

Intersectionality Matters in Understanding the Effects of Gender Role Congruity, Individual Identity, and IT Self-Efficacy on IT Career Choices

K. D. Joshi
University of Nevada Reno
kjoshi@unr.edu

Eileen Trauth (Emeritus)
Pennsylvania State University
emtrauth@gmail.com

Lynette Yarger
Pennsylvania State University
lmk12@psu.edu

Abstract

The gender imbalance in the information technology (IT) field is frequently explained using group-level analyses suggesting that gender role expectations, that drive individuals to choose occupations that are congruent with the prescribed gender roles to reduce conflict caused by deviating from these expectations, account for under-representation. However, a problem with this explanation is that it assumes that all women and all men receive similar messages, interpret role senders' messages in the same manner, and adopt similar patterns of behavior. In this paper, we overcome this problem by taking into account between-group and within-group differences to investigate the effect of intersecting group membership that shapes one's identity on IT career choices. A survey methodology was used to collect and analyze data. By examining the perceptions of 5,585 undergraduate students across 11 large U.S. universities, we illustrate the importance of intersectionality in understanding the complexities of IT career choices and highlight the need for more inclusive and holistic approaches to address gender disparities in this field.

Keywords: Gender, Information Technology, Intersectionality, Ethnicity, Identity, Self-Efficacy

1. Introduction

At a time when IT is becoming increasingly pervasive and ubiquitous, and the career prospects for IT professionals are looking bright, it is deeply ironic that a majority of the U.S. population is not participating in this economic sector. Women and historically underrepresented ethnic groups (e.g., Blacks, Hispanics, Native Americans, and Alaska Natives) are largely absent in the IT profession. These gaps persist despite the movement by many federal and state government agencies, companies, and universities toward interventions to broaden participation in technical fields. In fact, in the U.S., women's participation in

computing occupations has declined since the 1990s (Funk and Parker, 2018).

For these reasons, we need to look at the groups that are underrepresented and why. Much of the research on underrepresentation views gender and ethnicity as two distinct groups. In other words, research and interventions tend to target women or racial/ethnic groups. Imbalance in the IT field is typically explained using group-level analyses based on the assumption that gender role expectations account for this underrepresentation. Thus, because of the "...conflict caused by deviating from these expectations, females and males predominantly sort themselves into occupations related to their gender roles" (Kidder, 2001; Joshi & Kuhn, 2005; Kidder and Parks, 2006). However, a problem with this explanation is that it assumes that all females receive similar messages, interpret role senders' messages in the same manner, and adopt similar patterns of behavior. However, the evidence of varying gender participation in IT among different societies and the mere fact that some women choose IT careers challenges this assumption. Hence, there is a need to probe deeper and examine the complexity of gender groups to identify factors that are influential in an IT career choice. Therefore, the objective of this study is to explore the following research question: *How does the interplay between self-efficacy, gender, ethnicity, and class identities affect IT career intentions amidst exposure to stereotypic gender role messages?*

To achieve this objective, we investigated the effect of two intersecting aspects of gender group membership that shape one's identity – ethnicity and socio-economic class – on an IT career choice. By investigating these intersecting group memberships, we uncovered more nuanced explanations of the gender imbalance in IT (Joshi, 2022). We accomplished this by examining the patterns of behavioral differences and the processes of conflict resolution through the lens of the Individual Differences Theory of Gender and IT (Trauth & Connolly, 2021, Trauth 2002, 2006; Trauth et al. 2004).

This theoretical approach allows for the inclusion of factors that help to explain why one person's interest and persistence in the IT field would be discouraged while another's would not, even though these individuals experience similar gender role expectations. In the process of examining factors influencing women, we also uncovered new gender insights related to minority masculine gender groups. The major contribution of this work is its theorizing of the problem of gender underrepresentation in IT. It contributes to the greater theorization of gender as it relates to participation in the IT discipline since it goes beyond the widely accepted gender role theory to reveal new and nuanced insights (e.g., uncovering factors that explain within-gender differences).

2. Theoretical Background

While gender imbalance in IT is a research topic in several academic disciplines (e.g., computer science, engineering), this review focuses on the gender research that exists in the information systems literature. This study seeks to find a middle ground that avoids the dual problems of social determinism and the perception of college students as completely free agents. By doing so, we can observe similarities and differences in how both societal and individual factors shape the IT career intentions of college students.

The Role Congruity Theory: Gender role theorists assert that gender roles are central to how we think and make judgments about ourselves and our assessments of others' behaviors (Eagly & Karau, 2002; Kidder & Parks, 2001; Eagly, Wood, & Diekmann, 2000; Kidder and Parks, 2006). Accordingly, gender roles are consensual beliefs about the attributes of women and men. "These beliefs are more than beliefs about the attribution of women and men. Many of these expectations are normative in the sense that they describe qualities or behavioral tendencies believed to be desirable for each sex" (Eagly & Karau, 2002, pg. 13). Beyond gender role expectations related to a particular job are the effects of gender role expectations related to workplace behaviors. Rudman's research examines backlash experienced by agentic women whose workplace behaviors deviate from gender-stereotyped expectations. That is, women in leadership positions who enact masculine behaviors are not liked when they deviate from gender stereotypes (i.e. that women should be kind, thoughtful, and sensitive to others' feelings). The Role Congruity Theory predicts that achieving leadership would be more difficult for women than men, because of a perception that women have less leadership ability and because of a preference that women not exhibit this ability and, instead, engage

in what is considered to be more 'feminine' behavior. When applied to the examination of the underrepresentation of women in IT, Role Congruity Theory suggests that the underrepresentation of females in certain male-dominated roles can be explained partially through the perceived incongruity of IT roles with stereotypic gender roles.

The issues that arise with gender role expectations, in turn, lead to gender role conflicts. Research on sex-role spillover has demonstrated that gender-based expectations of behaviors can spill over into occupational and job roles that males and females engage in, regardless of the actual job role (Eagly, Karau, & Makhijani, 1995). The research on spill-over effects shows that gender role expectancies can generate conflicts in the minds of both the individuals and those with whom they interact. Gender role conflicts (labeled as gender role incongruity or GRC in this paper) arise from the perceived association between the characteristics of gender and the requirements of the occupational roles that sex group members occupy or aspire to occupy (such as IT professional, leader, fighter-pilot).

A potential for conflict or incongruity exists when an individual holds a stereotype about gender that is incongruent with the attributes that are thought to be required for success in certain occupational roles. Thus, a woman's ambivalence about pursuing an IT career could arise from the incongruity that she perceives between the characteristics ascribed to females and the requirements of IT work (Camp, 1997, 1998; Katz, Allbritton, Aronis, Wilson, & Soffa, 2006; Ahuja, Chudova, Kacmar, McKnight, & George, 2007; Morgan, Quesenberry, and Trauth, 2004). For instance, roles ascribed to IT careers may be perceived by women as incongruent or in conflict with their perceived gender role (e.g., pretty cheerleader vs. a geeky programmer, skilled at math vs. verbally skilled). It is well documented that the IT field is a male-dominated occupation (Margolis, Fisher, and Miller, 1998; Margolis & Fisher, 2002; Joshi & Schmidt, 2006; Joshi & Kuhn, 2007; Joshi, 2023). As such, predominately masculine attributes have been ascribed to generic IT roles (Joshi & Kuhn, 2005; Joshi & Schmidt, 2006). Consequently, IT careers for women can be viewed as violating perceived norms of the female gender role. The Role Congruity Theory suggests that the greater the degree of masculinity present in the characterization of IT roles, the greater the incongruity between the female gender and IT roles. Conversely, if the IT roles are perceived to be less masculine, they would be more congruent with the female gender role, and therefore the tendency to view women as less qualified than men

should weaken. Defining IT roles as predominantly masculine contributes to the incongruity between the female gender role and professional IT roles. Thus, a female occupying an IT role would face expectations based on her gender which may conflict with expectations regarding IT roles.

According to this line of thinking, a person accepts a pattern of behaviors (or roles) by resolving or reducing the emotional and cognitive dissonance caused by role conflict. Hence, from a role congruity perspective, men and women are motivated to choose careers that are in congruence with their gender roles (Eagly, Wood, & Diekmann, 2000; Eagly & Karau, 2002). The Role Congruity Theory further suggests that congruity between gender and IT roles would vary based on a respondent's sex (a male-female binary is assumed). If one accepts normative societal messages that, on average, men possess greater masculine traits and women more feminine traits, then it follows that there would be greater gender and IT role incongruity among the female respondents than male respondents. Hence, it is argued that this role incongruity would decrease women's IT career intentions. This pressure to conform to normative gender expectations is explained by gender theorists through expectancy confirmation and self-regulatory processes. Gender role theorists posit that "through self-regulatory and expectancy confirmation processes, gender roles can induce sex differences in behavior in the absence of any intrinsic, inborn psychological differences between women and men" (Eagly & Karau, 2002, p. 510).

Psychological gender literature suggests that expectancies associated with gender roles and pressure to comply with those expectancies to abate role incongruities promote behaviors consistent with these roles through expectancy confirmation processes (Eagly, Wood, & Diekmann, 2000). Research shows that gender role stereotypic expectancies are powerful and these expectancies have resulted in some of the clearest demonstrations of behavioral confirmation (e.g., Skrypnik & Snyder, 1982; see the review by Geis, 1993). Expectancy confirmation processes would suggest that female students may be less attracted to IT roles and thus less likely to aspire to IT careers if their degree of incongruity between IT and gender roles is high (Varma & LaFever, 2007). However, the presence of women in the IT field suggests that some women can tolerate a high level of incongruity, that gender and IT roles are not widely incongruent (Cohoon, 2001), or that some other factors are also in play.

Also relevant to the effects of gender roles on IT career aspirations are self-regulatory processes. Prior gender

research suggests that self-regulatory processes are important causes of sex-differentiated behavior and, in turn, could explain the tendencies for certain occupations (such as IT) to remain relatively segregated by sex along gender-stereotypic lines (Eagly, Wood, & Diekmann, 2000; Cejka & Eagly, 1999). The notion of self-regulatory processes is grounded in the concept of self-definition. Prior gender research shows that a person's self-concept tends to include gender-stereotypic content, which implies that gender roles influence a person's identity. This influence is even more powerful or activated by certain situations. This line of thinking would suggest that a lower proportion of women in a group would trigger self-regulatory processes consistent with gender stereotypes. Some gender research informed by this theory shows that women's social identities in their work environments exhibit prevailing gender stereotyping, especially when women are underrepresented in organizations at senior levels (Gilbert, 2006). This line of research argues that women tend to behave according to gender stereotypes due to internalized aspects of gender roles, especially if situational cues (such as a lower ratio of women) make these aspects particularly accessible. This would suggest that female students, due to their underrepresentation in IT, would be much more likely to self-regulate and voluntarily opt out of IT careers.

However, the fact that there are some women in the IT field suggests that other factors must be taken into account to explain how not all women internalize the same gender roles, experience the same gender roles in the same ways, or experience the same constraints as a result of gender roles. The fact that some women overcome gender stereotype constraints suggests that Role Congruency Theory is a useful, but partial, explanation since it theorizes differences based on gender alone. That is, while Role Congruency Theory is valuable for explaining differences between the sexes with respect to participation in the IT field, it does not help to explain differences among females. Thus, there is a need for theoretical insights into within-gender variation in terms of influences that shape IT career selection and persistence.

Individual Differences Theory of Gender and IT:

The Individual Differences Theory of Gender and IT presents an alternative to theorizing the underrepresentation of women in the IT field based on sex-group-level assumptions. The prevailing theories currently reflected in the majority of the literature about the underrepresentation of women in IT tend to adopt either an essentialist or a social constructivist stance (Trauth & Connolly, 2021). Essentialism is the assertion of fixed, unified, and opposed female and male natures

(Wajcman, 1991; Heyman and Giles, 2006). When applied to the topic of gender and IT, the essentialist perspective presumes the existence of relevant inherent differences between women and men concerning IT. It uses the observed differences in the participation of women and men in the IT field as evidence. Thus, the causes of gender underrepresentation in IT are attributed to inherent differences between men and women that are presumed to be derived from bio-psychological differences between the sexes. The social construction theoretical perspective focuses on IT as a male domain. Reflective of Gender Role Congruency Theory at the psychological level, this theoretical perspective, which operates at the sociological level, asserts that society has constructed a fundamental incompatibility between feminine identity and the gender identity of IT and IT work as masculine.

This theory emerged in response to a perceived need for greater theorization of the role of within-gender variation in explaining the underrepresentation of women in the IT field. Developed by Trauth in prior research (i.e. field studies of female IT professionals), it focuses on understanding the individual variation in response to societal-level gender influences regarding IT (Trauth & Connolly, 2021; Trauth & Quesenberry, 2023). It is concerned with addressing the question of why some women enter and persist in the IT field in the face of systemic gender biases and gender role incongruities that manifest in both education and work environments. The theory posits that the answer can be found in the combined influences of endogenous and exogenous factors that impact an individual's personal development and subsequent IT career decisions. That is, while all females in a particular society may be exposed to the same messages about gender roles and IT careers, both the interpretation of these messages and the response to them will vary as a result of individual factors (Trauth & Connolly, 2021; Trauth & Quesenberry, 2006). Thus, the Individual Differences Theory of Gender and IT searches for the causes of gender underrepresentation by examining the factors that account for the varied ways that individuals internalize and respond to messages about gender. It seeks to understand the sources of individual agency that enable some women to overcome systemic negative influences.

According to this theory, an understanding of individual responses to societal influences can be obtained from an understanding of the combination of personal characteristics and environmental influences. Hence, the focus is on differences within rather than between genders. The theory also views women and men as individuals who possess different technical talents and

inclinations and respond to the social shaping of gender in unique and particular ways. This theory acknowledges that common social shaping messages are conveyed to subgroups in a culture (e.g., to women by age, race, etc.). But at the same time, it also takes into account the varied influences of individual backgrounds and critical life events that result in a range of responses to uniform messages (i.e. not all women of a certain age group respond in the same way to commonly received messages). The Individual Differences Theory of Gender and IT is comprised of three general constructs that, together, explain women's decisions to enter and remain in the IT field. The individual identity construct includes both personal demographic items (e.g., age, race, ethnicity, nationality, socio-economic class, and parenting status) and career items (e.g., industry in which one currently or will work, IT discipline – computer science, information systems, and information science – one is studying). The individual influence construct includes personal characteristics (e.g., educational background, personality traits, and abilities) and personal influences (e.g., mentors, role models, experiences with computing, and other significant life experiences). Finally, the environmental influence construct includes cultural attitudes and values (e.g., attitudes about IT, about women in IT, about race/ethnicity) related to the geographic area in which one lives, as well as economic and policy influences in that region/country. The Individual Differences Theory of Gender and IT posits that, collectively, these constructs account for the differences among men and women in the ways they relate to the IT field, and societal messages about women, men, and IT.

The research reported in this paper includes two of the constructs of the Individual Differences Theory of Gender and IT – individual identity and individual influences -- along with Gender Role Theory to understand underrepresented groups in IT. It is accomplished by building on prior research that focused on differences with respect to race, ethnicity, and class (Kvasny, Trauth, & Morgan, 2009). This theory enables the exploration of complex interactions among specific aspects of the individual identity construct (i.e. race, gender, class, and ethnicity) to provide more nuanced ways of understanding their relationships to the career interests of young women and men (Augustine, Camp, Martin, & Wardle, 1999). For instance, it has been shown that ethnic identity and other-group orientation are more significant predictors of career decision-making self-efficacy for people of color than for whites. In addition to glass ceilings based on gender, women of color may also perceive challenges based on racism and discrimination. Thus, the external environment that

women of color perceive is similar but also different from the environment perceived by white women.

In addition, the individual influence construct of this theory facilitates the examination of the relationships among race, ethnicity, and class on the one hand, and personal self-efficacy on the other. Prior studies on the interaction of race and gender in STEM education suggest that gender-differentiated self-confidence in STEM learning varies across races. For instance, African-American women were found to be independent and assertive and, in some cases, expressed greater confidence than women in other racial/ethnic groups. However, African-American women who choose majors in STEM tend to be from high schools where they have been seen as academically outstanding relative to their peers. These highly capable women have developed strong academic self-confidence but have not taken or been offered the advanced placement or similar coursework necessary for STEM programs at the college level—especially in highly selective universities (Lopez & Schulte, 2002a; Lopez & Schulte, 2002b). These women face a unique dilemma which Seymour and Hewitt (1997) term the “conflict between over-confidence and poor preparation .”

The individual identity and individual influence constructs of this theory combined with the Gender Role Congruency Theory provide a more robust examination of influences on the individual’s career intentions. That is, as a person perceives fewer barriers and believes in her ability to undertake an endeavor, she will persist in STEM coursework and have a higher likelihood of being successful (Camp 1997, 1998; Stockard, Myungsook, & Akbari, 2005). This likelihood of success reinforces the career intention. However, if the barriers are viewed as significant and self-efficacy is low, there is a weaker intention. For underrepresented groups, self-efficacy beliefs may be undermined by a combination of racial and sex-role stereotypes. Indeed, a review of studies of self-efficacy in IT and STEM across countries, decades, and educational environments reveals a consistent finding: observed gender differences in self-efficacy can be directly linked to the imposition of gender role stereotypes and stereotype threats (Guimond & Roussel, 2001; Hamlin, Riehl, Hamlin & Monte, 2010; Henwood, 2000; Serva, Baroudi, & Kydd, 2009).

Therefore, individuals may foreclose career options that they perceive are not truly open to them. This type of finding would be highly troublesome because it would suggest that women may, in fact, be discouraged from majoring in STEM-related disciplines. This type of finding would also be helpful in that it demonstrates that

some women have been able to persist and achieve in a non-supportive environment. The use of the theoretical lens of the Individual Differences Theory of Gender and IT produces the insight that coping mechanisms and self-efficacy are ways of theorizing women’s persistence in non-supportive environments.

3. Conceptual Model

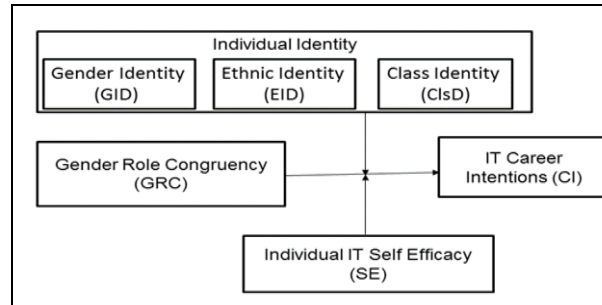


Figure 1. Research Model.

The research model illustrated in Figure 1 is constructed out of two complementary theoretical pillars discussed in the prior section. One is the body of gender role theories which considers individual behaviors in light of gender-group level influences. The other theoretical pillar is the Individual Differences Theory of Gender and IT which considers a variety of influences that result in within-group variation. Taken together, they can help to explain factors that enhance and inhibit men’s and women’s interest in IT. Based on the two theoretical underpinnings, we argue that individual identities and IT self-efficacy intersect with gender role congruity to explain IT career intentions. We further posit that individual identities and IT self-efficacy moderate the relationships between gender role congruity and IT career intentions. Gender is modeled and handled in this study very subtly (not simply as male or female), first by computing gender role congruities based on one’s sex (man or woman) and gender typing of IT skills, and then by capturing an individual’s gender identities. In our research model, the IT roles construct is conceptualized as an individual’s personal views about the important attributes, skills, and competencies required for IT work, while the gender roles construct is conceptualized as an individual’s internalization of socially defined gender attributes necessary to be an IT professional. These attributes are described along a masculine/feminine continuum. These two constructs are used to measure gender role congruity, which is the congruity between gender roles and IT stereotypes. The individual identity construct is conceptualized as the relative importance or salience of sex, ethnicity, and class in shaping a sense of identity. The individual self-efficacy construct is conceptualized

as the individual's belief that she can complete the tasks necessary to become an IT professional. Finally, career intention is operationalized as an individual's intentions regarding her future IT career. The resulting research model is shown in Figure 1.

The objective of this study was to explore the intersecting influences of three factors – individual identity (derived from gender, ethnicity, and socio-economic class), self-efficacy, and gender role congruency – on IT career intentions of university students who are considering IT or who have already committed to an IT career. The overarching research question examined in this study is the following: *How does the interplay between self-efficacy, gender, ethnicity, and class identities affect IT career intentions in the context of stereotypic gender role messages?*

4. Methods

A survey methodology was used to examine the research question. Undergraduate students enrolled in IT courses at 11 large U.S. universities were surveyed to model the effects of gender role congruity (GRC), IT self-efficacy (SE), and individuals' identities on IT career choices. Students participated in this study on a volunteer basis with the opportunity to earn bonus points. A total of 5,585 students completed the survey. The sample is comprised of 62% males and 38% females. Of those who identified an academic major, 66% of the students in the sample selected a non-IT-related major, and 34% reported having chosen an IT-related major. In our model, we controlled for the attended university and academic major. We did not need to control for gender, class, and ethnicity since these identities are captured through the individual identity constructs.

Operationalization of Constructs: The scales for IT Career Intentions (CI) (Taylor & Todd, 1995), Gender Identity (GI) (Bem Sex Role Inventory (BSRI); Bem, 1981), Ethnic Identity (EI) (Ethnic Identity Measure (MEIM); Phinney, 1992), Class Identity (ClsD) (Status Identity Scale, Thompson & Subich, 2007) were adopted from the existing literature. However, the items for the IT SE and Gender Role Congruity (computed using IT Skills Importance and IT Skills gender typing) constructs were based on an extensive literature review conducted by Huang et al. (2009), who reviewed IT job skills across three genres of texts: scholarly articles, practitioner literature, and online job ads. The content from these three sources was analyzed using a two-stage, grounded theory approach in which the IT job skills emerged from the data. In the first stage, three coding schemes were developed based on the articles

and job advertisements. In the second stage, the authors synthesized and summarized the data across the three data sources to develop a comprehensive set of 60 skill items. In this study, we further consolidated these 60 items into 39 broader categories (e.g., C#, COBOL, Java, and .NET were consolidated into one item, namely Programming Skills). These 39 items were used to measure IT Self-Efficacy IT Skills Importance and IT Skills Gender Typing constructs.

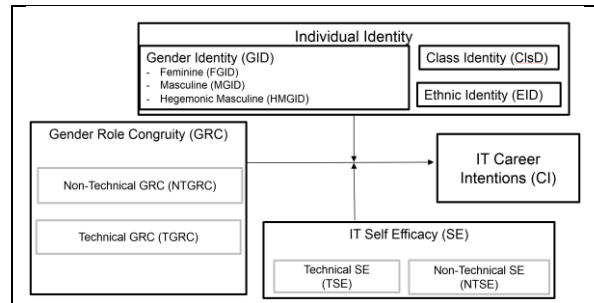


Figure 2. Measurement Model.

Measurement Models: The measurement model with the validated factor structures for each of the constructs included is illustrated in Figure 2. An extensive multi-year pilot study was conducted to uncover this measurement model and to test the psychometric properties of the constructs (Joshi, Trauth, Kvasny, and McPherson, 2013).

Career Intentions (CI): This construct was measured by asking students the likelihood of their majoring in MIS. On a scale of 1 to 5 respondents specified the likelihood of the following two items: “Assuming I satisfy the requirements, I intend to take an IT-related major” and “I intend to pursue my career in the field of Information Technology.” The reliability for these two items as measured by Cronbach's Alpha was .94, which is above the acceptable cutoff of 0.70.

IT Skills Self-Efficacy: For the IT self-efficacy items, on a scale of 1 (not at all confident) to 5 (totally confident), respondents were asked to specify their level of self-confidence about their ability to learn and engage with each of the 36 items. To avoid any bias due to sequencing, these 36 items were presented to each individual in a randomized fashion. First, an exploratory factor analysis was conducted on 36 IT skills to uncover the underlying factor structure for the IT self-efficacy construct. Two factors emerged from this analysis. The factor loadings and the corresponding model fit statistics are listed in Table 2. An item was said to load on a given factor if the factor loading was greater than 0.44 for that factor and less than 0.30 for the others. Eight of the 36 skills were removed because they loaded marginally on

multiple factors, which suggested that these eight items did not fit into one of the two factors. The model fit statistics for the two-factor model structure were very strong, thus providing strong support for our two-factor model. The Comparative Fit Index (CFI) is well above the cut-off of 0.90 and the Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) were well below the required cutoff of 0.06. It has been demonstrated that the chi-square test of model fit is sensitive to sample sizes greater than 200 (Browne, 2006). Thus, even though the chi-square for this model is significant, this is likely due to our sample being much larger than 200. The EFA analysis confirms that 28 IT skills were adequately captured by the two constructs, each of which is distinct from one another. The review of the skills in each of the two factors revealed that one factor consisted of all the skills that were predominately viewed as technical (e.g., programming skills, integrating enterprise applications, systems implementation). We refer to IT Technical Skills Self-Efficacy as Technical Self-efficacy (TSE). The second factor predominately consisted of non-technical skills (such as customer relationship skills, and leadership skills) and therefore is referred to as Non-Technical Self-efficacy (NTSE). We confirmed our measurement model by conducting a confirmatory factor analysis. A measurement model describes the relationship between the factors uncovered in the EFA analysis and their respective indicator variables. The measurement model is said to provide a good fit to the data if each of the IT skills items was doing a good job of measuring the two factors. CFA analysis allowed us to test the fit of our measurement model. The comparative Fit Index (CFI) for the IT Self-Efficacy model was well above the cut-off of 0.90 and the Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) were below or at the required cutoff of 0.06. The loading ranged from 0.49 to 0.76, which explains variances ranging from 24% to 58%. The CFA analysis provided strong support for our measurement model, which suggests that the IT skill items under each of the two factors adequately measure the two self-efficacy constructs. Furthermore, the reliabilities for these two self-efficacy constructs as measured by Cronbach's Alpha was well above the acceptable cutoff of 0.70.

Gender Role Congruity (GRC): GRC measures the degree to which an individual's perceptions regarding the importance of IT roles are congruent with her gender and gender typing of those roles. This measure accounts for the variations between genders, thus explaining gender-group level influences postulated by gender role theorists. To compute this measure, the participants' perceptions about IT roles and gender typing of those

roles were captured using the 39 skills discussed above. The IT roles captured participants' perceptions regarding the importance of the 39 skills necessary to successfully perform the roles prescribed to IT professionals. Their perceptions were captured on a scale of 1 (not at all important) to 5 (very important). Respondents were asked to specify their opinions about how important is it that someone working in an IT career would need these skills to be successful. The typing according to gender for these same roles captures their perceptions regarding the degree to which these 39 skills are gendered. For this construct, using the same list of 39 skills, individuals were asked to specify on a Likert scale (with 'feminine' and 'masculine' as anchors) the degree to which they consider a skill to be masculine or feminine. For females, the anchor represented an increasing degree of femininity (1 masculine; 5 feminine) whereas for males the anchor represented an increasing degree of masculinity (1 feminine; 5 masculine). The Gender Role Congruity (GRC) measure was computed by subtracting an individual's rating on the importance scale from the gender typing scale (Joshi & Kuhn, 2011). The GRC values were converted to z-scores to make the interpretation simpler (i.e. mean of 0, standard deviation of 1). This variable was coded to measure the increasing level of congruity such that 0 indicates perfect incongruity, while scores that get farther away from 0 indicate more congruity. Zero means an individual's stereotypic gender roles are completely incongruous (i.e. incongruity) with the IT roles. Reciprocally, as a person's score moves away from zero, then her stereotypic gender roles are more congruous with the IT roles (i.e., high congruity). These GRC scores were used to conduct the EFA and CFA analysis to first uncover the underlying factor structure for the GRC construct and then to validate the fit of the resulting measurement structure. The EFA analysis revealed strong support for a two-factor structure. The comparative Fit Index (CFI) for the GRC model was well above the cut-off of 0.90 and the Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) were below or at the required cutoff of 0.06. The loading ranged from 0.58 to 0.77. The CFA analysis provided strong support for our measurement model, which suggests that the GRC under each of the two factors was adequately measuring the two GRC constructs. Furthermore, the reliabilities for these two self-efficacy constructs as measured by Cronbach's Alpha was well above the acceptable cutoff of 0.70.

Individual Identities: Like IT SE, the individual identities account for variation within gender groupings by examining how gender, ethnicity, and social class influence career intentions as postulated by Trauth and

Connolly (2021) Individual Differences Theory of Gender and IT. The ethnicity identity was measured using the Multigroup Ethnic Identity Measure (MEIM; Phinney, 1992). The MEIM scale, which is developed to capture the race/ethnicity identity, has good psychometric properties. The sex role identity was captured using the Bem Sex Role Inventory (BSRI 27-item scale) (Bem, 1981). Not only has BSRI been shown to have excellent reliability and high validity, but it is also the most frequently used sex role instrument (Lenney, 1991). We used the Thompson and Subich (2007) class status scale to measure class identity. This scale has three dimensions comprising a total of 13 items (access to resources and benefits; feeling valued as compared to the average U.S. citizen) that collectively form a latent class identity factor. We re-validated the psychometric properties of these three scales. The factor structure in the MEIM and Class Identity scales remained intact. However, the BSRI scale factor structure revealed three factors instead of two factors. The non-feminine items were split into two factors. One factor which included 11 items, such as independent and ambitious, is similar to Bem's Masculine Gender Identity (MGID). The second factor which included seven items, such as dominant, aggressive, and competitive, represents hegemonic masculinity gender identity (HMGID). The remaining nine items, such as affectionate, sympathetic, and sensitive to other's needs, are collectively labeled as feminine gender identity (FGID).

5. Preliminary Results and Next Steps

The results of the effects of Gender Role Congruity, Self-Efficacy, and identity on Career Intentions modeled by Gender and Ethnicity are summarized in Table 1. The most striking results are illustrated in the R-Square values that represent the percentage of the response variable variation. The model represented in Table 1 fits the data most poorly for the African-American (AA) population (explains 22% variation for AA women and 33% variation for AA men) compared to the rest of the groups (51% for White women, 46% for Asian women, 56% for Hispanic women, 55% for White men, 43% for Asian men, and 56% for Hispanic men). The differences in the amount of variation explained by the gender-ethnic group models suggest that the intersecting gender and ethnic group memberships are important in understanding students' IT career choices.

Our findings indicate that analyzing the posited model of gender-ethnicity intersectionality unveils significant variations in the factors influencing career choices among men and women from different ethnic

backgrounds. Notably, no discernible pattern of influence is exclusively tied to either gender or ethnicity. Therefore, the key observation uncovered from these findings is that intersectionality matters. The significance of gender-ethnicity intersectionality revealed in this study's finding in explaining IT career choices supports our thesis that there is a need for theoretical insights into within-gender variation to explain influences that shape IT career choices. It demonstrates that the Role Congruity Theory, which theorizes differences based on gender alone, is insufficient in explaining gender differences.

But, interestingly, our analysis at the Gender-ethnicity levels uncovered another important identity, i.e., academic major, which appears to play a key role in shaping students' IT career choices. Therefore, there is a need to dig deeper to find and fully interpret the stories about IT career choices that live in our dataset. To achieve this, we must account for the considerable variance explained by academic majors by including this additional group identity in our analysis. This inclusion will allow us to explore how gender, ethnicity, and academic major intersect and influence our findings. Through such analysis, which compares women majoring in IT with other women who are not within a certain ethnic group, we can delve deeper into our thesis, which posits that not all women, due to their underrepresentation in IT professions, are necessarily inclined to self-regulate and voluntarily opt out of IT careers. This nuanced examination will provide valuable insights into why some women enter the IT field in the face of systemic gender biases and gender role incongruities that manifest in the environments. The next step is to examine the role of academic majors by testing the model at the intersection of gender-ethnic-academic major groups. Instead of controlling for this new identity, we will account for the variations in IT career choices according to the extent to which one identifies with being an IT professional.

6. References

- Ahuja, M. K., Chudoba, K. M., Kacmar, C. J., McKnight, D. H., & George, J. F. (2007). IT road warriors: Balancing work-family conflict, job autonomy, and work overload to mitigate turnover intentions. *Mis Quarterly*, 1-17.
- Augustine, D., Camp, T., Martin, D., and Wardle, C. (1999). "The Silicon Ceiling: Gender Barriers in the Computer Science Profession in Germany and the USA," *Proceedings of the 1999 International Symposium on Technology and Society*, (47-356).
- Bem, S.L. (1981). *Bem Sex-Role Inventory*, Redwood City, CA: Consulting Psychologists Press.
- Camp, T. (1997). "The Incredible Shrinking Pipeline," *Communications of the ACM*, 40, 10, (103-110), 1997.

- Camp, T. (1998). "CS Programs in Engineering Colleges = Fewer Females," *Journal of Women and Minorities in Science and Engineering*, 4, 1 (15–25).
- Cejka, M. A., & Eagly, A. H. (1999). Gender-stereotypic images of occupations correspond to the sex segregation of employment. *Personality and Social Psychology Bulletin*, 25(4), 413-423.
- Cohoon, J. M. (2001). Toward improving female retention in the computer science major. *Communications of the ACM*, 44(5), 108-114.
- Eagly, A. H., & Karau, S. J. (2002). Role congruity theory of prejudice toward female leaders. *Psychological review*, 109(3), 573.
- Eagly, A. H., Wood, W., and Diekmann, A. B. (2000). Social role theory of sex differences and similarities: A current appraisal. In T. Eckes & H. M. Trautner (Eds.), *The Developmental Social Psychology Of Gender* (123-174). Mahwah, NJ: Erlbaum.
- Geis, F. L. (1993). Self-fulfilling prophecies: A social psychological view of gender. In A. E. Beall, & R. J. Sternberg (Eds.), *The psychology of gender* (9-54). New York: Guilford Press.
- Gilbert, J.E. (2006) Applications Quest: Computing Diversity. *Communications of the ACM*, 49, 3 (99-104).
- Guimond, S., & Roussel, L. (2001). Bragging about one's school grades: Gender stereotyping and students' perception of their abilities in science, mathematics, and language. *Social psychology of education*, 4(3-4), 275-293.
- Hamlin, B., Riehl, J., Hamlin, A. J., & Monte, A. (2010). Work in progress – What are you thinking? Overconfidence in first year students. In 2010 IEEE Frontiers in Education Conference (FIE) (pp. F2H-1). IEEE.
- Henwood, F. (2000). From the woman question in technology to the technology question in feminism: Rethinking gender equality in IT education. *European Journal of Women's Studies*, 7(2), 209-227.
- Huang, H., Kvasny, L., Joshi, K.D., Trauth, E.M. & Mahar, J. (2009). Synthesizing IT Job Skills Identified in Academic Studies, Practitioner Publications and Job Ads. Proceedings of the ACM SIGMIS Computer Personnel Research Conference (Limerick, Ireland, May 28-30).
- Heyman, G. & Giles, J. (2006). Gender and Psychological Essentialism. *Enfance*, 58, 293-310. <https://doi.org/10.3917/enf.583.0293>
- Joshi, K. D., & Schmidt, N. L. (2006). Is the information systems profession gendered? Characterization of IS professionals and IS career. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems*, 37(4), 26-41.
- Joshi, K. D., & Kuhn, K. M. (2007). What it takes to succeed in information technology consulting: Exploring the gender typing of critical attributes. *Information Technology & People*.
- Joshi, K. D. (2023). Am I good enough? Sources of IT self-efficacy as key impediments to narrowing the IT gender gap. *Handbook of Gender and Technology: Environment, Identity, Individual*. Edward Elgar Publishing.
- Joshi, K. D., Trauth, E., Kvasny, L., & McPherson, S. (2013, December). Exploring the differences among IT majors and non-majors: Modeling the effects of gender role congruity, individual identity, and IT self-efficacy on IT career choices. In *International Conference on Information Systems (ICIS)* (pp. 1613-1633).
- Joshi, K. D. 2022. Conceptualizing the Marginalized Context in Information Systems Research: An Intersectionality View. *SIGMIS Database* 53, 2 (May 2022), 7–10. <https://doi.org/10.1145/3533692.3533694>
- Katz, S., Allbritton, D., Aronis, J., Wilson, C., Soffa, M.(2006).Research contributions: Gender, achievement, and persistence in an undergraduate computer science program. *ACM SIGMIS Database*, 37, 4
- Kidder, D. L., & Parks, J. M. (2001). The good soldier: who is s (he)? *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 22(8), 939-959.
- Kidder, D. and Parks, J. (2006). The good soldier: Who is s(he)? *Journal of Organizational Behavior*, 22, 8, (939).
- Kvasny, L., Trauth, E. M., & Morgan, A. J. (2009). Power relations in IT education and work: The intersectionality of gender, race, and class. *Journal of Information, Communication and Ethics in Society*, 7(2/3), 96-118.
- Lenney, E. (1991). Sex roles: The measurement of masculinity, femininity, and androgyny. In J. Robinson, P. Shaver, and L. Wrightsman (Eds.), *Measures of Personality and Social Psychological Attitudes* (573-660). San Diego: Academic Press.
- Lopez, A., and Schulte, L. (2002a) Bachelor's Degrees in Computer Science Awarded to African American Women: Some Interesting Anomalies. Proceedings of the ADMI 2002, Orlando, FL, (28-32).
- Lopez, A., and Schulte, L. (2002b) African American Women in the Computing Sciences: A group to be studied. Proceedings of the Thirty-third ACM SIGCSE Technical Symposium on Computer Science Education, Cincinnati Northern Kentucky, KY, (87-90).
- Margolis, J., & Fisher, A. (2002). *Unlocking the clubhouse: Women in computing*. MIT Press.
- Margolis, J., Fisher, A., and Miller, F. (1998). *Geek Mythology, Working Paper of Women in Computer Sciences: Closing the Gender Gap in Higher Education*.
- Morgan, A.J., Quesenberry, J.L. and Trauth, E.M. (2004). Exploring the importance of social networks in the IT workforce: Experiences with the 'boy's club.' Proceedings of the Americas Conference on Information Systems (New York, August).
- Phinney, J. (1992). The Multigroup Ethnic Identity Measure: A new scale for use with diverse groups, *Journal of Adolescent Research*, 7,2, (156-176).
- Serva, M.A., Baroudi, J. J. & Kydd, C. T. (2009). The Effects of Stereotype Threat on MIS Students: An Initial Investigation, *Journal of Computer Information Systems*, 50(2), 142-150.
- Seymour, E., & Hewitt, N. M. (1997). *Talking about leaving* (Vol. 34). Westview Press, Boulder, CO.
- Skrypnek, B. J., & Snyder, M. (1982). On the self-perpetuating nature of stereotypes about women and men. *Journal of Experimental Social Psychology*, 18(3), 277-291.

Stockard, R., Myungsook, K., Akbari, A. (2005) Computer science higher education pipeline. *Journal of Computing Sciences in Colleges*, 20, 3.

Taylor, S., & Todd, P. (1995). Assessing IT usage: The role of prior experience. *MIS Quarterly*, 561-570.

Trauth, E., & Connolly, R. (2021). Investigating the nature of change in factors affecting gender equity in the IT sector: a longitudinal study of women in Ireland. *MIS Quarterly*, 45(4).

Trauth, E.M. (2006). Theorizing gender and information technology research. In E.M. Trauth (Ed.), *Encyclopedia of Gender and Information Technology* (1154-1159). Hershey, PA: Idea Group Publishing.

Trauth, E. M., & Quesenberry, J. L. (2023). Introduction to the Handbook of Gender and Technology. Chapters, 1-21.

Trauth, E.M. and Quesenberry, J. (2006). Are women an underserved community in the information technology profession? Proceedings of the International Conference on Information Systems (Milwaukee, WI, December).

Thompson, M. N., & Subich, L. M. (2007). Exploration and validation of the differential status identity scale. *Journal of Career Assessment*, 15(2), 227-239.

Varma, R., & Lafever, M. (2007). Importance of gender homophily in the computer science classroom. *IEEE Technology and Society Magazine*, 26(2), 43-47.

Wajcman, J. (1991). *Feminism confronts technology*. Penn State Press.

Table 1. Effects of Gender Role Congruity, Self-Efficacy, & Identity on Career Intentions Modeled by Gender and Ethnicity

Var Name	Variable	Men Standardized β (S.E)				Women Standardized β (S.E)			
		White	Asian	Hispanic	AA	White	Asian	Hispanic	AA
Non-Technical Gender Role Congruity	NTGRC	0.257 (0.231)	0.759 (0.552)	0.940 (0.781)	0.215 (0.672)	0.470 (0.260)	0.627 (0.705)	(-0.644) (0.628)	0.299 (0.618)
Technical Gender Role Congruity	TGRC	0.004 (0.260)	(-0.414) (0.546)	(-1.176) (0.814)	0.579 (0.723)	(-0.061) (0.341)	(-0.962) (0.864)	0.446 (0.706)	0.006 (0.731)
Non-Technical Self-Efficacy	NTSE	(-0.115) (0.150)	0.147 (0.382)	(-0.062) (0.370)	(-0.137) (0.461)	(-0.224) (0.232)	(-1.733) ^{***} (0.468)	(-0.126) (0.495)	(-0.590) (0.500)
Technical Self-efficacy	TSE	0.452 ^{**} (0.141)	(-0.618) (0.424)	(-0.316) (0.376)	0.697 (0.462)	0.757 ^{**} (0.229)	1.958 ^{***} (0.460)	0.320 (0.473)	0.429 (0.549)
Non-Technical Gender Role Congruity*Non-Technical Self-Efficacy	NTGRC*NTSE	(-0.420) (0.261)	0.283 (0.693)	(-1.017) (0.889)	(-1.411) (0.931)	0.270 (0.350)	2.560 ^{**} (0.765)	0.889 (0.736)	0.475 (0.789)
Technical Gender Role Congruity*Non-Technical Self-Efficacy	TGRC*NTSE	0.654 [*] (0.254)	(-0.741) (0.701)	1.301 (0.769)	1.740 [*] (0.715)	0.000 (0.327)	(-0.627) (0.697)	(-0.744) (0.665)	0.302 (0.846)
Non-Technical Gender Role Congruity*Technical Self-Efficacy	NTGRC*TSE	(-0.092) (0.174)	0.416 (0.541)	1.268 [*] (0.582)	(-0.047) (0.539)	(-0.779) ^{**} (0.240)	(-2.850) ^{***} (0.722)	0.335 (0.553)	(-0.278) (0.547)
Technical Gender Role Congruity*Technical Self-Efficacy	TGRC*TSE	(-0.212) (0.131)	0.913 (0.534)	(-0.897) [*] (0.440)	(-0.467) (0.350)	0.299 (0.197)	1.382 [*] (0.553)	(-0.822) (0.526)	0.261 (0.384)
Ethnic Identity	EID	0.141 (0.108)	0.452 [*] (0.194)	(-0.205) (0.334)	0.248 (0.282)	0.202 (0.280)	(-0.183) (0.278)	(-0.289) (0.344)	0.179 (0.319)
Non-Technical Gender Role Congruity*Ethnic Identity	NTGRC*EID	(-0.027) (0.153)	(-1.852) ^{***} (0.400)	0.771 (0.479)	(-0.030) (0.607)	(-0.086) (0.326)	0.679 (0.545)	0.500 (0.504)	(-0.447) (0.593)
Technical Gender Role Congruity*Ethnic Identity	TGRC*EID	(-0.128) (0.130)	1.339 ^{***} (0.369)	(-0.567) (0.324)	(-0.426) (0.536)	(-0.091) (0.235)	(-0.395) (0.546)	(-0.182) (0.661)	0.240 (0.523)
Class Identity	ClassID	0.059 (0.105)	0.592 ^{**} (0.203)	0.360 (0.224)	0.123 (0.236)	0.118 (0.235)	0.372 (0.294)	0.187 (0.423)	(-0.276) (0.230)
Non-Technical Gender Role Congruity*Class Identity	NTGRC*ClassID	0.008 (0.188)	(-0.500) (0.546)	(-1.425) [*] (0.637)	0.173 (0.482)	(-0.071) (0.326)	(-0.734) (0.565)	(-0.077) (0.519)	0.297 (0.452)
Technical Gender Role Congruity*Class Identity	TGRC*ClassID	(-0.164) (0.163)	(-0.498) (0.505)	1.070 (0.657)	(-0.261) (0.446)	(-0.127) (0.228)	0.309 (0.618)	0.004 (0.519)	0.168 (0.496)
Masculine Gender Identity	MGID	(-0.136) (0.152)	0.145 (0.424)	(-0.012) (0.362)	(-0.605) (0.448)	(-0.239) (0.318)	(-0.426) (0.680)	(-0.392) (0.574)	0.066 (0.594)
Feminine Gender Identity	FGID	0.311 [*] (0.122)	(-0.263) (0.328)	0.512 (0.282)	0.793 [*] (0.388)	0.502 (0.258)	0.641 (0.533)	0.372 (0.512)	0.290 (0.536)
Hegemonic Masculinity Gender Identity	HMGID	(-0.150) (0.146)	0.052 (0.282)	(-0.094) (0.376)	(-0.052) (0.496)	(-0.166) (0.264)	(-0.174) (0.398)	(-0.209) (0.583)	0.376 (0.473)
Non-Technical Gender Role Congruity*Masculine Gender Identity	NTGRC*MGID	0.331 (0.247)	(-0.637) (0.898)	(-0.401) (0.798)	0.496 (1.086)	(-0.051) (0.395)	0.297 (1.365)	(-2.020) [*] (0.750)	0.053 (0.898)
Technical Gender Role Congruity*Masculine gender identity	TGRC*MGID	(-0.211) (0.217)	0.498 (0.836)	0.678 (0.646)	(-0.914) (0.942)	0.433 (0.324)	0.227 (1.065)	0.750 ^{***} (1.005)	(-0.290) (0.793)
Non-Technical Gender Role Congruity*Feminine Gender Identity	NTGRC*FGID	(-0.089) (0.182)	0.615 (0.529)	(-0.624) (0.638)	(-0.783) (0.573)	(-0.594) (0.313)	(-2.146) (1.240)	0.671 (0.577)	(-0.149) (0.654)
Technical Gender Role Congruity*Feminine Gender Identity	TGRC*FGID	(-0.245) (0.160)	(-0.102) (0.571)	0.209 (0.535)	(-0.417) (0.428)	(-0.095) (0.220)	1.333 (0.881)	(-1.680) [*] (0.725)	(-0.380) (0.610)
Non-Technical Gender Role Congruity*Hegemonic Masculinity Gender Identity	NTGRC*HMGID	(-0.085) (0.209)	0.770 (0.686)	0.527 (0.512)	(-0.193) (0.747)	0.380 (0.286)	1.294 (0.749)	1.040 (0.683)	(-0.607) (0.510)
Technical Gender Role Congruity*Hegemonic Masculinity Gender Identity	TGRC*HMGID	0.260 (0.177)	(-0.969) (0.760)	(-0.663) (0.417)	(-0.034) (0.483)	(-0.262) (0.234)	(-1.106) (0.835)	(-0.936) [*] (0.467)	(-0.049) (0.595)
IT Major	IT Major	0.638 ^{***} (0.018)	0.477 ^{***} (0.046)	0.588 ^{***} (0.046)	0.349 ^{***} (0.046)	0.595 ^{***} (0.032)	0.469 ^{***} (0.067)	0.568 ^{***} (0.055)	0.080 (0.055)
University	University	0.072 ^{**} (0.022)	(-0.075) (0.049)	(-0.004) (0.053)	(-0.086) [*] (0.043)	0.119 ^{***} (0.033)	(-0.128) (0.076)	0.106 (0.058)	(-0.002) (0.056)
Variance Explained (R²)		0.549	0.433	0.554	0.330	0.513	0.475	0.560	0.216

* p < 0.05, **p < 0.001; ***p < 0.000