

## **GENDER EFFECTS ON PERCEIVED PROFESSIONAL MASTERY: EVIDENCE FROM STEM TEACHERS\***

BRANDON OFEM

College of Business Administration  
University of Missouri – St. Louis, MO 63121

SAMUEL J. POLIZZI

Kennesaw State University

GREGORY T. RUSHTON

Middle Tennessee State University

MICHAEL BEETH

University of Wisconsin Oshkosh

BROCK COUCH

Middle Tennessee State University

MARGARET MOHR-SCHROEDER

University of Kentucky

GILLIAN ROEHRIG

University of Minnesota

KEITH SHEPPARD

Stony Brook University

### **INTRODUCTION**

A common observation in the self-efficacy literature is that women report lower self-efficacy than men across a range of occupations (Bandura, Barbaranelli, Caprara, & Pastorelli, 2001; Eccles, 1994; Scherer & Siddiq, 2015; Zeldin, Britner, & Pajares, 2008). Explanations of this observation are usually built around socialization mechanisms that elicit a cognitive response of efficacy enhancement or constraint. Socialization processes arising from prevailing cultural attitudes and practices can enhance or diminish domain-specific self-efficacy based on the gender of the person. As a social construction, gender identity is associated with gender-typic norms and stereotypes that can influence cognitive processing of efficacy information. For example, research shows that women generally report a lower sense of self-efficacy for occupations requiring quantitative skills, but report equivalent or higher efficacy to perform the same quantitative activities in stereotypically feminine tasks (Bandura, 1997; Betz & Hackett, 1983; Junge & Dretzke, 1995). That differential reporting is likely due to unequal social norms that can create unequal assessments of self-efficacy beliefs (Lenney, 1977).

In this study, we model a social cognitive theory (SCT) approach to understanding professional mastery that highlights the importance of gender, age, and communities of practice, with implications for research on teacher induction, professional development, and retention. We

focus on the STEM teacher workforce, in particular, since it is a population of critical importance to equipping the next generation of workers for the dynamic and rapidly evolving global economy. However, it is also one that faces a host of pressing challenges, including a teacher shortage, pervasive job dissatisfaction, and high turnover; problems largely attributable to working conditions within schools and districts (Ingersoll & Smith, 2003). This workforce has also seen a steady trend towards becoming a female-dominated profession (Polizzi, Jaggernauth, Ray, Callahan, & Rushton, 2015; Rushton et al., 2014), an imbalance that is even more striking at the global level (Drudy, 2008). Since self-efficacy is a key determinant of job satisfaction and retention, we document variation in STEM teacher self-efficacy using data from 159 teachers at five different universities across the United States. In doing so, we contribute to knowledge on the individual, social, and interactive sources of variation in perceived professional mastery, measured through self-efficacy beliefs, that can inform the designing of managerial solutions to address these critical workforce challenges.

## THEORY AND HYPOTHESES

Self-efficacy beliefs come from four sources: enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states (Bandura, 1997). *Enactive mastery experiences*, which is the *doing* of performances, are often the most influential source of efficacy information because they provide authentic information about one's ability to perform a given task. Successful performances can strengthen self-efficacy, while failures can weaken it. Or, failures can result in more robust efforts to practice and correct performances to achieve success. Hence, enactive mastery experiences can serve as a training ground for the honing of skills to competently execute the duties of a given job. However, a tremendous power of the human intellect is its capacity to learn without direct experience. People (e.g. teachers, athletes, scientists) can also learn complex skills through modeling, where they observe the actions of others and run simulations of that activity in their minds in a way that enhances their own confidence and capacity to execute the modeled attainment. Thus, *vicarious experiences*, which operate through the tool of observational learning, also serve as a primary source of self-efficacy. *Verbal persuasion* affects self-efficacy beliefs through social influences processes. People can be persuaded verbally that they have what it takes to succeed, and such persuasion can indeed boost their self-efficacy. If significant others have confidence in one's ability to accomplish a given task, one is more likely to adopt that self-affirming belief. In judging their capabilities, people also rely on *physiological and affective states* that convey somatic signs of the vulnerability to dysfunction in carrying out taxing or stressful tasks (Bandura, 1997).

These four sources of self-efficacy provide diagnostic information that is cognitively processed to determine the level of self-efficacy for a given performance. According to SCT and its triadic system of reciprocal causation, the relative weight given to diagnostic information from each of those sources and the manner and extent of integration between them is a function of the person and the environment. In this study, we focus on two important characteristics of the person—gender and age—and an important environmental feature of the workplace—communities of practice. The purpose of the study is to explore individual differences in self-efficacy in the context of STEM teachers, a vocation with conflicting sociological forces, cultural sex-typing of profession (i.e., overrepresentation of women in caring professions) versus that of its subject (i.e., underrepresentation of women in science and quantitative fields). We posit that age and social networks constitute critical sociodemographic boundary conditions in

disentangling gender effects on self-efficacy in this context, with broader implications for the organizational sciences.

### **Gender and Self-efficacy**

Appraisals of self-efficacy are socially conditioned and influenced by social constructions of identity (Bandura, 1987). Gender, the social construction of sex that underlies notions of femininity and masculinity, is constantly created and recreated through social interaction, and is one of the fundamental ways that humans organize their lives (Justo, DeTienne, & Sieger, 2015; Lorber, 2014; Marlow & Patton, 2005; Oakley, 2016). In the context of high school (secondary if international) teaching, which is predominantly female, male teachers are likely to experience “tokenism”, a social phenomenon where individuals feel noticeably different from their peers in a given social setting based on distinctive and relative demographic characteristics (Kanter, 1977; Yoder, 1994; Zimmer 1988). The higher proportion of women teachers coupled with ingrained gender stereotypes regarding gender-typic occupational matching, is likely to make male teachers identify less with the teaching profession than their female coworkers. The weaker identification with the profession among men, and the stronger identification among women, is likely to result in a gender difference in self-efficacy in the STEM teacher context.

In addition, teaching is a “caring” profession, which places a premium on tenderness, nurturance, and a relational orientation (Basow, 2000; Cancian & Oliner, 2000; O’Connor, 2008). Male socialization patterns, which tend to emphasize emotional restrictiveness and stoicism (Levant, 2011; Riggs, 1997; Yarnell et al., 2015), may limit the range and depth of emotional resources male teachers can harness in their dealings with students. Since effective teaching takes place in the socioemotional management of a messy human relationship (Lowman, 1995), female teachers may have a relational advantage interacting with students in the classroom. This relational advantage is likely associated with a greater frequency of successful enactive experiences that heighten the self-efficacy beliefs of women relative to men in the STEM teacher context.

In sum, occupational gender-typing of occupationally-appropriate norms, a higher proportion of women in the teacher workforce, and a greater relational orientation among female STEM teachers, are likely to create variance in self-perceptions of professional mastery, measured through self-efficacy, across gender identities in the STEM teacher context. Thus, we hypothesize the following:

*Hypothesis 1 (H1): Gender is associated with self-efficacy, such that female STEM teachers will report higher overall levels of teacher self-efficacy.*

### **Moderating Role of Age**

According to SCT, gender’s effect on self-efficacy is likely to depend on other characteristics of the individual. Of those characteristics, prior experience within the task domain, unsurprisingly, has most commonly been identified as a key antecedent to self-efficacy within that domain. Prior experience is directly related to the number and quality of enactive mastery experiences that can enhance self-efficacy (Bandura, 1997). In this study, we extend this research by examining the related but distinct concept of a workers’ chronological age. While related to prior experience since older workers are often more likely to have more work

experience within a given profession, we view age as a distinct sociological construct. In accordance with recent studies that take a more nuanced view of age (Bau, Sieger, Eddleston, Chirico, 2017; Levesque & Minniti, 2011), age is not only as an indicator of human capital, but also a reflection of membership in population cohorts socialized by their common experience of similar significant events and norms at important life stages.

From this generational lens, individuals raised within the same historical and socio-cultural context share collective memories and norms that lead to a common generational consciousness, a set of shared attitudes, values, and behaviors. (Joshi, Dencker, Franz, & Martocchio, 2010; Lyons & Kuron, 2014). Age, as an indicator of membership in these separate generational cohorts, therefore, is likely to be associated with different socialization trajectories that alter the relationship between gender and self-efficacy. In the context of STEM teaching in particular, teachers' age is likely associated with the degree of socialization into stereotypical gender roles and cultural sex-typing of occupational domains. Older teachers are more likely to exhibit propensities associated with gender role socialization, and younger teachers are less likely to do so. This speculation is in keeping with evidence that shows that occupational sex stereotyping may be weakening with younger generations (Jacobs, 1989; Post-Kammer & Smith, 1985). Thus, we expect the gender gap in teaching self-efficacy to widen with age.

*Hypothesis 2 (H2): Age moderates the effect of gender on self-efficacy, such that the gender gap in teacher self-efficacy widens with increasing age.*

### **Moderating Role of Social Networks**

Like all socially conditioned cognition, self-efficacy beliefs do not exist in a vacuum. People interact, through imposition or preference, with others in ways that determine the type of cognitive skills, behavioral competencies, and emotional propensities that are repeatedly observed (Bandura, 1997). SCT views cognition as a malleable and generative human capability that is deeply influenced by the social milieu. In the workplace, important features of the social environment can be captured with the social network perspective, a relational lens that emphasizes the socially embedded nature of social action. Formal and informal networks within organizations regulate knowledge, influence, and peer modeling that can shape an employee's perceptions of professional mastery. Thus, in this study we define a *community of practice* (CoP) as the overall ego network of professional interactions that revolve around a shared craft. The ego is the teacher, and the CoP is the ego network of professional relationships that revolve around teaching content and/or pedagogy.

We theorize that *network strength*, measured by the total number of role models, the overall frequency of interaction, the number of colleagues that contribute to feelings of teacher effectiveness, and/or the overall level of positive affect in a teachers' community of practice are likely to positively moderate the relationship between gender and teacher self-efficacy, such that women derive more value from their social ties. If our preceding logic is correct regarding the organizational demography of the workplace (i.e., overrepresentation of women), women are more likely to have CoP characterized by more women. Similarity in gender between a teacher and her colleagues and mentors facilitates richer exchange, trust, and deeper social modeling (Ensher & Murphy, 1997). In contrast, male teachers, who are less likely to have an equivalent number of male colleagues, are more likely to have CoP characterized by higher levels of gender heterophily. Thus, female teachers are more likely to derive more value from their strong ties,

broadly defined, in enhancing self-efficacy than men, who have relatively less homophilous ties that serve as richer conduits for social persuasion.

*Hypothesis 3 (H3): Network strength moderates the effect of gender on self-efficacy, such that the female teachers derive more benefits to self-efficacy from a one unit increase in network strength than male teachers.*

With respect to network structure, on the other hand, we theorize an opposite effect. *Network density*, which is the degree to which an ego's alters are all connected, is associated with strong normative pressures due to the "audience effect" and increased monitoring of more embedded structures (Coleman, 1988). Dense CoPs, in particular, are likely to result in more advantageous information exchange, leading to higher levels of trust, cooperative norms, and reciprocity between a teacher and their CoP. These denser structures, characterized by higher levels of trust and a shared identity from stronger social norms, are likely to benefit male teachers more than women, who are more likely to already have a stronger identification with the profession. In other words, men are more likely to derive more self-efficacy gains from a one unit increase in network density than women. We posit that dense networks make male teachers feel more part of the teacher community, making them more receptive to social persuasion from their CoPs that enhances self-efficacy.

*Hypothesis 4 (H4): Network density moderates the effect of gender on self-efficacy, such that the male teachers derive more benefits to self-efficacy from a one unit increase in network density than female teachers.*

## METHODS

The study sample was drawn from a pool of teachers with recent involvement in a teacher preparation program from five institutions of higher education awarded a Robert Noyce Teacher Scholarship Program grant by the National Science Foundation. The Noyce programs selected spanned institutions in the Midwest, Northeast, and Southeast US. We then distributed surveys, which captured demographic and network data, via email to approximately 431 teachers who went through these various teacher preparation programs, which generated 166 responses for a completion rate of 38.5%. 159 responses were used in the analysis due to missing data in seven survey responses.

We conducted multiple ordinary least squares (OLS) regression to test the four hypotheses. To model the interactions within the multiple regression framework (Aiken & West, 1991), we create interaction terms for (a) gender and age, (b) gender and network composition, and (c) gender and network density, respectively. For the interactions between gender and network composition, we ran four separate models that used a different operationalization of network composition. Our model specification is shown below.

$$\text{Self-efficacy} = \text{controls} + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 (x_1 * x_2) + \beta_6 (x_1 * x_3) + \beta_7 (x_1 * x_4) + \varepsilon_1$$

In this specification, *controls* = the set of control variables;  $\beta$  = regression coefficient;  $x_1$  = gender;  $x_2$  = age;  $x_3$  = network composition;  $x_4$  = network density and  $\varepsilon_1$  is the error term. In the four separate models of the main analysis,  $x_3$  is operationalized using the four different measures

of network composition (i.e., total role models, total frequency of interaction, total effectiveness as a teacher, total positive affect).

Our results revealed a strong gender effect on self-efficacy ( $\beta = -6.37$ ;  $p < .01$ ), supporting *H1*. However, the complete models indicated that gender is moderated by age ( $\beta = .65$ ;  $p < .05$ ), all four operationalizations of network composition (i.e., role models, frequency, effectiveness, positive affect;  $\beta = -.61, -.31, -.78$ , and  $-.63$ , respectively;  $p < .05$ ), and network density ( $b > 9.06$ ;  $p < .01$ ). Together, these results provide empirical support for the hypotheses.

## CONCLUSION

Of all the mechanisms of human agency in social science, none is more central or pervasive than self-efficacy. This core belief, that an individual can exercise control over events in one's life, is the foundation of motivation, behavior, and performance across an impressive array of occupational domains (Bandura, 1997). It is the primary means through which professional mastery is acquired, and is a key precursor to job satisfaction, performance, and retention. While our work focuses on one particular occupation, STEM teaching, it speaks to the broader question of how the sources of professional mastery are demographically and socially conditioned. As our findings reveal, self-efficacy is a malleable cognitive construct, shaped by generational and social factors. This is actionable knowledge for managers because it means that theory and practice can be harnessed to strengthen self-efficacy in tailored ways across occupational domains. Professional mastery is within reach of all employees, and skilled managers create conditions that enable its grasp. For employees, knowledge of how socialization processes, occurring through gendering and generational conditioning, shape self-efficacy beliefs can be empowering because it can deflate the power of unwarranted self-doubt to constrain the actualization of professional potential. And as we know from the burgeoning literature on psychological capital (Newman et al., 2014), organizations operate at their highest levels when their employees actualize their highest professional potentialities.

## REFERENCES AVAILABLE FROM THE AUTHORS

(Note: Author list alphabetical after first three)