer science, math, mechanical engineering, mechanical engineering technology, and physics).

Small-group interviews were conducted with ten women as part of a larger research project. During these interviews, two open-ended questions were asked to gauge the extent to which women experienced positive marginality (i.e., "What is it like to be a woman in your major?" "What do you think it is like to be a man in your major?"). The interviews were recorded and transcribed. Responses were content coded by the primary researcher and trained undergraduate research assistants in order to identify evidence of positive marginality and to categorize such evidence into dimensions of the construct.

To further elucidate the construct, individual interviews were conducted with women who demonstrated positive marginality in a STEM major. Specifically, three women who reported experiences of positive marginality in focus groups for a separate research project were invited to participate in an interview with the primary researcher. These interviews were semi-structured and approximately 45 minutes in duration. During individual interviews, participants were asked open-ended questions about their general experiences in STEM (e.g., "Describe a typical day as a student in your major") as well as more targeted questions about positive marginality (e.g., "What are some of the benefits you have experienced in being one of just a few women in your STEM major?"). The full interview guide used for the three individual interviews appears in Appendix A.

Individual interviews were recorded, transcribed, and content coded in the same manner as the small-group interviews. Small-group interview transcripts were coded in accordance with consensual qualitative research (Hill et al., 2005). As described in Table 1, three major dimensions of positive marginality emerged from participant responses, which were labeled as visibility, prestige, and resilience (see Streets, Haislip, Litano, & Major, 2015 for more detail). These dimensions were identified based on their status as *variant* (i.e., mentioned by at least half of all participants) or *typical* (i.e., mentioned by all participants) themes (Hill, Thompson, & Williams, 1997). The three individual interviews were then content coded to further define each dimension of positive marginality. Participant responses were coded following a phenomenological approach (Moustakes, 1994), which is intended to identify the depth and meaning of participants' experiences. Unlike consensual qualitative research, which emphasizes the identification of common themes and shared experiences, phenomenological research utilizes smaller samples to better capture the depth of a particular experience or phenomenon (Hays & Singh, 2012). Phenomenological data analysis was used to broaden and solidify the definitions of visibility, prestige, and resilience, thereby enabling the primary researcher to generate items for a quantitative measure of positive marginality. Study 1 seeks to establish that the three components reflect distinct but related aspects of positive marginality.

Hypothesis 1: Positive marginality has three distinct dimensions: visibility, prestige, and resilience.

Hypothesis 2: Visibility, prestige, and resilience each contribute to an overall construct of positive marginality.

Table 1

Hypothesized Dimensions of Positive Marginality

Dimension	Illustrative Quote	Sample Item
Visibility – the acceptance of one's gender salience and the acknowledgement that it may be associated with some advantages	"I like being the odd ball because I stick out and I can make that work for me...I've pulled in the young girls from high schools...telling them that 'you can do math!' ... I like being able to use my difference to my advantage and to help other girls"	I think of myself as a role model for other women in STEM.
Prestige – the recognized pride or esteem derived from being a woman in a male-dominated domain (i.e., STEM)	"I just know that we [women] are kind of a minority in our field. I am proud to say that I am a math major."	I feel proud to be a woman in STEM.
Resilience – the perceived increased opportunity, due to one's gender, to successfully overcome barriers in STEM	"To be a female [in STEM]... it makes you want to do better; it makes you like 'I have to prove myself – that I am as good as the people in there.'"	Being resilient is part of being a woman in STEM.

CHAPTER III

STUDY 1A

Method

Procedure. Based on the data collected in the pilot study, 16 items were generated to comprise a measure of positive marginality (see Appendix B for the complete measure). Based on the hypothesized dimensions of the construct, eight items were created to represent the dimension of prestige, three items were generated to assess visibility, and five items were written to measure resilience. The measure was administered to participants as part of a larger research project sponsored by the National Science Foundation (NSF). The project examined a population of students at a large, public university with high research activity in the southeastern United States. An online survey consisting of eighteen measures regarding students' STEM experiences (e.g., persistence intentions in a STEM major, embeddedness in a STEM major) was administered via Qualtrics. Participants were recruited via email and in-person advertisements delivered during visits to STEM classes. The survey was emailed to sophomore and junior STEM majors and required approximately 30 minutes to complete. Participants were compensated $30 for survey completion. The project received approval from the Institutional Review Board (ODU IRB# 14-184) and was conducted in compliance with human subjects protections.

Participants. The research questions addressed by the overall NSF project required a sample of sophomore and junior STEM students. The population was identified through university enrollment records. Of the 2,094 students identified in the population, 1,367 students were emailed a survey invitation. Two hundred and ninety-four individuals completed the survey (i.e., 21.5% response rate).

Because the measure of interest was contextualized to women in STEM, only women participants were administered the positive marginality measure. The population consisted of 689 women, all of whom were invited to complete the survey. A total of 107 women completed the survey (i.e., 15.5% response rate). Of the women who responded, two were eliminated from the sample for reasons described below, resulting in a final sample size of 105 women.

A common concern in survey-based data collection, particularly in the online administration of surveys, is insufficient effort responding. Insufficient effort responding characterizes responses that reflect low motivation to comply with survey instructions or to provide accurate responses (Huang, Curran, Keeney, Poposki, & DeShon, 2012). Three items were included in the larger survey to detect such response patterns (e.g., for quality purposes, please select "strongly disagree"). Following recommendations from Meade and Craig (2012), participants were excluded from analyses if they incorrectly answered two or more of these items. Such a guideline resulted in one woman being excluded from the sample. Additionally, one woman failed to complete the survey in its entirety and did not complete the positive marginality measure, thereby preventing her inclusion in any analyses.

Participants reported an average age of 21.70 years (*SD* = 3.25) and were enrolled in an average of 13.23 credits (*SD* = 3.40) at the time of survey completion. Most participants were Caucasian (59.01%) or African American (16.19%). Additionally, most participants were enrolled in Biology (19.05%), Mechanical and Aerospace Engineering (13.33%), Ocean, Earth, and Atmospheric Science (11.43%), Electrical and Computer Engineering (11.43%), and Engineering Technology (11.43%). A complete list of participant response frequencies on nominal demographic variables is presented in Table 2.

Table 2

Frequency Table of Demographics

Variable	*n*	Percentage
Major		
Biochemistry	5	4.76
Biology	20	19.05
Civil & Environmental Engineering	10	9.52
Chemistry	4	3.81
Computer Science	3	2.86
Electrical & Computer Engineering	12	11.43
Engineering Technology	12	11.43
Mathematics	10	9.52
Mechanical & Aerospace Engineering	14	13.33
Modeling, Simulation, & Visualization Engineering	2	1.90
Ocean, Earth, & Atmospheric Sciences	12	11.43
Physics	1	0.95
Race		
Caucasian	62	59.01
African American	17	16.19
Asian	7	6.67
Hispanic/Latino	2	1.90
Other	2	1.90
Multiracial	15	14.29
Transfer Status		
Transfer	40	38.10
Non-transfer	65	61.90
In-State Status		
In-state	99	94.29
Out-of-state	6	5.71
International Status		
Domestic	100	95.24
International	5	4.76
Mother’s Educational Background		
Less than high school diploma	1	0.95
High school diploma	24	22.86
Some college	18	17.14
Associate’s degree	16	15.24
Bachelor’s degree	29	27.62
Master’s degree	15	14.29
Doctoral level degree	2	1.90

Table 2 (Continued)

Variable	*n*	Percentage
Father's Educational Background		
Less than high school diploma	3	2.86
High school diploma	24	22.86
Some college	12	11.43
Associate's degree	13	12.38
Bachelor's degree	24	22.86
Master's degree	24	22.86
Doctoral level degree	2	1.90
Unsure	3	2.86

Results

Parallel analysis (Horn, 1965) was conducted in SPSS to determine the number of factors to retain. Parallel analysis is recommended as an initial step in factor analysis, as it reduces the likelihood of retaining factors that emerged by chance (Tabachnick & Fidell, 2007). Though not heavily utilized in organizational research, parallel analysis tends to yield more accurate factor extraction as it is less subjective and less influenced by sample size than other methods (e.g., scree plot analysis, maximum likelihood extraction; Hayton, Allen, & Scarpello, 2004). In parallel analysis, random datasets are generated containing the same number of variables and cases as the original dataset. Next, principal components analysis is conducted on the random datasets in order to calculate eigenvalues, and those eigenvalues are subsequently averaged (Horn, 1965). Results of the parallel analysis are displayed in Table 3. Eigenvalues from the sample data were compared to the eigenvalues averaged from the randomly generated datasets. Factors should only be retained when the eigenvalues from the sample data exceed those from the randomly generated data (Hayton et al., 2004; Horn, 1965). Because only the eigenvalue associated with the first factor exceeded its corresponding average eigenvalue, only one factor was recommended for extraction.

Because three factors were hypothesized and the study is exploratory in nature, further evidence of a single factor solution was sought. An exploratory factor analysis with maximum likelihood extraction was conducted in SPSS. Because there was no theoretical basis for assuming the factors are orthogonal, oblique (i.e., promax) rotation was used prior to factor interpretation. The Kaiser criterion, which proposes that factors with eigenvalues greater than one should be retained (Kaiser, 1960), resulted in the extraction of two factors. However, analysis of the factor loadings revealed several cross-loadings (i.e., loadings that exceed 0.32 on more than one factor; Comrey & Lee, 1992), which failed to demonstrate meaningfully differentiated factors (see Table 4 for factor loadings). Furthermore, an "elbow test" based on the scree plot revealed only one factor, and the total variance explained by the first factor (48.76%) was substantially higher than that which was explained by the second factor (9.84%). Thus, a final exploratory factor analysis with maximum likelihood extraction was conducted in which a unidimensional solution was forced. Because only a single factor was extracted, no rotation was conducted prior to interpretation. Results of the unidimensional loadings are displayed in Table 5.

Table 3

Parallel Analysis Results for Study 1A

Factor	Sample Data Eigenvalues	Random Data Eigenvalues
1	8.833	1.742
2	1.286	1.569
3	0.992	1.442
4	0.836	1.333
5	0.674	1.238
6	0.592	1.152
7	0.498	1.071
8	0.465	0.994
9	0.379	0.921
10	0.354	0.852
11	0.295	0.783
12	0.227	0.717
13	0.185	0.651
14	0.158	0.584
15	0.147	0.515
16	0.078	0.435

Table 4

Factor Loadings for Two-Factor Solution

	Item	Factor 1	Factor 2
P	There is a sense of specialness that comes with being a woman in STEM.	.805	.770
P	I find it empowering to be a woman in STEM.	.804	.632
V	I think of myself as a role model for other women in STEM.	.779	.535
P	I feel proud to be a woman in STEM.	.779	.648
V	I am paving the way for other women in STEM.	.773	.519
R	I choose to focus on the positive aspects of being a woman in STEM.	.758	.512
P	There is something gratifying about being a woman in STEM.	.755	.739
R	Being a woman has made me more determined to pursue STEM.	.688	.639
V	I owe it to other women to persist in STEM.	.661	.463
P	I view women in STEM as a well-respected group.	.655	.536
R	I have more reason to persevere in STEM because I am a woman.	.631	.563
R	Being resilient is part of being a woman in STEM.	.588	.553
R	I feel equipped to handle any challenges that come my way as a woman in STEM.	.481	.289
P	Women in STEM are a prestigious group of people.	.618	.964
P	It is prestigious to be a woman in STEM.	.580	.917
P	There is something special about being a woman in STEM.	.778	.787

Note. The first column shows the hypothesized factor for each item: V = visibility, P = prestige, R = resilience.

Table 5

Factor Loadings for Single-Factor Solution

	Item	Factor Loading
P	There is a sense of specialness that comes with being a woman in STEM.	.861
P	There is something special about being a woman in STEM.	.852
P	There is something gratifying about being a woman in STEM.	.815
P	I find it empowering to be a woman in STEM.	.788
P	Women in STEM are a prestigious group of people.	.784
P	I feel proud to be a woman in STEM.	.777
P	It is prestigious to be a woman in STEM.	.745
R	Being a woman has made me more determined to pursue STEM.	.728
V	I think of myself as a role model for other women in STEM.	.715
R	I choose to focus on the positive aspects of being a woman in STEM.	.712
V	I am paving the way for other women in STEM.	.706
R	I have more reason to persevere in STEM because I am a woman.	.661

Table 5 (Continued)

	Item	Factor Loading
P	I view women in STEM as a well-respected group.	.654
R	Being resilient is part of being a woman in STEM.	.617
V	I owe it to other women to persist in STEM.	.612
R	I feel equipped to handle any challenges that come my way as a woman in STEM.*	.423

Note. The first column shows the hypothesized factor for each item: V = visibility, P = prestige, R = resilience; *Item dropped from future analyses.

Hypothesis 1, which predicted that visibility, prestige, and resilience represent distinct dimensions of positive marginality, was not supported; only a single factor solution was supported. Hypothesis 2 was also unsupported, as the unidimensional structure yielded from the exploratory factor analysis prevented its testing. With the exception of one item (i.e., “I feel equipped to handle any challenges that come my way as a woman in STEM”), all items demonstrated sufficient loadings (i.e., loadings ≥ .50; Comrey & Lee, 1992) onto a single factor. The overall measure demonstrated sound reliability, yielding a Cronbach’s alpha of 0.94 across all sixteen items. Removal of the item that did not demonstrate an adequate factor loading did not change the alpha reliability of the scale; thus the item was dropped from further analyses.

CHAPTER IV

STUDY 1B

Method

Procedure. Due to the small sample size in Study 1A, the 15-item version of the positive marginality measure was later tested on an additional sample. The measure was administered to participants as part of data collection for Study 2. Participants completed the measure at two time points separated by two weeks. More detail regarding the data collection procedure is covered in Study 2.

Participants. A national sample of women working in a STEM profession was collected. To establish a degree of objectivity and agreement on the definition of STEM professions, the online database O*Net served as a reference. O*Net categorizes occupations by career cluster, such as finance or human service. One such cluster provided by O*Net is STEM, which features the subgroups Engineering and Technology and Science and Math. Participants were asked to select the title most representative of their current position from the list of STEM occupations. The full list of STEM occupations is provided in Appendix C.

A group of 433 women completed the positive marginality measure during the first time point. The group had an average age of 33.24 (SD = 8.23) and worked an average of 40.28 hours per week (SD = 7.56) in their STEM occupations. The majority of participants were Caucasian (55.4%) or Asian (22.4%). Of the 433 women who completed the first measure of positive marginality, 313 also completed the second measure. The sample of 313 women had an average age of 34.01 (SD = 8.04) and worked an average of 39.01 weekly hours (SD = 8.16). As with the larger group, the majority of the smaller sample was Caucasian (55.6%) or Asian (20.4%).

Results

Prior to any analysis of the measure, missing data were handled with EM imputation in SPSS. This approach uses maximum likelihood parameter estimation to find the expected value of the missing data point (Schumacker & Lomax, 2004). Simply put, participants' previous responses are used to predict their missing responses.

Because the sample size in Study 1A was small, an additional exploratory factor analysis was conducted on positive marginality as measured at the first time point. Parallel analysis was again conducted in SPSS to determine the number of factors to retain. Results of the parallel analysis are displayed in Table 6. Consistent with Study 1A, only the sample eigenvalue associated with the first factor exceeded its corresponding average eigenvalue, suggesting that only one factor should be extracted from the measure. Additionally, the positive marginality measure yielded an alpha reliability of 0.88 at the first time point.

Table 6
Parallel Analysis Results for Study 1B

Factor	Sample Data Eigenvalues	Random Data Eigenvalues
1	5.635	1.327
2	1.068	1.255
3	0.969	1.199
4	0.867	1.152
5	0.797	1.108
6	0.771	1.068
7	0.703	1.028
8	0.646	0.989
9	0.623	0.953
10	0.591	0.918
11	0.571	0.882
12	0.522	0.843
13	0.460	0.804
14	0.401	0.762
15	0.376	0.711

A confirmatory factor analysis was then conducted in MPlus-7 using positive marginality as measured at the second time point. The analysis was run using maximum likelihood estimation and bootstrapping at 5,000 iterations. Maximum likelihood estimation is the ideal approach to attaining accurate parameter estimates unless extreme assumption violations are present (Schumacker & Lomax, 2004). Bootstrapping randomly selects cases with replacement to generate additional datasets, allowing for estimation of standard errors and confidence intervals (Kline, 2011).

Because a single factor structure was suggested in all previous exploratory tests, a factor analysis with all 15 items loading onto a single factor was conducted. Model fit indices were evaluated according to four guidelines established by Hu and Bentler (1999). First, the model chi-square is an indicator of model misfit, as it tests the difference between the values in the sample covariance matrix and the reproduced implied covariance matrix. Good model fit is indicated by a non-significant chi-square. Root-mean-square error of approximation (RMSEA) values of less than .05 are indicative of acceptable model fit. The standardized root-mean-square residual (SRMR) indicates variance misspecification and should be less than .08. Lastly, the comparative fit index (CFI) assesses the fit of the model compared to a baseline model. CFI values should be greater than or equal to .95.

The single factor structure yielded the following fit statistics: $\chi^2(90) = 175.906$, $p < .001$, CFI = .925, RMSEA = .056 (90% CI [.044, .069]), SRMR = .047. Although the model chi-square was significant and the CFI did not exceed .95, the RMSEA and SRMR estimates did suggest model fit. The fit statistics provide conflicting evidence of model fit but, as shown in Table 7, all indicators yielded significant factor loadings within a unidimensional structure (Kline, 2011), thereby providing additional support for a single factor structure. Furthermore, an alternate model was tested with the hypothesized three factor structure. Such a model failed to converge, as there was linear dependency between the three hypothesized factors. Thus it was concluded that positive marginality is best modeled in a unidimensional fashion.

Table 7
Factor Loadings from Confirmatory Factor Analysis

	Item	Factor Loading
P	I find it empowering to be a woman in STEM.	.625
R	I choose to focus on the positive aspects of being a woman in STEM.	.612
P	There is a sense of specialness that comes with being a woman in STEM.	.602
P	Women in STEM are a prestigious group of people.	.596
P	There is something special about being a woman in STEM.	.578
P	There is something gratifying about being a woman in STEM.	.566
V	I think of myself as a role model for other women in STEM.	.563
P	I feel proud to be a woman in STEM.	.554
R	Being a woman has made me more determined to pursue STEM.	.538
P	It is prestigious to be a women in STEM.	.537
V	I am paving the way for other women in STEM.	.520
P	I view women in STEM as a well-respected group.	.508
R	I have more reason to persevere in STEM because I am a woman.	.501
V	I owe it to other women to persist in STEM.	.444
R	Being resilient is part of being a woman in STEM.	.401

Note. The first column shows the hypothesized factor for each item: V = visibility, P = prestige, R = resilience.

The administration at time point two yielded an alpha reliability of .86. Additionally, test-retest reliability was assessed across both time points. A Pearson correlation of .732 was calculated, which is significant at the $p < .01$ level. Thus it can be concluded that the measure has strong internal consistency and is stable across time.

CHAPTER V

STUDY 1 DISCUSSION

Although positive marginality has been discussed in the psychology, sociology, and feminist theory literatures, this study is the first known work to quantitatively assess the construct. Furthermore, this is the first study to apply the construct to women in STEM fields. The results of Study 1 demonstrate initial support for a quantitative measure of positive marginality. However, additional research is needed to further validate the measure and to build a theory surrounding the construct of positive marginality.

Hypothesis 1 predicted that visibility, prestige, and resilience would constitute three distinct dimensions of positive marginality. However, exploratory factor analysis across two samples did not reveal positive marginality to be a multidimensional construct. A confirmatory analysis further suggested a single factor structure. Only the qualitative pilot for Study 1 suggested three distinct factors, consistent with previous qualitative work proposing multiple dimensions of positive marginality (e.g., Alfred, 2001). However, dimensions previously reported in the literature differed slightly from those uncovered in the Study 1 pilot. Given the conflicting qualitative and quantitative evidence, it is likely that the ideas of resilience, visibility, and prestige that are reflected in the survey items describe the experience of positive marginality but do not exist as three distinct concepts or dimensions. Rather, these ideas overlap with one another to define the construct of positive marginality.

Hypothesis 2 predicted that visibility, prestige, and resilience would contribute to a higher-order factor: the overall construct of positive marginality. Items representing each of these areas did comprise a cohesive measure, thereby suggesting that they represent the broader construct of positive marginality. However, the dimensions of visibility, prestige, and resilience did not produce unique factors and therefore cannot be attributed to the measure's items or supported as dimensions of positive marginality. The qualitative pilot study revealed evidence of positive marginality among women pursuing STEM majors, and the results of Study 1 further supported evidence of the construct in such a context. Survey items reflected the extant literature's defining characteristics of positive marginality. At its core, positive marginality is conceptualized as an internalization of the positive aspects of belonging to a nondominant group (Mayo, 1982). By assessing the extent to which participants perceived and endorsed advantages of being a woman in STEM, the new measure taps the construct of positive marginality. Though preliminary in nature, initial evidence demonstrated sound psychometric properties, thereby revealing promise for assessing positive marginality in future research.

Results of Study 1 provided an important first step in exploring the nature of positive marginality, especially as it pertains to women's STEM experiences. This initial evidence is essential to carrying out future research and preliminarily demonstrates support for positive marginality as a measurable construct. However, future research is needed to further support and define the construct. First, the measure tested in Study 1 should be administered to additional samples to provide further evidence of the measure's reliability in terms of internal consistency as well as stability over time. Evidence of validity is also a necessary next step. Additional research should be conducted to explore the criterion-related validity of the measure. Such testing will not only serve to refine the measure but will develop the body of knowledge surrounding positive marginality. Study 2 provided additional opportunities to test the measure and further develop the construct. Given the lack of support for Hypothesis 1, Study 2 explored positive marginality as a unidimensional construct rather than emphasizing individual dimensions. Furthermore, Study 2 built upon Study 1 by extending the construct of positive marginality from educational to work settings.

CHAPTER VI

STUDY 2 INTRODUCTION

The extant positive marginality literature is largely descriptive and entirely qualitative in nature. Consequently, there exists a knowledge base surrounding the general tenets of and shared experiences related to positive marginality, but very little is understood about antecedents and consequences of the construct. The current research took an initial step in this direction, as it tested links between positive marginality and its antecedents and outcomes. Given the early stage of construct development, a complete nomological network was not explored, but rather the initial steps in building a theory surrounding positive marginality.

The hypothesized model was developed under some general assumptions about positive marginality. First positive marginality was tested within the context of women's STEM experiences, as positive marginality is a construct to be contextualized to a given domain and identity. Previous work on positive marginality has looked into a variety of domains (e.g., academic departments, social circles; Alfred, 2001; Hall & Fine, 2005). Positive marginality can occur so long as an individual is in a domain where he or she is marginalized, or underrepresented. Second, positive marginality is a continuous variable. In other words, an individual can experience positive marginality to a greater or lesser degree rather than simply being positively marginalized or not. Finally, positive marginality is a person-by-situation variable. Rather than acting as a trait or state of an individual, the emergence of the construct is contingent upon a context in which one is marginalized as well as individual differences, some of which are hypothesized below.

Although marginalized identities are not inherently stigmatized, marginality is often examined in contexts where the identity is devalued and negatively stereotyped. Therefore, positive marginality may best be understood through the theoretical framework surrounding social stigma (see Crocker et al., 1998 for a review). Positive identity construction often serves as a way to cope with adversity and stigma (Dutton, Roberts, & Bednar, 2010; Hobfoll, 1989). Individuals who do not effectively cope with stigma often suffer deleterious effects, including anxiety (Beilock, Rydell, & McConnell, 2007), dejection (Keller & Dauenheimer, 2003), and lowered performance (Steele & Aronson, 1995). However, many stigmatized individuals do not experience these detrimental effects (Crocker & Major, 1989; Miller & Kaiser, 2001). Two alternate ways of facing stigma have been asserted: a coping model and an empowerment model (Oyserman & Swim, 2001). When individuals cope with a stigma, they work to prevent negative consequences, usually by avoiding situations where the stigma is present or working to distance themselves from the stigma (Higgins, Roney, Crowe, & Hymes, 1994). However, the empowerment model characterizes stigmatized or marginalized individuals as proactive individuals who seek positive outcomes. Such individuals are not burned out by overcoming adversity, but rather feel enriched for doing so (Oyserman & Swim, 2002).

Because positive marginality is a form of reframing or constructing one's identity in a positive way, it should fit into the larger social stigma framework via the empowerment model. Positive marginality is another mechanism for handling a stigmatized identity, or a positive manifestation of such an identity. In other words, a positively marginalized individual feels empowered by his or her marginal identity. While some individuals may experience negative cognitive, affective, and performance effects, individuals with high levels of positive marginality should instead display positive outcomes, as they perceive their marginal status in a positive, rather than stigmatized, manner. In a sense, I conceptualize positive marginality as being antithetical to stereotype threat, which describes the risk of confirming negative stereotypes of one's identity group as true (Steele & Aronson, 1995). Thus, many of the individual and contextual characteristics that predict negative manifestations of a stigmatized identity, or stereotype threat effects, should also predict positive marginality. However, the outcomes associated with positive marginality should counter those associated with social stigma and stereotype threat. For example, individuals who experience social stigma tend to leave the domain in which their identity is stigmatized (Gupta & Bhawe, 2007). However positive marginality has largely explained the persistence of individuals in contexts where they are underrepresented (e.g., Unger, 1998).

Antecedents of Positive Marginality

The empowerment model of interpreting social stigma argues that a core group of determinants affect whether social stigma will be associated with negative outcomes such as dejection, anger, or performance decrements. This core group consists of self-perceptions, motivation, and interpretation of a stigmatized domain (Watson & River, 2005). One's interpretation of stigmatized identities is influenced by evaluations of self-worth and competence such that higher or more favorable evaluations are associated with an empowered reaction to stigma and positive outcomes (Crocker & Wolfe, 2001). Additionally, motivation is associated with one's reactions to stigma; individuals who demonstrate greater motivation within a given domain are more likely to be empowered in the face of stigma within that domain (Zimmerman, 1995). Lastly, the more closely individuals associate with a domain in which they are stigmatized, such as a STEM field, the more likely they are to respond to a stigmatized identity with empowerment rather than with avoidance coping (Watson & River, 2005). Thus, antecedents that stem from these determinants were hypothesized, specifically: core self-evaluations, need for achievement, and domain identification.

Core self-evaluations. Core self-evaluations, also referred to as positive self-concept, emerged as a dispositional explanation of job satisfaction (Judge, Locke, & Durham, 1997). Specifically, the construct represents a stable and consistent way that individuals understand and feel about themselves. As a dispositional trait, it is self-evaluative rather than descriptive in nature, fundamental (i.e., underlying surface traits), and broad in scope (Judge et al., 1997; Judge & Bono, 2001). The trait is a higher-order factor, consisting of four dimensions. *Self-esteem* represents the value one places on the self, including one's self-acceptance and self-respect (Harter, 1990). *Generalized self-efficacy* refers to an individual's assessment of how well he or she can act in accordance with a given situation (Bandura, 1982). While conceptually similar to self-esteem, self-efficacy is an indication of perceived competence as opposed to self-worth. *Neuroticism*, which may be regarded as the converse of emotional stability, is marked by insecurity, worry, and emotional instability (Barrick & Mount, 1991). Finally, *locus of control* describes the extent to which one feels they have control over outcomes or events, with a high degree being indicative of an internal locus of control (Rotter, 1990). The four dimensions of core self-evaluations are conceptually related, as they yield an average correlation of .60 (Bono & Judge, 2003). Furthermore, they demonstrate good fit in a single-factor model, with high factor loadings for self-esteem (average loading = .91), generalized self-efficacy (average loading = .81), locus of control (average loading = .74), and neuroticism (average loading = -.73; Erez & Judge, 2001).

From a social stigma perspective, core-self evaluations are a form of self-enhancement. Self-affirmation, in the form of efficacy and esteem building, has been identified as a strategy to overcome the negative effects associated with stigma (Martens, Johns, Greenberg, & Schimel, 2006). Moreover, core self-evaluations describe the fundamental appraisal individuals make regarding their worth and capabilities relative to their environment (Judge et al., 1997). Thus, individuals who make positive appraisals are likely to derive a sense of empowerment from their environment (Judge, Bono, Erez, & Locke, 2005; Seibert, Wang, & Courtright, 2011). Accordingly, core self-evaluations are a component of the empowerment model of stigma (Oyserman & Swim, 2001).

Individuals high in self-esteem are likely to extend their feelings of self-worth to contextualized feelings of competence and adequacy, such as in a work environment (Bandura, 1977). Self-esteem allows individuals to see themselves as valuable and worthwhile in a given work domain, whereas those lower in the dimension see themselves as less able to contribute to their work and organizations (Zimmerman, 1995). It would follow that women who view themselves as having greater levels of worth and value also view their position in STEM in a more positive light. Because they view themselves as valuable, they are less likely to feel threatened by working in a male-dominated context or to interpret such marginalization negatively.

Like self-esteem, generalized self-efficacy reflects an individual's assessment of his or her worth, though the focus of self-efficacy is on worth as it relates to one's competence (Bandura, 1982). It reflects a fundamental judgment of one's abilities, meaning that such judgments spill over into a variety of work and life domains. Thus, high levels of generalized self-efficacy should be linked to similarly positive appraisals of one's work context. For example, if a woman is high in generalized self-efficacy, she believes she is able to perform well at her job. Such a belief should buffer any deleterious effects of working in a domain in which one is marginalized and negatively stereotyped (e.g., a woman in STEM).

Individuals high in neuroticism report greater levels of worry, self-doubt, and nervousness (Barrick & Mount, 1991). Such negative affectivity is related to both conscious and non-conscious (i.e., implicit) evaluations of oneself (Robinson & Meier, 2005). It should follow that neuroticism would be negatively related to positive marginality, as negative affect should undermine positive evaluations of one's occupation of a marginalized role.

An internal locus of control is related to increased perceptions of impact and ability. Specifically, individuals with an internal locus of control feel better equipped to shape their work and work environment (Spreitzer, 1995). Those with an internal locus of control should thereby view themselves as capable of overcoming obstacles associated with a marginalized identity and thus demonstrate greater resilience in such situations.

As a higher-order factor, core self-evaluations positively predict one's perceptions of work characteristics such as meaningfulness and opportunity for growth (Judge, Locke, Durham, & Kluger, 1998). Such favorable evaluations of one's work reflect a sense of optimism and should in turn correspond with a more positive disposition to one's role at work, even when that role is a marginalized one. Additionally, core self-evaluations have been demonstrated to predict coping processes. Core self-evaluations are associated with fewer perceived stressors and less avoidance coping (i.e., avoiding a problem), and more active coping that aligns with empowerment (Kammeyer-Mueller, Judge, & Scott, 2009), thereby equipping individuals to demonstrate resilience and overcome obstacles. Because marginalized roles are marked by barriers, such empowerment-focused coping processes are likely to be especially beneficial in marginal contexts. For example, women in STEM often face obstacles such as social exclusion and negative stereotypes regarding their abilities (e.g., Singh et al., 2013). However, given their improved disposition toward their work context and coping skills, women who demonstrate high core self-evaluations are less likely to be negatively affected by such marginalization. Thus,

Hypothesis 3a: Core self-evaluations are positively related to positive marginality.

Need for achievement. Social stigma is often cited as a contributing factor to achievement gaps between demographic groups (Nguyen & Ryan, 2008). When evaluative scrutiny is high, meaning that performance in a given context is believed to be indicative of one's ability, marginalized individuals can become especially susceptible to a stigmatized identity (Frantz, Cuddy, Burnett, Ray, & Hart, 2004). However, individuals highly motivated by achievement are more likely to derive a sense of empowerment from contexts where performance is evaluated (Jha, 2010). For example, a woman working in an industry in which she is negatively stereotyped will likely feel empowered to overcome performance and evaluative pressures at work to the degree that she is achievement motivated.

Need for achievement refers to an individual's drive to excel, master skills, and meet high standards (McClelland, 1961). Individuals high in need for achievement display a propensity for difficult tasks, as they view such work as attainable and rewarding due to the inherent challenge. Simply put, employees motivated by achievement tend to be bigger risk takers within an organization (Spangler, 1992). Such employees tend to value achievement above any praise, recognition, or material rewards (Ramlall, 2004). Choosing to work in a situation in which one is marginalized is typically a difficult task. Marginalization is commonly associated with experiences of isolation, distress, and self-consciousness (Mayo, 1982). Pursuing a STEM field, a woman is likely to be in the minority, placing her in a more challenging and precarious position than would a more gender-neutral domain. Given that achievement-oriented individuals find reward in succeeding in difficult contexts, it would make sense that women who perform well in a marginalized role would adopt a more positive outlook on that role. For example, a woman physicist who is the sole woman at her place of work is likely to thrive on being in the minority if she has a high need for achievement, as her minority – or marginalized – status is a continual source of challenge.

Achievement-oriented individuals report greater levels of confidence in their work. (Daniels, et al., 2008). Furthermore, need for achievement is associated with choosing careers marked by heightened visibility and challenge, as well as performance and persistence in such domains (Collins, Hanges, & Locke, 2004; Wu, Matthews, & Dagher, 2007). Because positive marginality reflects heightened visibility in a given domain, as well as acceptance of that visibility, it should be the case that achievement-oriented individuals experience greater levels of positive marginality than do individuals who are not motivated by achievement.

Hypothesis 3b: Need for achievement is positively related to positive marginality.

Domain identification. According to identity theory (Stryker, 1980), individuals subscribe to multiple identities, each of which corresponds to a specific social role that they fulfill. These identities range from specific social roles (e.g., an engineer) to demographic characteristics (e.g., a woman; Burke & Stets, 2009; Hazari, Sonnert, Sadler, & Shanahan, 2010). Identity theory argues that an individual's multiple role identities are organized hierarchically and enacted according to identity salience. The salience of a given identity is largely determined by one's commitment to that identity (i.e., the importance placed on that role and the satisfaction derived from it; Stryker, 1980; Serpe & Stryker, 2011).

Generally, an identity tied to a specific social role is developed and becomes more salient through active participation in that role. For example, a STEM employee is likely to more strongly identify with the STEM domain to the extent that he or she participates in discipline-specific professional development activities (Major, Bauer, Morganson, & Orvis, 2014; Stryker & Burke, 2000). Furthermore, development of a STEM identity is related to beliefs regarding one's competence and ability to make contributions with his or her work. It is also negatively related to perceived costs associated with pursuing a STEM career (e.g., time, effort; Perez, Cromley, & Kaplan, 2014). In other words, individuals who identify closely with their field feel more competent and place a higher value on their work; they demonstrate empowerment. An individual who places personal significance on a given domain is more likely to feel empowered as an actor in that domain and to positively perceive his or her role in that domain.

In addition, underrepresented individuals who identify closely with their STEM discipline demonstrate greater persistence than do minorities who report lower levels of domain identification (Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011; Eccles & Barber, 1999). This may be at least partially explained by Richman, vanDellen, and Wood's (2011) findings that a stronger domain identification is associated with reduced susceptibility to threats to social identity, such as being an underrepresented minority in that domain. Individuals who identify more strongly with a given domain report greater levels of positive affect as a result of participating and performing well in that domain (Crocker, Karpinski, Quinn, & Chase, 2003). It should follow that an underrepresented minority who identifies strongly with a particular domain will experience a greater degree of positive marginality in that domain. For example, a woman scientist who considers science to be a central component of her identity and worth should feel more positively about her role in the science domain, despite being underrepresented in that domain. Put more simply, for a given situation to incite a sense of positive marginality, the domain in which that situation occurs should be regarded as important.

Hypothesis 3c: Domain identification is positively related to positive marginality.

Outcomes of Positive Marginality

Career Satisfaction. Career satisfaction is regarded as a marker of career success that encompasses an individual's feeling of satisfaction with his or her career as a whole (Judge, Higgins, Thoresen, & Barrick, 1999; Lounsbury et al., 2003). It is characterized by the positive affect regarding one's cumulated work experiences. These experiences include objective (e.g., salary, promotion) and subjective (e.g., an individual's appraisal of his or her career achievement) indicators (Judge & Bretz, 1994). Specifically, career satisfaction relies upon one's subjective appraisal in relation to his or her expectations and goals (Seibert & Kraimer, 2001). It is derived from an individual's evaluation of his or her career development and advancement across jobs (Greenhaus, Parasuraman, & Wormley, 1990).

Career satisfaction is predictive of individual variables such as global life satisfaction (Burke, 2001; Lounsbury et al., 2003). It is also related to a number of important organizational outcomes, such as organizational commitment (Joo & Park, 2010) and support for organizational change (Gaertner, 1989; Nauta, van Vianen, van der Heijden, van Dam, & Willemsen, 2010). Furthermore, career satisfaction predicts turnover intentions (Igbaria, 1991; Joo & Park, 2010). In the event of career dissatisfaction, employees are likely to search for career improvements (e.g., new employers; Nauta et al., 2010). Further, satisfaction with one's career predicts turnover intentions equally well as the perception of available work alternatives (Herriot, Gibbons, Pemberton & Jackson, 1994). In STEM fields, career satisfaction has been demonstrated to predict not only turnover intentions but actual turnover behavior (Boyd, Huang, Jiang & Klein, 2007).

Career satisfaction stems from organizational and individual factors. Quality of work life, which includes the extent to which one's job is viewed as rewarding and fulfilling as opposed to being marked by negative consequences, positively predicts one's career satisfaction (Rose, Beh, Uli, & Idris, 2006). Such findings have elucidated the construct of career satisfaction to show that satisfying careers include opportunities to utilize one's talents, face challenges, and take pride in what he or she is doing (Rose et al., 2006). Thus, meaningful and satisfying work is represented by aspects of positive marginality, as resilience often stems from overcoming challenges and prestige is derived from the pride one feels in doing his or her work.

Careers are considered to be more satisfying when they are higher in factors such as power and prestige (Korman, Mahler, & Omran, 1983). Therefore, individuals who report high levels of prestige associated with their work context (e.g., an employee experiencing positive marginality at work) should also report greater levels of career satisfaction. Career satisfaction is also predicted by personality traits such as emotional resilience, optimism, and tough-mindedness (Gibson et al., 2003; Lounsbury, Moffit, Gibson, Drost, & Stevens, 2007). Such traits are evidenced by individuals who experience positive marginality. Given the connections between extant predictors of career satisfaction and characteristics of positive marginality, it is expected that positive marginality will also predict career satisfaction.

Hypothesis 4a: Positive marginality is positively related to career satisfaction.

Persistence Intentions. Previous research on positive marginality has been qualitative in nature. Although the construct has repeatedly been found as an explanatory factor in the persistence of underrepresented minorities (Alfred, 2001; Mayo, 1982; Unger, 1998, 2000), quantitative work is a necessary next step in substantiating that finding. Though limited, the extant positive marginality literature has explored the construct largely as a means of explaining the persistence of underrepresented minorities in various contexts (e.g., Unger, 1998). For example, Alfred (2001) conducted a qualitative study to uncover the reasons behind African

American women faculty members' persistence at predominantly White universities. Characteristics of positive marginality emerged in participant responses, resulting in the finding that positive marginality was a common thread among women who persisted in the field.

Within a STEM context, it is likely that positive marginality plays a role in predicting persistence. Much of the existing STEM research focuses on explaining attrition via discipline-specific abilities and interests (e.g., Ackerman, Kanfer, & Beier, 2013; Crisp, Nora, & Taggart, 2009; Lent et al., 2015). While such factors do predict both voluntary and involuntary turnover (Le, Robbins, & Westrick, 2014; Lee, Burch, & Mitchell, 2014), they do not comprise a complete picture of STEM persistence. In exploring persistence, research has uncovered other individual variables that explain retention in STEM fields. For example, embeddedness (i.e., the extent to which one is anchored in a given context based on his or her degree of fit, links to others in that domain, and sunk costs incurred in leaving that context; Mitchell, Holtom, Lee, Sablynski, & Erez, 2001) has recently emerged as an explanatory mechanism behind persistence in STEM fields (Morganson, Major, Streets, Litano, & Myers, 2015). Such research underscores the value of individual factors beyond one's competence and interests in work; broader attitudes toward the position one occupies in his or her work context also seem to play a role. Positive marginality is such a construct, as it is a product of one's personal qualities as they interact with a specific domain.

Hypothesis 4b: Positive marginality is positively related to persistence intentions.

CHAPTER VII

STUDY 2 METHOD

Participants

An a priori power analysis was conducted using the equations provided by Kim (2005) to determine an appropriate sample size for this research. Specifically, necessary sample sizes were calculated based on 80% power and acceptable fit indices for comparative fit index (CFI), root-mean-square-error of approximation (RMSEA), and Steiger's γ. Following conventions established by Hu and Bentler (1999), acceptable fit values were set at .95 for CFI and Steiger's γ and .05 for RMSEA. Sample sizes of 329, 133, and 419 were calculated for CFI, Steiger's γ, and RMSEA respectively. Although a sample of 419 was sought it was not obtained.

During the first phase of participant recruitment, which was conducted via MTurk, 346 individuals completed the screening survey. Despite the survey being advertised for women working in STEM, 41 of the individuals who completed the screening survey were men and were thus screened out from further participation. Additionally, 25 participants were not invited to participate in the study because they did not work in a STEM occupation. Therefore, 280 participants completed the screening survey and were invited to participate in the full study. Of the participants invited to participate in the study, 218 individuals completed Survey 1. When the data were screened for insufficient effort responding, 21 participants failed at least two quality check items, yielding a sample size of 197. A total of 82 participants completed Survey 2, five of whom failed at least two quality checks. Thus, a final sample size of 77 participants was obtained via MTurk.

During the second phase of recruitment, 289 participants completed the screening survey. All 289 participants met the qualifications for participation and were invited to participate in the full study. While all 289 women completed Survey 1, 33 of those women failed at least two quality check items and were removed from the study (*N* = 256). The remaining participants were invited to complete the study and 240 of those participants completed Survey 2. Four participants failed at least two of the quality check items, resulting in a final sample size of 236 for the second phase of recruitment. Across both means of recruitment, a sample of 313 participants was obtained for the final sample.

The final sample had an average age of 34.01 (*SD* = 8.04) and worked an average of 39.01 weekly hours (*SD* = 8.16) in their STEM occupation. Of the 313 participants, 174 worked in Engineering and Technology (55.6%) and the remaining 139 worked in Science and Math (44.4%). The majority of the sample was Caucasian (55.6%) or Asian (20.4%). Additionally, 159 participants reported membership in professional societies or organizations that focus on women's participation in STEM fields (50.8%) and 44 reported active membership (e.g., roles on special committees, officer positions; 14.1%).

Procedure

The study employed a cross-sectional self-report survey design. Surveys were distributed at two points in time, separated by two weeks, to offset common method bias concerns (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). Hypothesized antecedents of positive marginality (i.e., core self-evaluations, need for achievement, domain identification) were assessed at time one, hypothesized outcomes of positive marginality (i.e., career satisfaction, persistence intentions) were assessed at time two, and positive marginality was assessed at both time points.

Online data collection occurred across two phases of recruitment. During the first phase, surveys were administered via Amazon's Mechanical Turk (MTurk). Mechanical Turk launched in 2005 as a means of crowd-sourcing labor intensive tasks. It has recently been adopted as a source of research participants in Psychology because it provides a large and diverse subject pool, low costs, and brief turnaround times (Crump, McDonell, & Gureckis, 2013; Mason & Suri, 2012). Some differences between MTurk and laboratory participants have been identified: MTurk participants are less likely to pay attention to experimental manipulations, are more likely to research answers on the Internet, and report lower levels of extraversion and self-esteem than laboratory participants. However, this difference was only statistically significant when comparing MTurk participants to student laboratory samples, and did not reach significance when compared to adults recruited from the broader community (Goodman, Cryder, & Cheema, 2013). Given that the current research is concerned with a population of working adults, this finding was not seen as a barrier for using MTurk.

The survey was advertised as available for women working in science, technology, engineering, or mathematics. A qualification survey was first posted in which respondents answered demographic questions (i.e., gender, age, current job, number of hours worked per week, and membership in professional societies) to determine their eligibility for inclusion in the study. Participants were compensated $0.10 for completing the brief qualification survey.

Participants who indicated on the qualification survey that they were women working at least 32 hours per week in a STEM profession within the United States were then invited to take the first survey. The MTurk bonus function was used to distribute invitations to the first survey. The bonus function facilitates communication with MTurk participants while protecting anonymity. Participants who completed Survey 1 were compensated $1. Two weeks later, those participants received an invitation via the bonus function to complete Survey 2. In an attempt to reduce attrition between time points, compensation was increased to $2 for Survey 2. In order to receive compensation, participants had to complete the surveys in their entirety and pass quality checks implemented to detect insufficient effort responding. Items to indicate insufficient effort responding were included and evaluated in accordance with the process used in Study 1 (i.e., participants must pass two of the three quality check items in order to receive compensation).

Although MTurk provides the ability to recruit from a large group of individuals, the population targeted by the current research was likely too specific for such a medium, as MTurk did not yield a sufficient sample size, a second phase of participant recruitment was conducted. An approach was adopted to better advertise to members of the intended population. The study was advertised via LinkedIn and Facebook to professional membership groups for to which women STEM professionals were likely to belong. These groups included Society of Women Engineers; Women in Science, Engineering, and Technology; Graduate Women in Science; American Association of University Women, and Association for Women in Science. The advertisement informed participants of the compensation available through MTurk and provided a link to participate via MTurk for compensation. An anonymous link for the second survey was posted to the same groups two weeks later.

For participants who did not wish to complete the survey via MTurk, an anonymous link was provided. Beginning with the screening survey, participants who accessed the survey via the anonymous link were instructed to create a unique identification code. Specifically, participants were instructed to create a six-digit code in which the first two digits were the participant's middle initial and the first letter of their street of residence, respectively. The last four digits were the final four digits of the participant's telephone number. Participants were instructed to provide this code for each survey so that their data could be linked across time points.

Measures

Positive marginality was assessed with the measure piloted in Study 1. The measure yielded an alpha reliability of .85 at time one and .86 at time two. All antecedent and outcome measures have been previously validated and have demonstrated strong psychometric properties in previous research.

Core self-evaluations. Core self-evaluations were assessed with Judge et al.'s (2003) Core Self-Evaluations Scale (Appendix D). The 12-item measure assessed all four dimensions of core self-evaluations (i.e., self-esteem, generalized self-efficacy, neuroticism, and locus of control) with items such as "overall, I am satisfied with myself." The scale demonstrated an alpha reliability of .74, though this coefficient was lower than the alpha reliability obtained by Judge et al. during scale development (α = .84; 2003).

Need for achievement. Need for achievement was measured with Ray-Lynn Achievement Orientation Scale (Ray, 1971; Appendix E). This 14-item measure assessed a single factor of need for achievement with items such as "have you always worked hard in order to be among the best in your own line? (school, organization, profession)." Although the Thematic Apperception Test has most commonly been used to measure need for achievement, it has been the subject of considerable controversy regarding its psychometric properties (Soley, 2010). Further, meta-analytic findings have shown that the Thematic Apperception Test is most effective in the presence of social incentives (Spangler, 1992). Because the current study did not establish such incentives, a questionnaire was deemed more appropriate. The Achievement Orientation Scale yielded a reliability coefficient of .75, which is consistent with findings from previous research (Ray, 1979).

Domain identification. Identification with STEM was assessed using an adapted version of Chemers et al.'s (2011) measure of identity as a scientist (Appendix F). The measure included items such as "In general, being a STEM professional is an important part of my self-image," to assess the degree to which an individual identifies with the STEM domain. In the current study, the measure demonstrated an alpha reliability of .68. The reliability coefficient obtained by the current research was considerably lower than that of previous research (α = .89; Chemers et al., 2011). Because the reliability of this scale was lower than what is considered acceptable (Nunnally, 1978), the scale was investigated for problematic items that might be weakening the reliability coefficient. However, no such items were detected.

Career satisfaction. Career satisfaction was assessed with the five-item measure developed by Greenhaus et al. (1990; Appendix G). A sample item included "I am satisfied with the progress I have made toward meeting my overall career goals." The scale demonstrated low reliability (α = .63) and was thus examined at the item level. However, no individual items appeared to drive the low scale reliability. While low reliability was revealed in the current study, this scale has been validated and demonstrated acceptable reliability (α = .88) upon development (Greenhaus et al., 1990).

Persistence intentions. Persistence intentions was measured with an adaptation of the four items used by Martin, Hunt, and Osborn (1981; Appendix H). The items were adapted to reflect intent to stay within a STEM career rather than within a specific organization. A sample item was "Which of the following statements most clearly reflects your feelings about your future in STEM in the next year?" The scale yielded an alpha reliability of .76. The current reliability coefficient is comparable to that of previous research (α = .78; Martin et al., 1981).

CHAPTER VIII

STUDY 2 RESULTS

Analytic Approach

Data were first inspected for univariate and multivariate outliers. No cases were identified as extreme univariate outliers (i.e., yielding a *z*-score greater than 3 standard deviations beyond the mean; Tabachnik & Fidell, 2007). Multivariate outliers were examined on the basis of influence, leverage, and discrepancy. Influence was assessed via Cook's D, leverage via Mahalnobis distance, and discrepancy via externally studentized residuals. Based on these criteria, no multivariate outliers were detected. Further, the data were tested against all of the assumptions of a regression analysis. Specifically, plots of the residuals were created to ensure that the model is complete, and that residuals have a constant variance (i.e., homoscedasticity), are independent across participants, and are normally distributed. Variables were also screened for multicollinearity; no Variance Inflation Factor indicated multicollinearity (Mansfield & Helms, 1982). Missing data were handled with EM imputation in MPlus7. Finally, scale means, standard deviations, and intercorrelations were calculated (see Table 8).

The correlations presented in Table 8 provide preliminary support for all components of Hypothesis 3. Specifically, core self-evaluations, need for achievement, and domain identification were significantly and positively related to positive marginality. Additionally, the correlations provide preliminary support for Hypothesis 4, as positive marginality was significantly and positively correlated with career satisfaction and persistence intentions.

Hypotheses were tested with structural equation modeling in Mplus7. Prior to assessing the structural models that test the hypothesized relationships, confirmatory factor analyses were conducted to assess the fit of the measurement model. The structural models were tested using structural equation modeling with maximum likelihood estimation and bootstrapping at 5,000 iterations.

Measurement Equivalence

Prior to testing the measurement and structural models, measurement equivalence across time points was analyzed for positive marginality. Measurement equivalence demonstrates that scores on a measure provide the same information over time (Kline, 2011). Confirmatory factor analysis was used to test equivalence across time points. Specifically, a confirmatory factor analysis was first conducted in which the 15 items measured in Survey 1 loaded onto one factor and the 15 items measured in Survey 2 loaded onto a second factor; this was the unconstrained model. Second, a constrained model was tested in which similar parameters were constrained to equality. A chi-square difference test was then used to determine if the constrained and unconstrained models significantly differed. The model chi-square fit statistic for the unconstrained model was $\chi^2(404) = 708.489$. The constrained model yielded the following chi-square results: $\chi^2(418) = 724.617$. A chi-square difference test was non-significant, $\chi^2(14) = 22.201$, $p = .075$, thereby indicating measurement equivalence for positive marginality across both time points.

The Measurement Model

Prior to assessing the structural model of hypothesized relationships, a measurement model was assessed with confirmatory factor analysis. Because MPlus7 does not provide modification indices for models that have been bootstrapped, measurement models were first tested without bootstrapping to assess potential sources of misfit. The expected factor structure for the current research was one containing six factors: core self-evaluations, need for achievement, domain identification, positive marginality, career satisfaction, and persistence intentions. Items on the corresponding scales served as indicators of each factor (see Figure 1). The expected factor structure was tested against a 1-factor structure in which all items loaded onto a single latent factor, and a 3-factor structure in which all hypothesized antecedents formed a single factor, all hypothesized outcomes formed a single factor, and positive marginality served as the final factor.

Table 9 displays the model fit statistics for each of the three models. Global fit measures of chi-square and root-mean-square error of approximation (RMSEA) were assessed. Because the model chi-square is an indicator of model misfit, good model fit is indicated by a non-significant chi-square. RMSEA indicates good fit when values are less than or equal to .06 (Hu & Bentler, 1999). The standardized root-mean-square residual (SRMR) indicates variance misspecification and indicates good model fit when it is less than or equal to .08 (Hu & Bentler, 1999). Additionally, the comparative fit index (CFI) assess loading misspecification and indicates good fit when it exceeds .95 (Hu & Bentler, 1999).

Chi-square difference tests were conducted to determine the factor structure that best represented the data. As Table 10 indicates, the expected factor structure fit the data significantly better than did the 1- and 3-factor models. No model yielded statistics entirely indicative of good fit. However, the RMSEA and SRMR of the expected factor structure did suggest good fit. Further, as Table 11 displays, all standardized factor loadings for the expected measurement model were significant. Prior to testing a bootstrapped model, modification indices were examined. Several cross-loadings and error correlations were suggested, especially notable were several cross loadings between domain identification and positive marginality items. Specifically, modification indices suggested that all five domain identification items loaded onto the positive marginality factor. Closer examination of both scales suggested potential conceptual overlap, as items in the positive marginality scale likely imply close identification with STEM fields and the two measures were highly correlated (*r* = .780, *p* < .001). Thus, a five-factor model was also tested in which all domain identification and positive marginality items loaded onto a single factor. Of all measurement models tested, the five-factor model best fit the data, χ^2 (1421) = 21167.324, *p* < .001, CFI = .910, RMSEA = .042 (90% CI [.036, .048]), SRMR = .057. While the CFI still did not meet acceptable standards, (Hu & Bentler, 1999), a chi-square difference test revealed significantly better fit for the five-factor model than for the expected factor structure, χ^2 (6) = 117.159, *p* < .001. Furthermore, all items significantly loaded onto their corresponding factors.

Because the five-factor model provided the best fit, domain identification was excluded from further analysis. Given the empirical and conceptual overlap between positive marginality and domain identification, pursuing Hypothesis 3c cannot be justified. Therefore, a final measurement model was tested which did not include domain identification. This model yielded improved fit statistics compared to the preceding models: χ^2(1165) = 558.466, *p* < .001, CFI = .938, RMSEA = .032 (90% CI [.024, .039]), SRMR = .050. Furthermore, all items significantly loaded onto their corresponding factors (see Table 12).

Table 8

Means, Standard Deviations, and Intercorrelations

Variable	Mean	SD	1	2	3	4	5	6	7
1. Core Self-Evaluations[a]	3.25	0.53	(.74)						
2. Need for Achievement[a]	31.02	5.20	.49*	(.75)					
3. Domain Identification[a]	3.56	0.71	.50*	.45*	(.68)				
4. Positive Marginality[a]	3.60	0.59	.54*	.51*	.78*	(.85)			
5. Positive Marginality[b]	3.70	0.55	.50*	.47*	.67*	.73*	(.86)		
6. Career Satisfaction[b]	3.61	0.60	.50*	.26*	.38*	.40*	.60*	(.63)	
7. Persistence Intentions[b]	3.75	0.59	.47*	.46*	.56*	.53*	.55*	.52*	(.76)

Note. $N = 313$; [a] Responses collected in Survey 1; [b] Responses collected in Survey 2; Values in parentheses are alpha reliabilities; Scores for Need for Achievement can range from 14 – 42; Scores on all other variables range from 1 – 5; * $p < .01$.

Table 9

Measurement Model Fit Comparisons

Fit Statistic	Expected Model	3-Factor Model	1-Factor Model
χ^2	χ^2 (1415) = 924.753, $p < .001$	χ^2 (1427) = 1122.584, $p < .001$	χ^2 (1430) = 1237.389, $p < .001$
CFI	.895	.829	.791
RMSEA	.043	.054	.060
RMSEA 90% CI	[.038, .049]	[.049, .059]	[.055, .064]
SRMR	.051	.054	.060

Table 10

Chi-Square Difference Tests

Models	χ^2 Difference
Expected vs. 3-Factor	χ^2 (12) 204.613, $p < .001$
Expected vs. 1-Factor	χ^2 (15) 306.450, $p < .001$

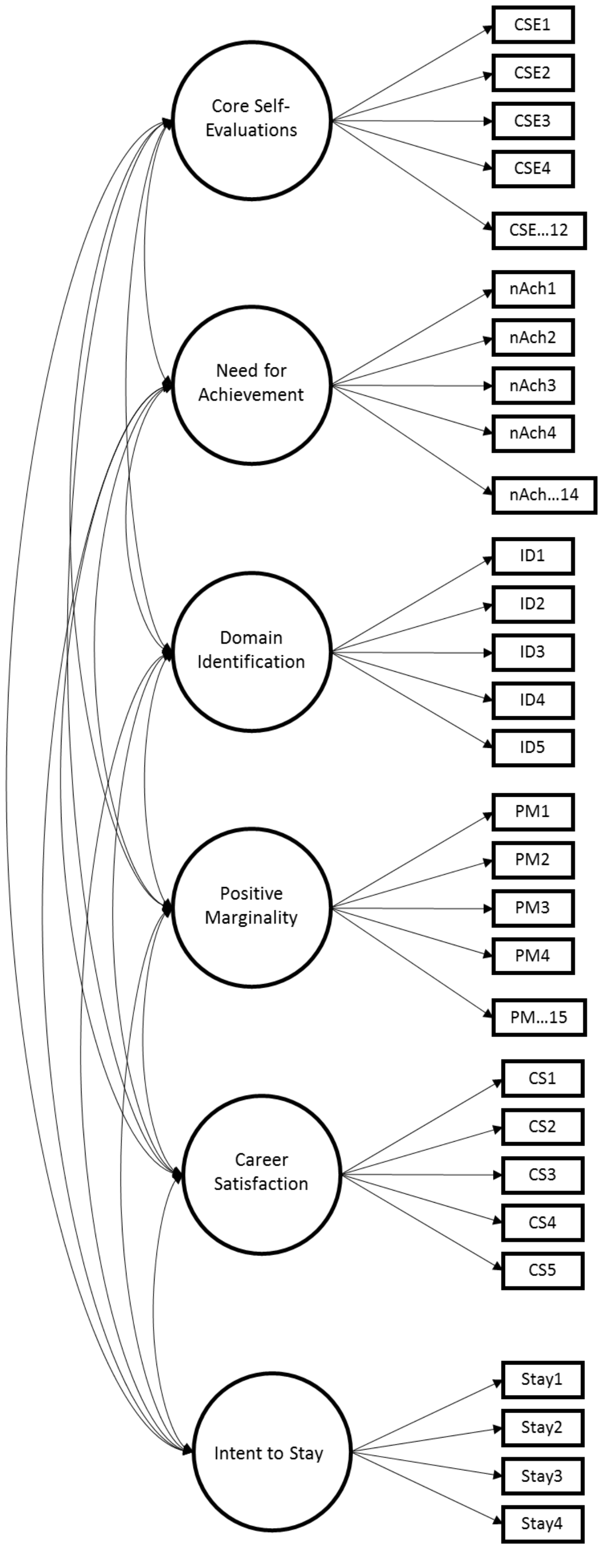

Figure 1. Measurement model.

Table 11

Factor Loadings for Measurement Model of Expected Factor Structure

Factor	*β*
Core Self-Evaluations	
CSE_1	.617
CSE_2	.532
CSE_3	.448
CSE_4	.562
CSE_5	.431
CSE_6	.504
CSE_7	.606
CSE_8	.501
CSE_9	.435
CSE_10	.560
CSE_11	.507
CSE_12	.625
Need for Achievement	
nAch_1	.734
nAch_2	.544
nAch_3	.709
nAch_4	.519
nAch_5	.659
nAch_6	.713
nAch_7	.686
nAch_8	.688
nAch_9	.846
nAch_10	.646
nAch_11	.570
nAch_12	.602
nAch_13	.705
nAch_14	.499
Domain Identification	
ID_1	.630
ID_2	.653
ID_3	.614
ID_4	.577
ID_5	.546
Positive Marginality	
PM_1	.628
PM_2	.585
PM_3	.520
PM_4	.514
PM_5	.547
PM_6	.602

Table 11 (continued)

Factor	β
PM_6	.548
PM_7	.596
PM_8	.569
PM_9	.627
PM_10	.560
PM_11	.564
PM_12	.584
PM_13	.514
PM_14	.650
PM_15	.563
Career Satisfaction	
CS_1	.608
CS_2	.529
CS_3	.516
CS_4	.598
CS_5	.585
Persistence Intentions	
Stay_1	.671
Stay_2	.747
Stay_3	.680
Stay_4	.591

Table 12

Factor Loadings for Five-Factor Measurement Model

Factor	β
Core Self-Evaluations	
CSE_1	.625
CSE_2	.503
CSE_3	.525
CSE_4	.527
CSE_5	.695
CSE_6	.520
CSE_7	.608
CSE_8	.496
CSE_9	.491
CSE_10	.630
CSE_11	.570
CSE_12	.610

Table 12 (continued)

Factor	β
Need for Achievement	
nAch_1	.747
nAch_2	.505
nAch_3	.761
nAch_4	.501
nAch_5	.581
nAch_6	.721
nAch_7	.499
nAch_8	.533
nAch_9	.621
nAch_10	.735
nAch_11	.818
nAch_12	.691
nAch_13	.700
nAch_14	.497
Positive Marginality	
PM_1	.634
PM_2	.588
PM_3	.621
PM_4	.518
PM_5	.554
PM_6	.653
PM_7	.603
PM_8	.737
PM_9	.694
PM_10	.663
PM_11	.618
PM_12	.600
PM_13	.601
PM_14	.641
PM_15	.599
Career Satisfaction	
CS_1	.689
CS_2	.535
CS_3	.548
CS_4	.696
CS_5	.585
Persistence Intentions	
Stay_1	.678
Stay_2	.675
Stay_3	.746
Stay_4	.589

Hypothesis Testing

The structural model was tested using structural equation modeling in MPlus7 with maximum likelihood estimation and bootstrapping at 5,000 iterations. Because the measure of positive marginality performed similarly across time points, a single time point of positive marginality was included in the model. Positive marginality as measured at time point one was included so as to better alleviate common method bias concerns with the outcome variables of interest. Membership in organizations emphasizing women's STEM persistence was initially included as a control variable in the current research, as such organizations could likely influence women to think of their role in STEM in a way that aligns with positive marginality. However, the variable neither significantly predicted positive marginality nor affected the significance of any relationships among variables. Therefore, the variable was excluded from the results of the current research but the model including this control variable is displayed in Appendix I.

The hypothesized antecedents contributed a statistically significant amount of variance in positive marginality (R^2 = .439, p < .001), career satisfaction (R^2 = .454, p < .001), and persistence intentions (R^2 = .504, p < .001). However, the structural model yielded conflicting evaluations of model fit: χ^2(1169) = 566.603, p < .001, CFI = .931, RMSEA = .033 (90% CI [.026, .041]), SRMR = .052.. The obtained chi-square was significant, but this statistic is sensitive to sample size such that it is commonly significant when large samples are analyzed (Schumacker & Lomax, 2004). Thus, a significant chi-square statistic is not in itself problematic. Additionally, the CFI did not meet established fit guidelines (Hu & Bentler, 1999). However, both the RMSEA and SRMR suggested that the model fit the data well, as both statistics fell below the recommended cutoff values (Hu & Bentler, 1999).

To test the hypotheses, individual paths were tested for statistical significance (Figure 2). Such tests indicated support for Hypothesis 3. Core self-evaluations significantly predicted positive marginality (β = .383, p < .001), thereby supporting Hypothesis 3a. Additionally, need for achievement was found to significantly predict positive marginality, (β = .266, p < .001), providing support for Hypothesis 3b. Finally, Hypothesis 3c was not tested, as domain identification demonstrated substantial overlap with positive marginality. Hypothesis 4 was also supported; positive marginality was a significant predictor of career satisfaction (Hypothesis 4a; β = .555, p < .001) and persistence intentions (Hypothesis 4b; β = .455, p < .001).

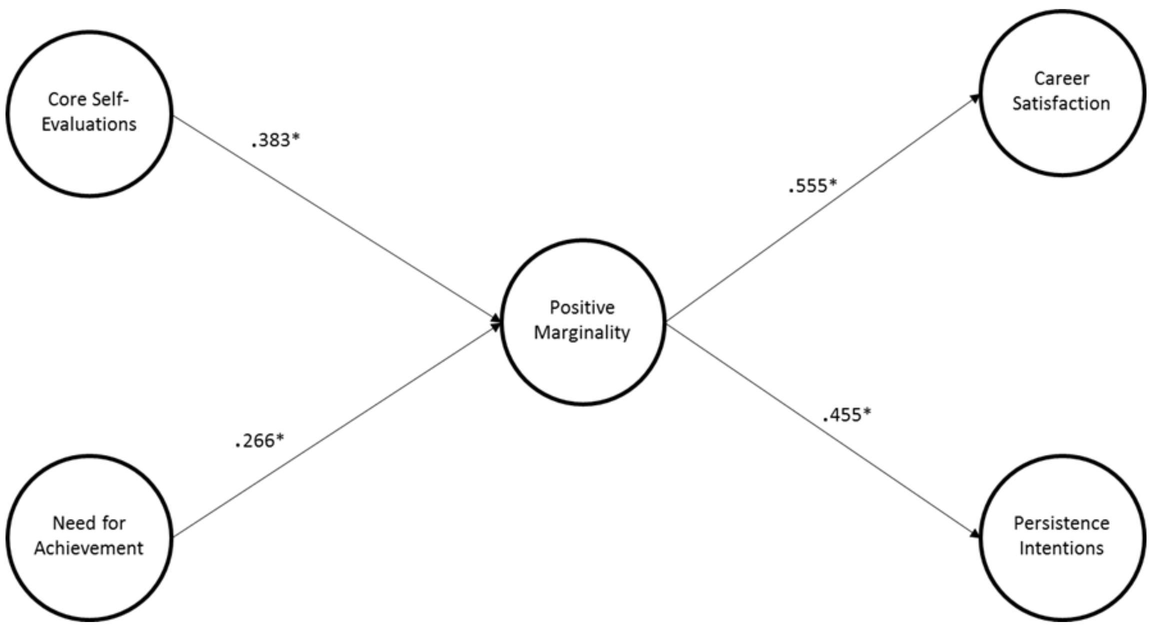

Figure 2. Hypothesized structural model. *p < .001

Ad Hoc Exploratory Analyses

While mediating hypotheses were not proposed, indirect effects were examined to better understand the role of positive marginality in the hypothesized model (see Table 13). Consistent with the results of the hypothesis tests, significant indirect effects were uncovered for all hypothesized antecedents on the outcome variables. Specifically, the indirect effect from core self-evaluations to career satisfaction was positive and statistically significant (β = .115, 95% CI

[.050, .180]). The indirect effect from need for achievement to career satisfaction via positive marginality was also positive and significant (β = .110, 95% CI [.047, .172]). Regarding persistence intentions, core self-evaluations demonstrated a significant and positive indirect effect via positive marginality (β = .286, 95% CI [.221, .352]). The indirect effect from need for achievement to persistence intentions via positive marginality was positive and significant (β = .277, 95% CI [.213, .341]).

Direct effects were also assessed between the two antecedent and two outcome variables. Core self-evaluations significantly predicted career satisfaction while need for achievement did not (β = .492, p < .001; β = .055, p = .403, respectively). Additionally, core self-evaluations and need for achievement significantly predicted persistence intentions (β = .155, p = .023; β = .191, p = .005, respectively; Figure 3). A structural model including direct and indirect effects yielded the following fit statistics: $\chi^2(1162)$ = 487.800, p < .001, CFI = .940, RMSEA = .038 (90% CI [.030, .045]), SRMR = .051.

Table 13

Summary of Indirect Effects

Path	Total Indirect Effect	SE	Sig
Career Satisfaction			
CSE → PM → CS	.115	.039	.003
ACH → PM → CS	.110	.038	.004
Persistence Intentions			
CSE → PM → PI	.286	.040	.001
ACH → PM → PI	.277	.039	.001

Note. ACH = Need for Achievement, CSE = Core Self-Evaluations, PM = Positive Marginality, CS = Career Satisfaction, PI = Persistence Intentions.

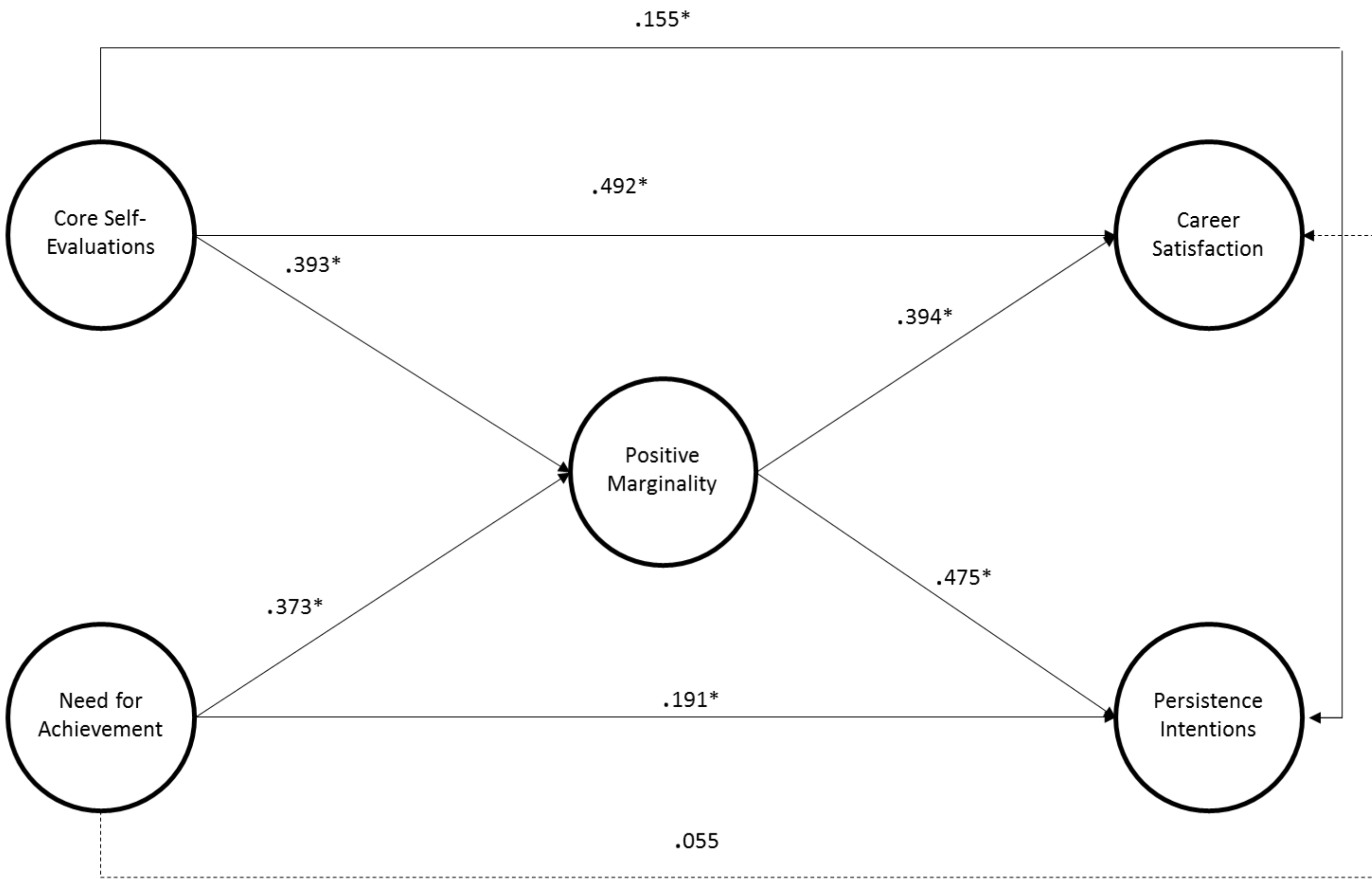

Figure 3. Structural model with direct effects. *$p < .001$.

CHAPTER IX

STUDY 2 DISCUSSION

This study further established a measure of positive marginality and introduced a partial nomological network for the construct. In conjunction with Study 1, the current study demonstrated the applicability of the construct of positive marginality as well as the validity of the new measure for women in STEM.

Support for Hypotheses 3 and 4 suggest that a partial nomological network has been identified by the current study. Core self-evaluations and need for achievement were both supported antecedents of positive marginality within a structural equation modeling framework. Additionally, structural equation modeling revealed that positive marginality was predictive of career satisfaction and persistence intentions. Therefore, the current study provides initial support of career satisfaction and persistence intentions as outcomes of positive marginality among women working in STEM.

Evidence in support of the hypotheses suggests that positive marginality fits into a conceptual framework commonly used to understand social stigma. Thus, one way to interpret positive marginality may be as a positive stigma. Because the hypotheses were driven by previous research on empowerment and stigma, the current findings align with an empowerment model of perceiving and handling a stigmatized or marginalized identity (Oyserman & Swim, 2002). Furthermore, exploratory analyses of indirect effects suggest positive marginality as a partial mediator of the relationship between antecedents and outcomes, as all indirect paths displayed significant effects and all but the path between need for achievement and career satisfaction were significant.

In the current study, domain identification demonstrated substantial overlap with positive marginality. It is likely that items included in the positive marginality measure are also capturing domain identification, thereby contributing to the overlap. All items included in the positive marginality measure were contextualized to women's pursuit of STEM fields. The context-specific nature of these items is therefore likely measuring the extent to which women identify with the STEM domain.

Theoretical Implications

By introducing a quantitative measure of positive marginality as well as a partial nomological network surrounding the construct, the current study unlocks new paths for understanding matters of diversity and inclusion in the workplace. Regarding the STEM education and retention literature, the current research introduces a new means of understanding women's experiences in STEM and persistence in the STEM career pipeline. To date, much of the research on women's career development in STEM emphasizes explanations of women's attrition from STEM careers (Blickenstaff, 2005; Ceci & Williams, 2007). However, the current research examined a sample of women who have persisted in STEM fields to better understand why they stay. This approach creates a deeper understanding of women's STEM retention as well as the experiences of women pursuing STEM careers.

The current research provides a conceptual framework in which to understand positive marginality. Positive marginality has previously been conceptualized as a form of positive self-definition among members of non-dominant groups (Alfred, 2001; Unger, 1998); the current research is consistent with this idea. The findings of the present study go beyond defining positive marginality to identifying individual characteristics that predict the experience of it, thereby providing a deeper understanding of the role of individual differences in the STEM gender gap. The current findings also establish relationships between positive marginality and career outcomes. Significant relationships between positive marginality and career satisfaction and persistence intentions were demonstrated among women in STEM occupations.

The application of positive marginality to a new context, women pursuing STEM careers, further suggests that this construct is relevant to a number of underrepresented populations. Consistent with previous qualitative research (Alfred, 2001; Unger, 1998), the current research demonstrates the importance of positive marginality to career persistence among minority groups. Demonstrating this finding with a new population provides additional support for the role of positive marginality in understanding the persistence and retention of underrepresented groups. By providing a new context and quantitative support for previous findings, the current research provides new discourse for understanding diversity in the workplace.

Practical Implications

The idea that marginal identities are not always interpreted as subordinate or deficient is not new (Alfred, 2001; Mayo, 1982). However, quantitatively measuring the construct is a new approach and one that may provide leverage for addressing retention. The current research provides a measure with strong psychometric properties that can be used to advance research and work with women pursuing STEM careers. This measure is a tool for further understanding women's retention in STEM and can be utilized in additional research on the topic.

The measure of positive marginality can also be used by employers, educators, career counselors to identify the factors that resonate most with women pursuing a STEM discipline. Women high in positive marginality may respond best to intervention and retention efforts that highlight the alignment between their career trajectory and components of positive marginality. Both in higher education and organizational settings, emphasizing aspects of one's STEM field or occupation that align with positive marginality may help retain women in the STEM career pipeline. This could be accomplished by highlighting resources available to women such as grants and scholarships, appealing to the prestige associated with being a woman in STEM, and underscoring the significance of women's STEM participation to other women who have similar interests in the field.

Limitations

A few limitations must be taken into consideration when interpreting the current findings. First, findings regarding Hypotheses 3c and 4a must be interpreted with caution due to measurement error. The measure of identity as a STEM professional demonstrated low reliability. The measure has demonstrated acceptable reliability in previous research (Chemers et al., 2011), however in that research it served as a measure of identity as a scientist. For the current study, items were adapted to inquire about identity as a STEM professional in order to generalize to a broader population. Given the low scale reliability, it is probable that domain identification is a more specific construct. The identity of a STEM professional may not be what resonates with the population of interest. Rather, the identity may be tied to more specific field or industry (e.g., engineering, physics). Because of the low reliability, validity of the measure may also be lower than desirable, meaning the measure of domain identification included in the current research may not have consistently measured the intended construct. Furthermore

Despite consistent demonstration of acceptable reliability (e.g., Porath, Spreitzer, Gibson, & Garnett, 2012; Seibert, Kraimer, & Liden, 2001), the career satisfaction scale used in the current research also demonstrated low reliability. Because four of the five items inquire about career progress, the scale may be ill-suited for a broad cross-section of professionals. Participants ranged in age from 18 to 65, suggesting a large range in career stages was represented by the sample. Career progress may be interpreted differently based on where an individual is in the career pipeline, making interpretation of the scale in a broad sample difficult. Measurement error commonly attenuates relationships between variables (Cortina, 1993). Thus, the detection of significant relationships despite low reliability coefficients likely indicates the strength of the true relationships between these variables.

Additionally, the current research is cross-sectional in nature. A longitudinal design would be better suited for revealing directionality of the relationships included in the model and interpreting the current findings. Although the current research utilized temporal separation of predictor and criterion variables, a longitudinal design would further reduce the concern of common method bias (Podsakoff et al., 2003).

Future Directions

The current research lays the foundations for a number of future investigations of positive marginality. First, additional testing of the proposed nomological network is needed to strengthen the conclusions drawn from the current research. Especially given the issues surrounding domain identification, more work is needed to better understand antecedents of positive marginality. A viable next step would be the examination of other contextualized predictors. For example, core self-evaluations reflects an overarching appraisal one makes of the self. Exploring dimensions of core self-evaluations that are contextualized to the given population may better predict positive marginality. When considering women in STEM, factors like math and science self-efficacy may be better suited for models of positive marginality. Additionally, finding support for other antecedents that are contextualized to STEM would better elucidate the findings surrounding domain identification. If domain identification remains a problematic variable while other contextualized predictors fit into a model of positive marginality, it is more likely the case that the current measure of positive marginality is also capturing domain identification. The current model can also be expanded in terms of outcomes. While career satisfaction and persistence intentions are related to actual persistence (Blau, 2007; Jiang & Klein, 2002), future research should establish the relationship between positive marginality and persistence.

While the current research is the first to quantitatively measure positive marginality and test that measure with other variables, it is not the first to empirically examine the construct. Positive marginality has been previously applied to other industries such as education and social sciences; the current research supports the relevance of positive marginality to STEM. Future research should explore positive marginality in other domains. This is likely a viable construct for explaining the experiences of underrepresented groups in a number of domains, such as women in management. Application of positive marginality to other contexts also provides the opportunity to adapt the measure and understand its generalizability. Furthermore, such research will help to determine whether the proposed nomological network is broadly applicable or if it is more context-specific. Given the contextualized nature of positive marginality, models may vary when different populations and types of underrepresentation are considered.

As the construct of positive marginality becomes better established, an important future step is determining if positive marginality is susceptible to intervention. If positive marginality is a construct that can be trained, the implications for the current work grow immensely. For example, core self-evaluations and need for achievement were both found to be significantly predictive of career satisfaction and persistence intentions. However, positive marginality may have greater utility than other predictors of career satisfaction and persistence intentions if it can be developed among underrepresented groups. Given the initial support for career outcomes of positive marginality, cultivating positive marginality among underrepresented individuals is likely to be a desirable goal for counselors, educators, and organizations to prevent voluntary turnover among at-risk groups.

CHAPTER X

CONCLUSIONS

The current research introduced the construct of positive marginality to the context of women's persistence in STEM careers. This was accomplished through the development of a measure of positive marginality and the testing of a partial nomological network of the construct for women in STEM. Results suggest that positive marginality is a construct that can be quantitatively assessed. Furthermore, results suggest that positive marginality is a viable concept for understanding women's experiences and persistence in STEM fields. While further research is needed to substantiate the current findings, especially research that is longitudinal in nature, this study provided an initial step in establishing positive marginality as an explanatory mechanism for women's career outcomes in STEM. Overall, the current research provides insight into what drives women's career experiences in STEM as well as a quantitative framework for understanding the experiences of other underrepresented groups.

In addressing the experiences of the underrepresented, it is important to note that the current research is intended to address the broader issue of STEM participation. While a notable gender gap exists in this domain, attrition is not solely a women's issue, but rather a broader STEM issue. Research, such as that presented here, which seeks to better understand women's STEM experiences can easily be viewed as prescriptive. In other words, research on underrepresented populations can be interpreted as providing instructions for assimilating with the mainstream culture. For example, research striving to understand women's STEM persistence often conveys a series of recommended traits and experiences that better equip women to persevere in STEM. The current research similarly describes characteristics of women who remain in STEM careers. However, the current research is neither intended nor best suited as a recommendation for women pursuing STEM; rather, it provides a positive lens through which to view women's STEM participation instead of highlighting deficits in women or the STEM culture.

Research that aims to better understand the experiences and persistence of underrepresented groups offers an important means of expanding the dialogue surrounding underrepresentation. By identifying positive aspects of women's STEM career development rather than aspects of the STEM domain that are problematic, the current research uncovers potential levers for men and women to work together to address the gender gap in participation. Findings such as those presented in the current research provide a way of understanding the STEM domain that does not threaten the existing culture, thereby encouraging collaboration among men and women to address the gender disparity in STEM participation.

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APPENDIX A

INDIVIDUAL INTERVIEW GUIDE (PILOT STUDY)

1. Describe a typical day as a student in your major.
2. What are your career goals?
3. What experiences have led you to or are leading you to these goals?
4. What kind of reactions do you get when people learn that you are a STEM major?
5. How do those reactions make you feel?
7. What has it been like being a part of a major with few other women?
8. What kind of expectations are there of you as a woman in STEM?
9. What are some of the benefits you've experienced in being one of just a few women in your major?
10. On the other hand, what are some of the disadvantages you've experienced because you're in the minority in your major?
11. Which of those aspects, the advantages or the disadvantages, have a greater impact on you? How do they affect you?
12. There is a concept called positive marginality. It simply means that some individuals experience being in the minority in a favorable way; they believe that being one of a few offers certain benefits. (Insert example) How does this concept apply to you as a woman in STEM?

APPENDIX B

POSITIVE MARGINALITY SCALE

Women sometimes have unique experiences as STEM majors, experiences that men just don't have. Sometimes the experiences are negative, but they can also be positive. The items below touch on some of the positive things you may experience as a woman in STEM. For each item below, please reflect on your feelings about being a woman in STEM and indicate your level of agreement. (Response Scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

1. Being a woman has made me more determined to pursue STEM.
2. Being resilient is part of being a woman in STEM.
3. There is something special about being a woman in STEM.
4. Women in STEM are a prestigious group of people.
5. It is prestigious to be a woman in STEM.
6. There is a sense of specialness that comes with being a woman in STEM.
7. I view women in STEM as a well-respected group.
8. I feel proud to be a woman in STEM.
9. I find it empowering to be a woman in STEM.
10. I think of myself as a role model for other women in STEM.
11. I owe it to other women to persist in STEM.
12. I choose to focus on the positive aspects of being a woman in STEM.
13. I am paving the way for other women in STEM.
14. I have more reason to persevere in STEM because I am a woman.
15. There is something gratifying about being a woman in STEM.
16. I feel equipped to handle any challenges that come my way as a woman in STEM.*

*Item removed from scale after Study 1A

APPENDIX C

STEM OCCUPATIONS AS CATEGORIZED BY O*NET

Engineering & Technology Subgroup

Aerospace Engineer	Agricultural Engineer	Architectural or Civil Drafter	Architectural or Civil Manager
Automotive Engineer	Biochemical Engineer	Biomedical Engineer	Chemical Engineer
Civil Engineer	Computer Hardware Engineer	Cost Estimator	Drafter
Education, Training, and Library Worker	Electrical or Electronic Engineering Technician	Electrical or Electronic Drafter	Electrical Engineer
Electro-Mechanical Technician	Electromechanical Engineering Technologist	Electronics Engineering Technologist	Electronics Engineer
Engineering Technician	Engineer	Environmental Engineer	Fire-Prevention & Protection Engineer
Fuel Cell Engineer	Fuel Cell Technician	Health & Safety Engineer	Human Factors Engineer or Ergonomist
Industrial Engineering Technician	Industrial Engineering Technologist	Industrial Engineer	Industrial Safety & Health Engineer
Logistics Engineer	Manufacturing Engineer Technologist	Manufacturing Engineer	Mapping Technician
Marine Architect	Marine Engineer	Materials Engineer	Mechanical Engineering Technologist
Mechanical Engineer	Mechatronics Engineer	Microsystems Engineer	Mining or Geological Engineer
Nanosystems Engineer	Nanotechnology Engineering Technician	Nanotechnology Engineering Technologist	Naval Architect
Nuclear Engineer	Nuclear Equipment Operations Technician	Nuclear Monitoring Technician	Nuclear Technician
Petroleum Engineer	Photonics Engineer	Product Safety Engineer	Quality Control Systems Manager
Robotics Engineer	Solar Energy Systems Engineer	Surveying or Mapping Technician	Technical Writer
Transportation Engineer	Validation Engineer	Water/Wastewater Engineer	Wind Energy Engineer

Science & Math Subgroup

Agricultural Technician	Anthropologist	Archaeologist	Architectural Manager
Archivist	Astronomer	Atmospheric & Space Scientist	Biochemist
Biofuels/Biodiesel Technology & Product Development Manager	Bioinformatics Scientist	Bioinformatics Technician	Biophysicist
Biostatistician	Cartographer or Photogrammetrist	Chemist	Computer or Information Research Scientist
Computer Programmer	Computer User Support Specialist	Conservation Scientist	Curator
Dietetic Technician	Dietitian or Nutritionist	Economist	Education, Training, or Library Worker
Environmental Economist	Environmental Restoration Planner	Environmental Scientist or Specialist	Epidemiologist
Family or General Practitioner	Food Science Technician	Geneticist	Geodetic Surveyor
Geographer	Geographic Information Systems Technician	Geoscientist	Geospacial Information Scientist or Technologist
Hydrologist	Industrial Ecologist	Life or Physical Scientist	Life or Physical Technician
Market Research Analyst	Materials Scientist	Mathematical Scientist or Technician	Mathematician
Medical Scientist	Microbiologist	Molecular or Cellular Biologist	Museum Technician or Conservator
Natural Sciences Manager	Non-Destructive Testing Specialist	Nuclear Equipment Operations Technician	Nuclear Monitoring Technician
Nuclear Technician	Park Naturalist	Physicist	Quality Control Analyst
Radio Frequency Identification Device Specialist	Remote Sensing Scientist or Technologist	Remote Sensing Technician	Software Developer
Statistician	Survey Researcher	Water Resource Specialist	Zoologist or Wildlife Bilogist

APPENDIX D

CORE SELF-EVALUATIONS SCALE

Below are several statements about you with which you may agree or disagree. Using the response scale below, indicate your agreement or disagreement with each item. (Response Scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

1. I am confident I get the success I deserve in life.
2. Sometimes I feel depressed.*
3. When I try, I generally succeed.
4. Sometimes when I fail I feel worthless.*
5. I complete tasks successfully.
6. Sometimes, I do not feel in control of my work.*
7. Overall, I am satisfied with myself.
8. I am filled with doubts about my competence.*
9. I determine what will happen in my life.
10. I do not feel in control of my success in my career.*
11. I am capable of coping with most of my problems.
12. There are times when things look pretty bleak and hopeless to me.*

*Denotes a reverse-scored item.

APPENDIX E

ACHIEVEMENT MOTIVATION QUESTIONNAIRE

Please answer each of the following questions about yourself. (Response Scale: 1 = no, 2 = unsure, 3 = yes)

1. Is being comfortable more important to you than getting ahead?*
2. Are you satisfied to be no better than most other people at your job?*
3. Do you like to make improvements to the way the organization you belong to functions?
4. Do you ever take trouble to cultivate people who may be useful to you in your career?
5. Do you get restless and annoyed when you feel you are wasting time?
6. Have you always worked hard in order to be among the best in your own line (e.g., school, organization, profession)?
7. Would you prefer to work with a congenial but incompetent partner rather than with a difficult but highly competent one?*
8. Do you tend to plan ahead for your job or career?
9. Is “getting on in life” important to you?
10. Are you an ambitious person?
11. Are you inclined to read of the success of others rather than do the work of making yourself a success?*
12. Would you describe yourself as being lazy?*
13. Will days often go by without your having done a thing?*
14. Are you inclined to take life as it comes without much planning?*

*Denotes reverse-scored item

APPENDIX F

IDENTITY AS A STEM PROFESSIONAL

Below are several statements about you with which you may agree or disagree. Using the response scale below, indicate your agreement or disagreement with each item. (Response Scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

1. Being a STEM professional is an important reflection of who I am.
2. I have come to think of myself as a "STEM professional."
3. I am a STEM professional.
4. In general, being a STEM professional is an important part of my self-image.
5. Having more people with my background in my field makes me feel more like a STEM professional.

APPENDIX G

CAREER SATISFACTION SCALE

Please indicate the extent to which you agree with each of the following statements. (Response Scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree)

1. I am satisfied with the success I have achieved in my career.
2. I am satisfied with the progress I have made toward meeting my overall career goals.
3. I am satisfied with the progress I have made toward meeting my goals for income.
4. I am satisfied with the progress I have made toward meeting my goals for advancement.
5. I am satisfied with the progress I have made toward meeting my goals for the development of new skills.

APPENDIX H

INTENT TO STAY SCALE

Please respond to the following four items.

1. Which of the following statements most clearly reflects your feelings about your future in STEM in the next year? (1 = I definitely will not leave, 2 = I probably will not leave, 3 = I am uncertain, 4 = I probably will leave, 5 = I definitely will leave)*
2. How do you feel about leaving STEM? (1 = I am presently looking and planning to leave, 2 = I am seriously considering leaving in the near future, 3 = I have no feelings about this one way or the other, 4 = As far as I can see ahead, I intend to stay in STEM, 5 = It is very unlikely that I would ever consider leaving STEM)
3. If you were completely free to choose, would you prefer or not prefer to continue working in STEM? (1 = Prefer very much to continue working in STEM, 2 = Prefer to work in STEM, 3 = Don’t care either way, 4 = Prefer not to work in STEM, 5 = Prefer very much not to continue working in STEM)*
4. How important is it to you personally that you spend your career in STEM rather than some other industry? (1 = It is of no importance at all, 2 = I have mixed feelings about its importance, 3 = It is of some importance, 4 = It is fairly important, 5 = It is very important for me to spend my career in STEM)

*Denotes reverse-scored item

APPENDIX I

STRUCTURAL MODEL WITH ORGANIZATIONAL MEMBERSHIP AS A CONTROL VARIABLE

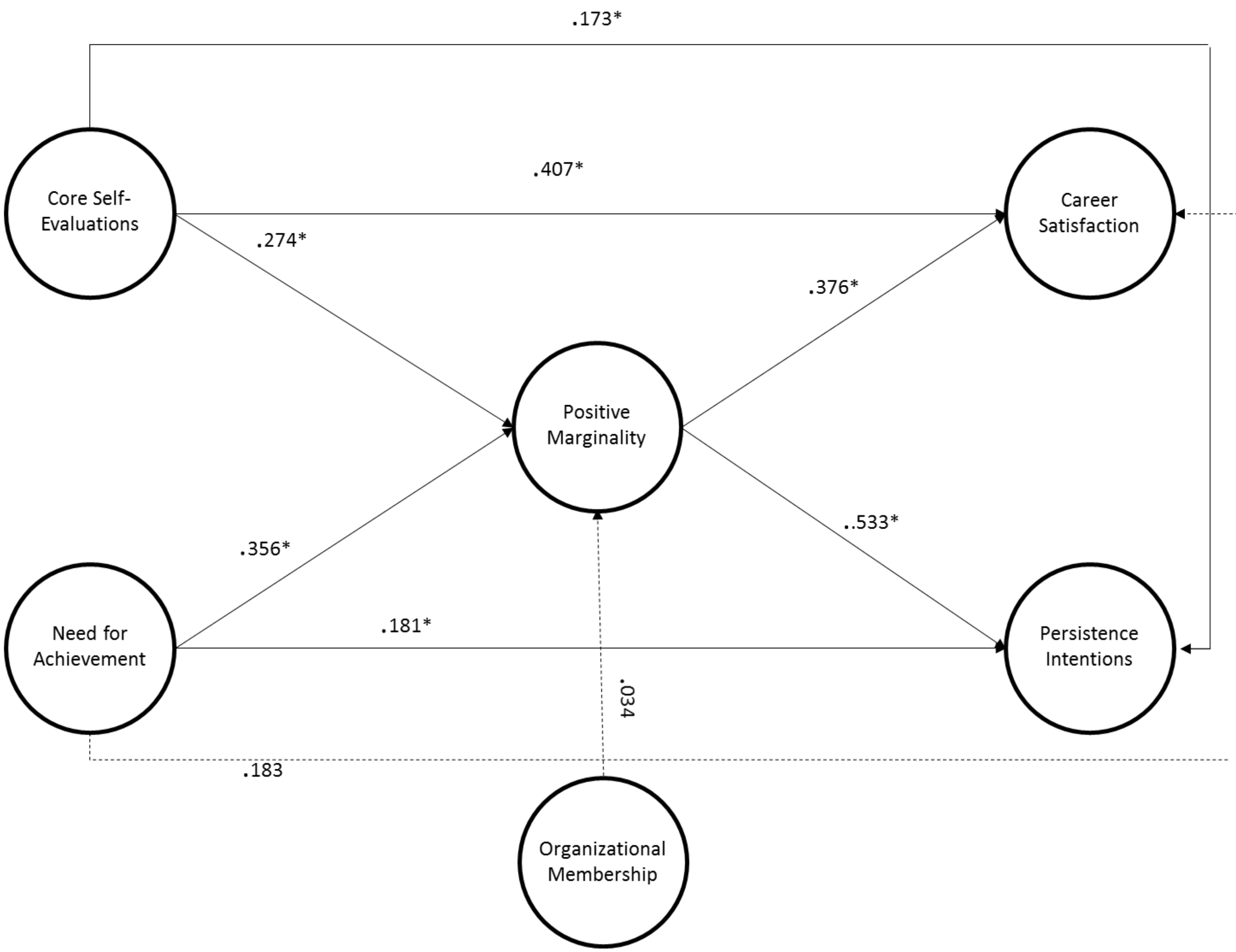

Figure 4. Structural model with control variable; χ^2 (df) = 768.293, CFI = .910, RMSEA = .044 (90% CI [.039, .050]), SRMR = .055; organizational membership was measured as a dichotomous variable (0 = *no,* 1 = *yes*); *p < .001.

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Instructor, Old Dominion University; Jan. 2015 – Aug. 2015
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Publications

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