*Perceived Identity Compatibility and Expected Post-Undergraduate Achievement for Women in Male-Dominated Major***s**

An Honors Thesis (HONR 499)

by

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Abstract

Women in male-dominated fields experience high rates of attrition. This attrition could be linked to perceived identity compatibility (PIC), which measures belonging between an individual and their field. London and colleagues (2011) found that women in STEM majors high in PIC also had higher motivation in STEM. The present study investigated the associations between PIC and expected post-undergraduate achievement among people in male-dominated majors (MDMs). It was predicted that higher levels of PIC would be associated with higher expected degree and more prestigious desired occupations, especially for women in MDMs. The dataset used is a part of a larger study examining the daily experiences of women in MDMs. Participants were separated into three groups: women in MDMs (n = 40), men in MDMs (n = 40), and women in GNMs (gender-neutral majors, n = 40). Via a Qualtrics survey, participants reported their PIC (London et al., 2011), highest expected academic degree (from no degree to professional degree, PhD, MD, etc.), and desired occupation. Desired occupation responses were coded using the NORC occupational prestige score (Smith & Son, 2014). A series of multiple regression analyses with PIC as a predictor and the NORC score as the criterion variable. PIC was not a significant predictor of higher NORC scores (B = .32, p = .04) nor did it predict a higher expected degree (p = .64). Future research could expand group design to include men in GNMs. It would also be valuable to recruit a more diverse sample as many theories on social belonging apply to more than simply gender.

Keywords: STEM, Gender, Social Belonging, Achievement, Education, Identity

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As for this particular educational achievement, I have to thank Dr. Katie Lawson, my thesis advisor, who not only provided the dataset for my study and hours of tutelage but also was a role-model for me. Her support and guidance have helped me to believe that I, too, can find success as a woman in STEM.

Process Analysis Statement

This thesis began when Dr. Lawson told me about an archival dataset she had from a previous study. Her study focused on the effects of daily encounters with sexism, but due to the volume of data and the numerous variables she had measured, she believed the data set could be used in a student thesis. The data set had three distinct participant groups, each of which had a total of 40 participants: men in male-dominated majors (MDMs), women in MDMs, and women in gender-neutral majors (GNMs). MDMs were defined as programs that had a majority of male students at both the institutional level and national averages.

I began by exploring the dataset and the variables that I wanted to focus on. I was immediately interested in academic motivation and how it might be affected by a measure called Perceived Identity Compatibility (PIC) between gender and major. PIC is meant to measure the extent to which an individual feels that their gender fits with their major. I was interested in how PIC might correlate to their expected academic achievement.

Before creating a concrete hypothesis, I reviewed academic research on the gender gap in Science Technology, Engineering, and Math (STEM) subjects, social belonging, and academic achievement. The gender gap in STEM has been well documented and it exists in several capacities. There are few women who have access to STEM programs and education, then there are fewer still who participate in said programs, and even further, there are few who continue to progress in a STEM career. This phenomenon is often described as a leaky pipeline which has multiple drop-off points (Cronin & Roger, 1999). Throughout my review, I found that social belonging has shown a positive correlation to multiple factors that contribute to an individual's academic career including: academic motivation, academic performance, pursuit and completion of higher education.

Based on these findings, I hypothesized that a higher score in PIC would contribute to higher expected degrees as well as more prestigious desired occupations. In the original dataset, participants reported their highest expected degree (from "You don't expect to earn a degree" to "Professional degree") and their desired occupations (which was an open-ended response). To quantify their desire occupations, I used the NORC occupational prestige score (Smith & Son, 2014) which assigns a numerical value to the perceived prestige of an occupation. I believed that if an individual felt more socially accepted in their major, they would have more ambitious academic plans and in turn, more prestigious career aspirations. Further, I believed this relationship would be strongest for women in MDMs because social belonging is often most influential on minority groups (Walton & Cohen, 2007 and Cohen & Garcia, 2008).

To determine if my hypothesis was supported, I ran a series of statistical analyses using Statistical Product and Service Solutions (SPSS). After running these tests, I postulated on possible contributing factors to the results that I found. I also considered future research that would be of value to this field of study.

Overall, this thesis allowed for me to learn about the full lifecycle of an academic research study. It has prepared me for graduate school in a way that is incomparable to other coursework. It was also accepted for a poster session at the Mid-Western Psychological Association conference, which was unfortunately cancelled due to the COVID-19 pandemic.

Perceived Identity Compatibility and Expected Post-Undergraduate Achievement for Women in Male-Dominated Majors

In the United States, there has been a significant effort to improve education in the Science, Technology, Engineering, and Mathematics fields (STEM). While there has been significant success in employment, from 9.7 million to 17.3 million occupations since 1990 (Graf, Fry & Funk, 2018), the gender gap has remained persistent. The lack of women in the STEM fields is present in both STEM jobs and in STEM degree-holders (Beede et al., 2011). This gender disparity has been well-documented in recent decades and it is a topic of frequent research. Since the 1980's, women have steadily overturned the gender gap in undergraduate participation (Goldin, 2006) to the point of being the majority of undergraduate students (Jacobs, 1999). Despite this parity in undergraduate study, women remain a minority in STEM undergraduate majors. Of the entire U.S. college-educated workforce, 6.7 million men have a STEM college degree while only 2.5 million women have a STEM college degree (Beede et al., 2011). Further, female STEM degree-holders are less likely to work in a STEM occupation, compared to their male counterparts. Beede et al. report that 40% of men with STEM college degrees work in STEM jobs, compared to the only 26% of women with STEM college degrees who work in STEM jobs. Clearly, balancing participation and retention in STEM fields cannot be solved with only undergraduate participation. The gender gap in STEM continues into post-undergraduate study. Of all STEM graduate degrees awarded in 2016, roughly 29.88% of master's degrees and only 22.85% of doctorate degrees were awarded to women (National Science Foundation, 2019). One possible factor for the gender differences in STEM can be seen in a study by Sax (1994), who investigated gender differences in students' interest in science,

math, and engineering (SME) during their undergraduate study. She found a student's desire and motivations for their intended career vary depending on gender. Women were more driven by the potential "social good" of their intended career compared to men, which negatively affected their pursuit of higher education in science.

Not only are less women in STEM, but attrition is also very common. This attrition is often described as a 'leaky pipeline' with multiple drop-off points on the path to a career in STEM. Cronin and Roger (1999) define a 3-step funnel of this pipeline; 1) *access*, 2) *participation*, 3) *progression*. Access is described as providing opportunities for women to pursue STEM in higher education. Participation includes the actions of higher education; attending classes and organizations and most importantly, remaining in a STEM program. Progression serves as the transition from degree-acquisition to pursuit of a career in STEM. Cronin and Roger outline the various drop-off points throughout this 3-step funnel. Each piece of the funnel retains less women. Cronin and Roger define the pipeline as both progressive (worsening over the course of an individual's higher education) and persistent (present over time). Although Cronin and Roger focused on pursuit of a career in STEM as the phase of progression, an individual's pursuit of graduate school can also be considered a commitment to a future in STEM.

Although some STEM fields are gender-balanced, or even female-dominated (e.g. Biology) there are certain programs within STEM that remain male-dominated majors (MDMs) (e.g. Computer Science) (Cheryan, Ziegler, Montoya, & Jiang, 2017). A lack of social belonging in these MDMs could contribute to the persistent gender gap. Social belonging and connected-ness have long been associated with positive outcomes. Baumeister, Twenge, and Nuss (2002) found a significant IQ drop in participants lacking in social belonging. Motivation and retention

in academic programs can also be affected by social belonging (Cheryan, Davies, Plaut, & Steele, 2009). It is hypothesized that the gender gap, which is present from undergraduate study, through doctoral study, and into occupational choice is associated with a lack social belonging. Specifically, Perceived Identity Compatibility (PIC), which assesses an individual's perceived compatibility between their major and gender, may be a predictor of career aspirations after undergraduate study. I hypothesize that PIC is associated with all students' post-undergraduate career aspirations, but it will have the greatest association with women in MDMs.

Social Belonging, Motivation and Achievement

The desire for and influence of social belonging has been well documented. For example, Lakin and Chartrand (2003) explored the concept of nonconscious behavioral mimicry, which occurs when an individual imitates the behavior of another without expressly intending to. In their study, Lakin et al. used deception to measure nonconscious behavioral mimicry while participants completed mundane tasks. One group of participants was primed to seek affiliation with the other participant while the other group was primed to be neutral. Participants were asked to remember the tasks of a participant in another room (which was actually a pre-recorded video). In the pre-recorded video, the individual completed mundane tasks while 'mindlessly' touching their face periodically. Participants who had been primed to seek affiliations and build rapport were more likely to imitate the face-touching behavior of the other 'participant'. Therefore, nonconscious behavioral mimicry can be used to attempt to build rapport, which is one of the first steps of creating social bonds.

Baumeister, Twenge, and Nuss (2002) hypothesized that human intelligence is used, in part, to navigate complex social situations so if a person is socially excluded, their IQ performance would drop. In their study, participants completed a personality assessment and

were then given predictions for their future life. These predictions were randomly assigned and were not actually related to the participant's personality. After being given their future predictions, they were asked to complete an IQ test. Participants who had been told they would likely be alone in the future performed poorer than participants who had been told they would have social belonging in the future. This IQ drop cannot be explained simply by a 'bad forecast' for their future, as the researchers also included a third prediction in which participants would be accident prone in the future. This third variable of a negative future did not affect performance during the IQ test as compared to the 'future alone' prediction. Therefore, it was specifically the threat of a loss of social belonging that negatively affected their IQ performance.

In a literature review on human cognition and perceived isolation, Cacioppo and Hawkley (2009) reported on several key factors of socialization and how they affect human cognition. Loneliness and lack of social support are contributing factors to cognitive decline. Executive functioning, which is in an individual's capacity to control one's attention, emotion, and behavior to socially fit in, is significantly affected by loneliness (Cacioppo et al., 2006). Cacioppo and Hawley (2009) also reported that self-reported lonely individuals sometimes view their social world as threatening. This mindset affects both how others actually interact with them and how they perceive others to interact with them. Lonely individuals can feel like passive victims which in turn, creates a cycle of social and self-isolation (Cacioppo & Hawkley, 2005). If for example, a woman feels isolated in her MDM, she may begin in this cycle and find it very difficult to make new bonds within her program, maintaining her initial isolation.

In an effort to investigate the full influence of social belonging, Walton, Cohen, Cwir & Spencer (2012) assessed how *mere* social belonging relates to motivation. In their experiment, participants were either given a stimulus that connected them to a successful mathematician or

no stimulus. They were then asked to solve an unsolvable math problem. Participants who had been given a stimulus that connected them to a successful mathematician persisted longer in attempting to solve the math problem compared to participants who were given no stimulus. By simply having a shared trait with a positive role-model, participants' motivation increased. (Walton, Cohen, Cwir & Spencer, 2012). Does social belonging only correlate with motivation, or could it also be related to important life decision, such as types of programs pursued in undergraduate study, pursuit and completion of graduate school, and post-college achievement?

Cheryan et al. (2009) explored participation in one specific program, but Milem & Berger (1997) took a step back and investigated college student persistence using a holistic approach. They attempted to consider college persistence through the lens of academic integration, social integration, and institutional commitment. Academic integration was defined as the extent to which an individual felt comfortable with their university's staff and individual academic program. They found that academic integration did not predict institutional commitment or intent to re-enroll. They did, however, find that social integration is a predictor of higher institutional commitment. Additionally, women reported higher levels of peer involvement, but lower levels of faculty involvement. Therefore, it is possible for women to feel socially supported in their college while also feeling disconnected from their program. This could be one of the factors contributing to both the gender parity of undergraduate study and also the disparity in STEM majors. Women may have enough social support to remain in college, but feel socially isolated in STEM programs, thus dropping off to a different program. Based on these findings, I predict that social belonging, specifically PIC, will be a predictor of expected educational achievement and desired occupation for all undergraduate students in our sample. I believe PIC is a possible

predictor of post-undergraduate achievement because it focuses specifically on the integration of an individual and their program, rather than their overall belonging at a university.

Women's Social Belonging in MDMs

It is clear that social belonging can have strong associations with achievement for people of all kinds. However, social belonging has been shown to have a greater impact on individuals of underrepresented groups. Davies, Plaut, and Steele (2009) investigated the effects of stereotype cues in relation to computer science participation and retention for women. In this study, they conceive the term *ambient belonging,* which they define as "socially symbolic objects" that affect how an individual perceives their compatibility within a domain. To evaluate this concept of ambient belonging, Cheryan et al. (2009) set up two pseudo classrooms, one of which contained stereotypical cues which favored men, and another which had gender-neutral cues. Male-stereotypical cues included items such as a Star Trek poster, comic books, and junk food. Gender-neutral cues included items such as water bottles, nature posters, and general interest magazines. Cheryan et al. (2009) hypothesized that the mere presence of stereotypical cues would affect a female participant's interest in computer science. Their results indicated that while there were no gender differences in the gender-neutral room, the same could not be said for the stereotyped room. In this condition, women were significantly less interested in computer science than were men. Their findings suggest that something as simple as room decoration can affect one's interest in participating in a MDM

Social belonging is also important for racial/ethnic minorities. Ellis (2001) used an intersectional lens to evaluated graduate school satisfaction and commitment to degree completion in Black women currently enrolled in doctoral study. Using a qualitative method, Ellis inquired about various dimensions of doctoral study (such as social integration and peer

support) and found four primary areas of concern for Black women pursuing their doctorate degrees: mentoring and advising, environment of the home department, interaction with peers, and research and teaching. Concerns reported by Black female participants consistently related back to a lack of social belonging. Ellis found that of all participant groups, Black women reported feeling the most isolated socially.

Why, of all doctorate students, did Black women feel the most socially isolated? Walton and Cohen (2007) attempt to answer this question. They define a term, *belonging uncertainty*, as a mental state that occurs in socially ostracized groups, such as females of color. Belonging uncertainty can be characterized as a distrust in the quality of one's social bonds (i.e. perceiving that one's social bonds are weaker than they actually are). Social belonging has been positively linked to academic performance and belonging uncertainty can affect one's social belonging, therefore minority groups' performance is uniquely influenced by social belonging, compared to non-minority individuals. In one of their studies, Walton and Cohen (2007) examined the effects of a lack of social belonging on minority computer science students. They hypothesized that students who are stigmatized in computer science (Black and Latino) would be affected more by a lack of friends than students who are not stigmatized (White and Asian). This hypothesis is, in part, supported by the concept of stereotype threat, which is described as a " risk of confirming . . . a negative stereotype about one's group" (Steele & Aronson, 1995). The negative effects of lower social belonging in combination with the threat of confirming negative stereotypes about one's group may be affecting individuals' academic performance. Results from Walton and Cohen's (2007) study support this idea. Minority students who had been manipulated to feel as though they lacked friends felt less compatibility and less likely to succeed in computer science as compared to non-minority students. If there are very few women in a MDM class, these

women may feel pressure to ‘represent’ all women and their performance can be negatively correlated to this.

In an effort to continue exploring the relationships between social belonging, stereotype threat, and achievement, Cohen and Garcia (2008) studied identity threat in the classroom. In all level of education, every student is being evaluated on their academic performance. However, for the minority students, they face additional pressure, as their performance will reflect on their group. Cohen and Garcia (2008) created a model to track the steps of social identity threat. First, an individual asks themselves, “Could my identity evoke a negative reaction in this social interaction?”. If the answer is yes, the individual enters a state of ‘vigilance’ in which they are observing for any cues that signal identity threat. These cues can be both verbal and nonverbal. If the individual perceives identity threat, they will evaluate their ability and/or desire to cope with the threat (e.g. “Should I take the time to confront my teacher?”). If an individual decides to not engage with the threat, they can experience lower performance in the classroom. While their study focused on racial/ethnic minorities, the female minority in MDMs could experience similar social identity threat as they too can be hyper-aware of their identity in comparison to the students around them.

Cohen and Garcia (2008) suggest two different points of intervention in the social identity threat model: vigilance stage and threat-appraisal stage. The effectiveness of the vigilance stage intervention was demonstrated in Walton and Cohen’s 2007 study, in which first-year college students were asked to read survey results from upperclassmen of the same university. The survey showed “that almost all students, regardless of race, feel uncertain of their belonging in college in their freshman year and that these feelings wane with time”. The survey did not have significant effects on White students, but Black students earned a higher GPA

during the next semester, which significantly lessened the achievement gap. Sherman and Cohen (2006) demonstrated the effectiveness of the threat-appraisal stage intervention in a double-blind study involving Black 7th-grade students. In an attempt to provide psychological resources for coping with social identity threat, one group of students was asked to write a self-affirming assignment while the control group was given a neutral prompt. The results were significant: after 2 years, Black students in the control group had dropped in performance and trust of school authorities while Black students who had been given the intervention did not. Students who had been given the self-affirming intervention positively affected their GPA over the course of 2 years.

Present Study

Women in STEM, and the lack thereof, have been well studied in several capacities. Their drop-off points, motivating factors to pursue STEM, and the various threats unique to women in MDMs have been investigated. The current study attempted to continue in this field of research by looking at one specific element of social belonging: PIC. The perceived compatibility between one's gender and their field of study has been shown to be negatively correlated to both commitment to STEM (Settles, 2004) and to male-dominated job choices (Cheryan et al., 2009). London, Rosenthal, Levy, and Lobel (2011) found that PIC, in combination with perceived social support, served as a predictor of commitment to STEM for women transitioning into their first year of college. To expand upon this, the current study compared the PIC and expected post-undergraduate achievement of undergraduate students. The current study is unique in that I compared three different groups (whereas past research has focused primarily on only minority groups in MDMs): women in MDMs, men in MDMs, and women in gender-neutral majors (GNMs). By comparing these groups, I was able to determine if

PIC has different associations dependent on the gender/major combination. Does PIC predict greater program integration for all students, or is it a unique factor only for under-represented students? I hypothesized that the PIC of women in MDMs would have a greater association with expected post-undergraduate achievement compared to men in MDMs and women in GNMs. By including men in MDMs, I was able to determine if gender is a contributing factor to a higher association between PIC and expected post-undergraduate achievement. By including women in GNMs, I was able to determine if this association is unique to women only when they are minorities (as is the case in MDMs). It is important to note that I am examining *expected* post-undergraduate achievement, rather than actual post-undergraduate achievement.

Method

Data Source

I drew my data from a portion of a larger study, whose data was collected during the 2017-2018 school year at a mid-sized university in the US Midwest. The full study was a combination of an initial in-person survey and an experience sampling method (ESM) that lasted 2 weeks. The primary purpose of the ESM surveys was to record daily encounters with sexism. To address my research question, I only included data from the initial in-person survey.

Participants

There were three distinct samples that were recruited; 40 women in male dominated majors (MDMs), 40 men in MDMs, and 40 women in gender neutral majors (GNMs). These groups were determined by statistics from both the University's records and from national statistics. MDMs were defined as any major where at least 2/3 of students are men (nationally and at the university). GNMs were defined as any major where 40-60% of students are women. Participant demographics can be seen in Table 1 for the total sample and by group (including a

list of all majors). The majority of participants were white (79.83%) and were evenly distributed across year in school (24.17% Freshman, 30.83% Sophomore, 30.00% Junior, 25.00% Senior). The most common MDMs were Computer Science and Finance (20 students in each major), and the most common GNM was Business Administration (8 students in the major). Using Chi-square analyses, it was determined that the groups did not significantly differ in terms of race/ethnicity, $\chi^2(10, 120) = 13.80$, $p = .18$, Cramer's V = .24, or student year in school, $\chi^2(6, 120) = 10.49$, $p = .11$, Cramer's V = .21.

Several recruitment methods were used. Targeted emails were sent to a list of female students in MDMs. This list was obtained from the Office of Institutional Effectiveness at the University. General emails were distributed to all students at the university via the university's communication center. Flyer advertisements were dispersed throughout the university. The research team presented at several relevant classes (both MDM and GNM classes). Recruitment materials informed potential participants that the study would examine the daily experiences of college students. This included daily stressors, positive and negative experiences, classroom experiences, department contexts, and career aspirations. Interested participants contacted the study coordinator, who verified eligibility. To qualify, participants needed to have access to a smartphone, be at least 18 years old, and identify as male or female and majoring in an MDM or identify as female in a GNM. Sixteen individuals who contacted the study coordinator did not qualify for the study, as the combination of their gender and major did not meet the requirements (e.g. a male in GNM or their major was not considered MDM or GNM).

Participants who qualified were scheduled for an in-person survey with research personnel, which consisted of the following: (1) informed consent procedures; (2) the completion of a survey via Qualtrics about demographics, experiences at the university and in their major,

attitudes, health, and career aspirations (the data used in the present study); and (3) the registration of smartphones to complete ESM assessments for the following two weeks. Participants received $10 compensation for completion of the in-person assessment. As mentioned earlier, the ESM portion of the data set was not included in the current study.

Measures

Perceived Identity Compatibility

A 6-item measure, as used in London, Rosenthal, Levy, and Lobel's (2011) study on social support for women in nontraditional fields, was used during the in-person assessment portion of the current study. Participants were asked to use a 7-point numerical rating scale to rate their agreement with each item. Items consisted of "I" statements related to a participant's perceived identity compatibility between gender and major. The following are example statements: "I think I may experience difficulties in my major because of my gender" and ''I don't think that my gender will affect how others view me in my major.'' Because of negative wording, some items were reverse coded. London et al. (2011) computed a mean score of all six items to create a composite measure of perceived compatibility between gender and major, with a higher score indicating higher perceived compatibility. They conducted two points of measurement, and at both time points, the measure demonstrated good internal reliability among female college students (Cronbach's as .63 at background, .73 at spring follow-up). The PIC measure in the current study had a Cronbach's alpha of .70. Individual items can be found in Appendix A.

Career Aspirations

Participants were asked about their career aspirations using a combination of two measures. First, participants were asked, in an open-ended response, to report their desired

occupation. These responses were coded using the National Opinion Research Center (NORC) occupational prestige score (Smith & Son, 2014). To create NORC scores, Smith & Son (2014) gave participants a list of occupations (as listed on the U.S. Census) and asked them to place each occupation on a ladder that ranged from "highest possible social standing" to "lowest possible social standing". The ladder had 9 boxes in which occupations could be placed. An averaged prestige score was recorded for each occupation included in the U.S. census. Averaged scores ranged from 1 to 9, with a higher score indicating higher levels of prestige. This measure was also used in a qualitative study by Mercurio (2019) in which the experiences of a stigmatized individual were observed. Mercurio determined that individuals in stigmatized occupations (in his sample, custodians) experience work differently compared to people in non-stigmatized occupations. Participants responses from the current study were coded by first determining the equivalent census label for each response and then assigning its value based on the NORC occupational prestige score. A neutral associate conducted a reliability check with 10% of the dataset to determine that equivalent census labels were determined. There was an agreement rate of 83%, and all disagreements were discussed until a consensus was reached.. In addition to desired occupation, participants were also asked to report the highest degree they expect to complete. There were 5 total possible responses which ranged from "You don't expect to earn a degree" to "Professional degree (PhD, MD, JD, etc.)". These two measures were used in combination to attempt to measure expected post-undergraduate achievement. Individual items can be found in Appendix B.

Results

Preliminary Results

To see all frequencies and descriptive statistics for study variables, see Table 2. The mean for PIC was 5.03, which was above the mid-point. This indicates a higher degree of perceived compatibility between their major and their gender for the sample. Approximately half of the sample expected their highest degree to be a Bachelors degree (52.5%). The mean score for the NORC prestige score was 5.72 (scores in the same ranged from 3.8 to 7.7, and the total possible scores for the scale ranged from 1 to 9). From the current study, the lowest valued occupation was a park ranger (3.9) and the highest was a pediatric neurosurgeon (7.7). I ran a one-way analysis of variance (ANOVA) to determine if groups significantly differed on these variables (PIC, highest expected degree, and NORC). In in terms of NORC prestige score, groups were not significantly different, $F(2, 117) = 6.54$, $p = .522$. Groups were significantly different in two variables: highest expected degree, $F(2, 117) = 9.83$, $p = .01$ and PIC $F(2, 117) = 15.08$, $p < .01$. To determine specific differences between groups, I ran a Tukey's post-hoc analysis. See Table 3 for all *F*-values and post-hoc results. Men in MDMs had significantly higher PIC scores compared to women in MDMs ($p < .001$) and women in GNMs ($p = .001$). For highest expected degree, women in MDMs reported a significantly higher expected degree compared to men in MDMs ($p < .001$) and women in GNMs also reported a significantly higher expected degree compared to men in MDMs ($p = .002$)

Hypothesis Tests

Do women in MDMs have a higher association between PIC and expected post-undergraduate achievement compared to men in MDMs and women in GNMs? To answer this question, I conducted a series of multiple regression analyses with PIC as a predictor variable and the NORC prestige score as the criterion variable. The predictor variable (PIC) were centered at the sample mean, as recommended by Steinberg, Oken, and Aiken (2012). This was

done by subtracting the average score of the total sample of each participant's PIC score. For group comparisons, two dummy variables were created so that women in MDMs were the reference group (dummy variable 1 referred to as mMDM: 0 = not a man in a MDM, i.e., wMDM or wGNM, 1 = man in a MDM; dummy variable 2 referred to as wGNM: 0 = not a woman in GNM, i.e., mMDM or wMDM, 1 = wGNM). PIC, dummy variables, and their interactions were added as predictors to the regression models. These variables were entered simultaneously.

To see all *B*-values and *SE*-values, refer to Table 4. Based on the results of the first multiple regression analysis, PIC was not a significant predictor of NORC score. However, there was a trend-level association which indicates that higher PIC scores were associated with lower NORC scores for the overall sample (B = -.20, p = .06). The interaction between PIC and the mMDM group was a significant predictor of higher NORC scores (B = .32, p = .04). Observing their two-way linear interaction effects, I determined that wMDMs were the group with the trend level association (B = -.20, p = .06) while mMDMs did not have a significant association (B = .12, p = .31). These results do not support the current study's hypothesis that the association between PIC scores and NORC scores would be stronger (and positively associated) for women in MDMs compared to their peers.

To see all *B*-values and *SE*-values for highest expected degree, refer to Table 5. In the second multiple regression analysis, PIC was not a significant predictor of highest expected degree (p = .64), and group did not significantly moderate this association. Men in MDMs expected to earn a significantly lower degrees of education when compared to women in MDMs (B = -.05, p < .01). Still, these results do not support the current study's hypothesis that the

association between PIC and highest expected degree would be stronger for women in MDMs compared to their peers.

Discussion

The current study focused on the associations between PIC and expected post-undergraduate achievement for women in MDMs. Higher levels of PIC were predicted to be associated with higher expected degrees as well as more prestigious desired occupations. It was predicted that this association would be stronger for women in MDMs, as compared to women in GNMs and men in MDMs. The results did not support the current study's hypothesis. Firstly, women in MDMs who scored high in PIC had lower NORC prestige scores for their desired occupation, which is the exact opposite of the hypothesis. Further, this was not true for women in GNMs or men in MDMs. Secondly, PIC did not predict expected degree for any of the groups in the study, no matter the gender/major combination.

Previous research has shown a positive correlation between social belonging and academic motivation. Motivation and retention in academic programs have been shown to be positively affected by social belonging (Cheryan, Davies, Plaut, & Steele, 2009). Another study found that by simply having a shared trait with a positive role-model, participants' motivation increased (Walton, Cohen, Cwir & Spencer, 2012). Yet the present study was unable to replicate these results by using PIC as an indicator of social belonging. Perhaps the positive correlation between social belonging and increased performance in STEM from previous studies is only true of short-term experiences. The positive effects of social belonging may not continue into long-term plans as demonstrated by the nonsignificant results of the current study.

Men in MDMs reported significantly higher levels of PIC compared to women in MDMs, which is slightly supported by previous research, which posited that women were more socially

isolated than men in MDMs (London, Rosenthal, Levy, & Lobel (2011). However, men in MDMs' PIC scores were also significantly greater than women in GNMs. If these results were completely consistent with past findings, women in GNMs should have had significantly higher PIC compared to women in MDMs as they did not have the gender gap to cause the social isolation.

Limitations

The current study attempted to investigate post undergraduate achievement. However, because archival data was used, it was difficult to compare all the relevant factors of post undergraduate achievement. By seeking to analyze the nature of post undergraduate achievement with only three variables (NORC prestige score, PIC, and highest expected degree), it was difficult to substantiate the predictions of the current study. Not only were there not enough variables included, the variables being considered were not necessarily the most applicable. Both the NORC prestige score and the highest expected degree relied on expectations. A participant's desired occupation may vary significantly from the occupation they actually obtain after undergraduate study. In turn, a participant's highest expected degree may be inaccurate to their actual achievement. Also, several studies that focused on post-undergraduate achievement used longitudinal or historical data, so it is difficult to compare to the current study which used predictions (see Garibay, Hughes, Eagan, & Hurtado, 2013 and Cronin & Roger, 1999).

Beyond the discrepancy between expected and actual variables, the study's sample was fairly homogenous. The sample consisted primarily of white students, yet several of the related studies discussed earlier focused on the effects of social belonging on racial minorities as well as gender differences. For example, Steele and Aronson (1995) explored the effects of stereotype threat with ethnic groups, and they found that Black and Hispanic groups were more negatively

affected than white participants by perceived stereotype threat. Similarly, socioeconomic status was not considered when recording participant demographics. This, too, could have an impact on how individuals react to social aloneness. With any research, geography is a factor and as the study's sample was almost entirely from the Midwest, its findings could only really be applied to this region.

Future Research

The gender difference found in highest expected degree could be due to a confidence gap between men and women. A Hewlett Packard internal report stated that "Men apply for a job when they meet only 60% of the qualifications, but women apply only if they meet 100% of them" (Mohr, 2014). Perhaps women reported higher expected degrees because they assumed that they needed more qualifications whereas the men had more confidence with less education. For example, Eaton, Saunders, Jacobson, & West (2019) found that hiring physics faculty in public research universities exhibited gender bias by favoring male candidates who were otherwise identical the female candidates. CVs were manipulated to indicate gender by changing the given name. By simply reading a man's name, faculty reported the candidate to be more competent and more hirable. Women may be aware of this bias and in turn pursue more schooling in an attempt to combat this issue.

As mentioned earlier, a person's expected achievement may not align with their actual achievement. To account for this in future research, a longitudinal design may be more effective. In this hypothetical study, a group of participants could be evaluated at several key points of their early-adulthood development: their transition into undergraduate study, their senior year of undergraduate study, and five years after graduating their undergraduate program. In this way,

PIC could be compared to both actual post-undergraduate education and more accurate NORC prestige scores.

Something else of interest could be the inclusion of female-dominated majors in the participant groups. Conceivably, men could experience the same lack of social belonging that women report when in MDMs. With this addition, it could be determined if the patterns observed in the current study (women reporting higher expected degrees and women in MDMs reporting lower PIC) were unique to women in MDMs and GNMs or if they would also be present in women in female-dominated majors.

Conclusion

Social belonging and its relationship with academic performance and motivation is hardly an exhausted field of study and the positive effects of social belonging have been well documented. As the demographics of STEM academic programs and careers continue to fluctuate, so too will the social climate. Though the present study's hypothesis was not supported, future research should continue to explore the numerous factors which contribute to the persistent gender and ethnic gap present in all STEM fields and especially higher education. Specific focus should be given to the group differences present between male-dominated majors, female-dominated majors, and gender-neutral majors.

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Table 1
Participant demographics

	Total Sample ($N = 120$)	Women in MDMs ($N = 40$)	Men in MDMs ($N = 40$)	Women in GNMs ($N = 40$)
Year in School				
Freshman	29 (24.17%)	4 (10.00%)	11 (27.50%)	14 (35.00%)
Sophomore	25 (30.83%)	7 (17.50%)	11 (27.50%)	7 (17.50%)
Junior	36 (30.00%)	17 (42.50%)	9 (22.50%)	10 (25.00%)
Senior	30 (25.00%)	12 (30.00%)	9 (22.50%)	9 (22.50%)
Race/Ethnicity				
White	95 (79.83%)	29 (72.50%)	37 (92.50%)	29 (74.36%)
Black	14 (11.76%)	7 (17.50%)	0 (0.00%)	7 (17.95%)
Hispanic	4 (3.36%)	2 (5.00%)	1 (2.50%)	1 (2.56%)
Asian	3 (2.52%)	1 (2.50%)	0 (0.00%)	2 (5.13%)
Mixed Race	2 (1.68%)	1 (2.50%)	1 (2.50%)	0 (0.00%)
Other	1 (0.84%)	0 (0.00%)	1 (2.50%)	0 (0.00%)
Male-Dominated Majors				
Computer Information Systems	8 (6.67%)	3 (7.50%)	5 (12.50%)	.
Computer Science	20 (16.67%)	8 (20.00%)	12 (30.00%)	.
Computer Technology	6 (5.00%)	2 (5.00%)	4 (10.00%)	.
Construction Management	6 (5.00%)	2 (5.00%)	4 (10.00%)	.
Economics	6 (5.00%)	3 (7.50%)	3 (7.50%)	.
Finance	20 (16.67%)	12 (30.00%)	8 (20.00%)	.
Industry and Technology	1 (0.83%)	1 (2.50%)	0 (0.00%)	.
Logistics Supply Chain Management	1 (0.83%)	1 (2.50%)	0 (0.00%)	.
Music Media Production	5 (4.17%)	2 (5.00%)	3 (7.50%)	.
Physics	2 (1.67%)	1 (2.50%)	1 (2.50%)	.
Sport Administration	5 (4.17%)	5 (12.50%)	0 (0.00%)	.
Gender-Neutral Majors				
Architecture	1 (0.83%)	.	.	1 (2.50%)
Business Administration	8 (6.67%)	.	.	8 (20.00%)
Chemistry	1 (0.83%)	.	.	1 (2.50%)
Criminal Justice Criminology	6 (5.00%)	.	.	6 (15.00%)
Exercise Science	6 (5.00%)	.	.	6 (15.00%)
History	2 (1.67%)	.	.	2 (5.00%)
International Business	1 (0.83%)	.	.	1 (2.50%)
Landscape Architecture	2 (1.67%)	.	.	2 (5.00%)
Marketing	4 (3.33%)	.	.	4 (10.00%)
Natural Resources Environmental Management	1 (0.83%)	.	.	1 (2.50%)
Political Science	1 (0.83%)	.	.	1 (2.50%)
Predental Preparation	1 (0.83%)	.	.	1 (2.50%)
Teaching Major in Social Studies	3 (2.50%)	.	.	3 (7.50%)
Teaching Major Music Education: Voice & General	3 (2.50%)	.	.	3 (7.50%)

Note. Frequencies (percent of the sample described in the column) reported. Results of chi-square analyses indicate that groups do not significantly differ in year in school or race/ethnicity. Reprinted from Lawson, K. M. (in press). An examination of daily experiences of sexism and reactivity among women in U.S. male-dominated academic majors using experience sampling methodology. Manuscript accepted for publication at Sex Roles. doi:10.1007/s11199-020-01135-z

Table 2

Frequencies and Descriptive Statistics

	Frequency	Mean	Standard Deviation
Perceived Identity Compatibility (PIC)	-	5.03	1.17
Highest Expected Degree	-	3.57	0.70
No degree	0 (0%)	-	-
Associates degree	1 (0.80%)	-	-
Bachelors degree	63 (52.50%)	-	-
Masters degree	43 (35.80%)	-	-
Professional degree (PhD, MD, etc.)	13 (10.80%)	-	-
NORC Occupational Prestige	-	5.72	0.68

Table 3

Mean (SD) of Study Variables by Group

	Women in MDM	Men in MDM	Women in GNM
Perceived Identity Compatibility (Mean, SD)	4.50 (1.03)[a]	5.75 (.97)[b]	4.84 (1.14)[a]
Highest Expected Degree (Mean, SD)	3.80 (.72)[a]	3.20 (.52)[b]	3.70 (.68)[b]
NORC Occupational Prestige (Mean, SD)	5.75 (.75)[a]	5.62 (.52)[a]	5.79 (.76)[a]

Note. Significant group differences in mean level scores are indicated by superscript letters.

Table 4

Multiple Regression, with NORC prestige score as dependent variable

	Beta (*B)*	Standard Error (*SE)*	Probability (*p)*
Intercept	5.64	.12	< .01
PIC, centered	-.20	.11	.059
mMDM	-.10	.18	.59
wGNM	.15	.16	.36
PIC*mMDM	.32	.15	.04
PIC*wGNM	.17	.14	.24

Note. Dummy coding was used; mMDM: 0 = not a man in a MDM, i.e., wMDM or wGNM, 1 = man in a MDM and wGNM: 0 = not a woman in GNM, i.e., mMDM or wMDM, 1 = wGNM.

Table 5

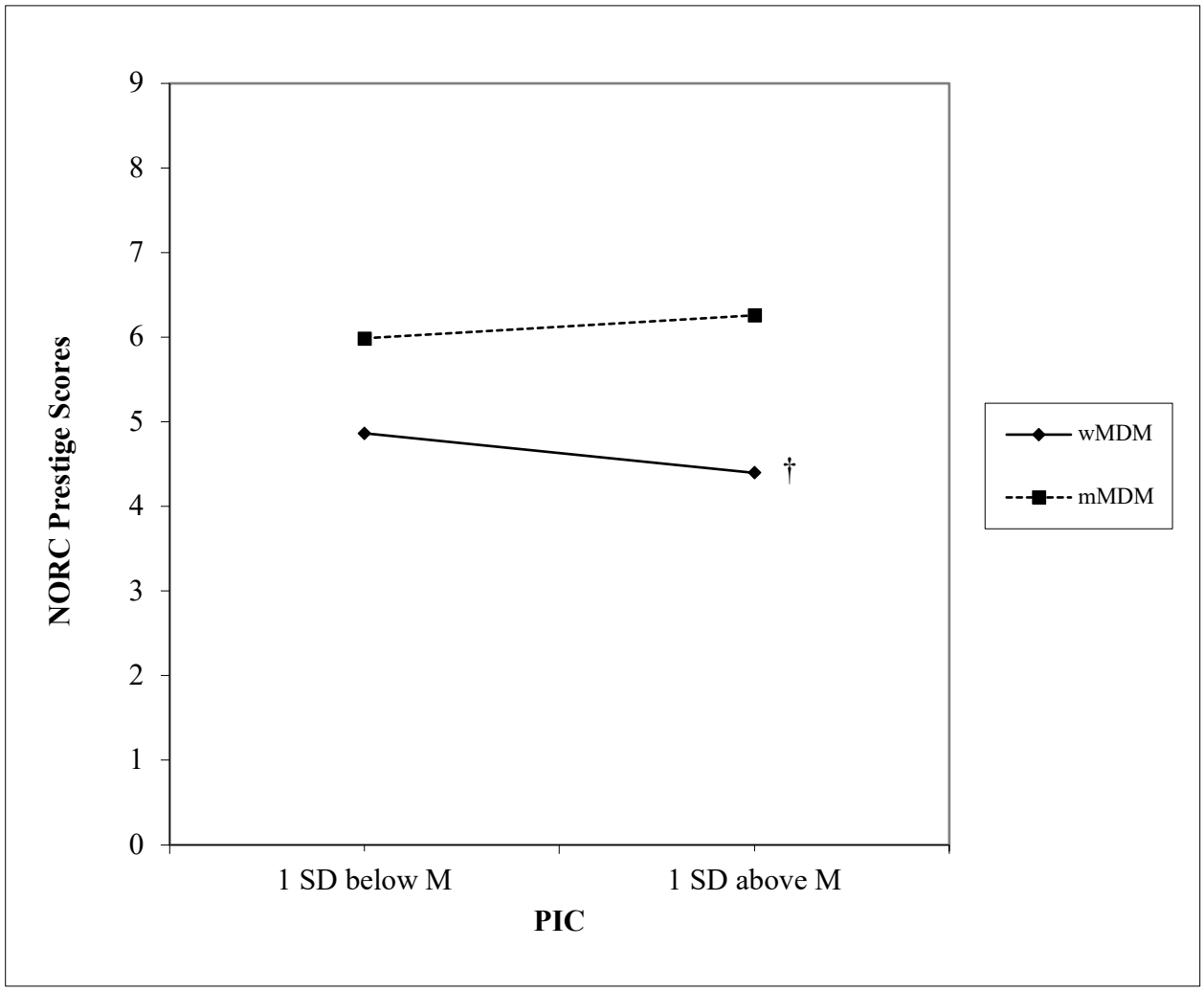
Multiple Regression predicting highest expected degree

	Beta (*B*)	Standard Error (*SE*)	Probability (*p*)
Intercept	3.78	.12	< .01
PIC, centered	-.05	.10	.64
mMDM	-.05	.17	< .01
wGNM	-.60	.16	.60
PIC*mMDM	.08	.15	.60
PIC*wGNM	<.01	.14	.98

Note. Dummy coding was used; mMDM: 0 = not a man in a MDM, i.e., wMDM or wGNM, 1 = man in a MDM and wGNM: 0 = not a woman in GNM, i.e., mMDM or wMDM, 1 = wGNM.

Figure 1

Interaction Effects Estimated Via Regression Analysis



Note. Two-way linear interaction effects estimated via regression analysis of NORC prestige score and PIC score between three groups.

Appendix A

Perceived Identity Compatibility between Gender and Major

Item Text	Reverse-Coded
I don't think that my gender will affect how others view me in my major.	
I don't think that my gender will affect how well I do in my major.	
I think my gender and my major are very compatible.	
I think I may experience difficulties in my major because of my gender.	RPIC4 = (1=7) (2=6) (3=5) (4=4) (5=3) (6=2) (7=1)
I think my gender will be an important factor in the type of career I decide to pursue.	RPIC5 = (1=7) (2=6) (3=5) (4=4) (5=3) (6=2) (7=1)
I don't think I would pursue certain fields because of my gender.	RPIC6 = (1=7) (2=6) (3=5) (4=4) (5=3) (6=2) (7=1)

ITEM SCALE

7-point Likert Scale
1 = Strongly Disagree
2 = Disagree
3 = Somewhat disagree
4 = Neither agree nor disagree
5 = Somewhat agree
6 = Agree
7 = Strongly agree

SCORING OF SCALE

A mean score of all 6 items is computed to create a composite measure of perceived compatibility between gender and major.

Appendix B

Career Aspirations

Item Text	Response Options
What is your desired occupation?	open-ended
What is the highest degree you expect to earn?	1 = You don't expect to earn a degree 2 = Associates degree 3 = Bachelor's degree 4 = Master's degree 5 = Professional degree (PhD, MD, JD, etc.)

Office of Research Integrity
Institutional Review Board (IRB)
2000 University Avenue
Muncie, IN 47306-0155
Phone: 765-285-5052
Email: orihelp@bsu.edu

DATE:	December 23, 2019
TO:	Viveka Melo, None
FROM:	Ball State University IRB
RE:	IRB protocol # 1531172-1
TITLE:	Perceived Identity Compatibility and Expected Post-Undergraduate Achievement for Women in Male-Dominated Majors
SUBMISSION TYPE:	New Project
DECISION:	APPROVED
PROJECT STATUS:	EXEMPT
DECISION DATE:	December 23, 2019
REVIEW TYPE:	Exempt Review

The designated reviewer for the Institutional Review Board (IRB) reviewed your protocol and determined the procedures you have proposed are appropriate for exemption under the federal regulations. As such, there will be no further review of your protocol, and you are cleared to proceed with the procedures outlined in your protocol. As an exempt study, there is no requirement for continuing review. Your protocol will remain on file with the IRB as a matter of record. All research under this protocol must be conducted in accordance with the approved submission and in accordance with the principles of the Belmont Report.

Exempt Categories:

	Category 1: Research conducted in established or commonly accepted educational settings, that specifically involves normal educations practices that are not likely to adversely impact students' opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
	Category 2: Research that only includes interactions involving educational test (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through

	identifiers linked to the subjects; (ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or (iii) The information obtained is recorded by the investigator in such a manner that the identity of the humans subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 46.111(a)(7).
	Category 3: Research involving benign behavioral interventions in conjunction with the collection of information from an adult subject through verbal or written responses (including data entry) or audiovisual recording if the subject prospectively agrees to the intervention and information collection and at least one of the following criteria is met: (A) The information obtained is recorded by the investigator in such a manner that the identity of human subjects cannot be readily ascertained, directly or through identifiers linked to the subjects; (B) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or (C) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can be readily ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 46.111(a)(7).
X	**Category 4:** Secondary research for which consent is not required.
	Category 5: Research and demonstration projects that are conducted or supported by a Federal department or agency, or otherwise subject to the approval of department or agency heads, and that are designed to study, evaluate, improve, or otherwise examine public benefit or service programs, including procedures for obtaining benefits or services under those programs, possible changes in or alternatives to those programs or procedures, or possible changes in methods or levels of payment for benefits or services under those programs.
	Category 6: Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.
	Category 7: Storage or maintenance for secondary research for which broad consent is required: Storage or maintenance of identifiable private information or identifiable biospecimens for potential secondary research use if an IRB conducts a limited IRB review and makes the determinations required by 46.111(a)(8).
	Category 8: Secondary research for which broad consent is required: Research involving the use of identifiable private information or identifiable biospecimens for secondary research use, if the following criteria are met: (1)Broad consent for the storage, maintenance, and secondary research use of the identifiable private information or identifiable biospecimens was obtained in accordance with §46.116(a)(1) through (4), (a)(6), and (d); (2) Documentation of informed consent or waiver of documentation of consent was obtained in accordance with §46.117; and (3) An IRB conducts a limited IRB review and makes the determination required by §46.111(a)(7) and makes the determination that the research to be conducted is within the scope of the broad consent referenced in paragraph (d)(8)(i) of this section; and (iv) The investigator does not include returning individual research results to participants as part of the study plan. Note: This provision does not prevent an investigator from abiding by any legal requirements to return individual research results.

Ball State Specific Exempt Categories

	Category 9: Research involving publicly observable online behavior. Any online behavior that requires a person's permission to access is considered private and does not fall under this category. Information that cannot be accessed by the general population would also be considered private.

	Category 10: Research involving BSU students who are under 18 but have legal authority over their FERPA protected information. Only studies that fall into another exempt category except for sampling from BSU students who are under 18 can be considered exempt in this category.

While your project does not require continuing review, it is the responsibility of the P.I. (and, if applicable, faculty supervisor) to inform the IRB if the procedures presented in this protocol are to be modified or if problems related to human research participants arise in connection with this project. **Any procedural modifications must be evaluated by the IRB before being implemented, as some modifications may change the review status of this project.** Please contact Grace Yoder at (765) 285-5034 or gmyoder@bsu.edu if you are unsure whether your proposed modification requires review or have any questions. Proposed modifications should be addressed in writing and submitted electronically to the IRBNet as a "Modification/Amendment" for review. Please reference your IRB protocol number 1531172-1 in any communication to the IRB regarding this project.

In the case of an adverse event and/or unanticipated problem, you will need to submit written documentation of the event to IRBNet under this protocol number and you will need to directly notify the Office of Research Integrity (http://www.bsu.edu/irb) **within 5 business days.** If you have questions, please contact Grace Yoder at (765) 285-5034 or gmyoder@bsu.edu.

Reminder: Even though your study is exempt from the relevant federal regulations of the Common Rule (45 CFR 46, subpart A), Ball State has elected to hold you accountable to these regulations to encourage best research practices. You and your research team are not exempt from ethical research practices and should therefore employ all protections for your participants and their data which are appropriate to your project.