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## Gender Bias at the Intersection of Engineering and Business: Implications for Workplace Education

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## Gender Bias at the Intersection of Engineering and Business: Implications for Workplace Education

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**Abstract:** STEM and business fields historically include pervasive gender biases. To better integrate women, and based on results of an industry survey, we propose ways adult education may address such biases.

**Keywords:** STEM, gender bias, Changing Mental Models Framework

Distribution is a vital linking function in supply chains and encompasses all aspects of moving products from manufacturer to customer. Industrial distribution (ID) focuses on buying and selling both technical and commodity-type products (Rice & Johnson, 2010), primarily to industrial customers. ID, as university major, is an engineering discipline occupying the intersection of engineering and business. ID engineers have expertise in mathematics, science, engineering technology, business, communications, and supply chain management, thus combining the science and technical skills of engineers with business (Benson, 2014; Industrial Career Pathway, 2017).

ID is currently experiencing high employment growth rates and demand for new graduates (Industrial Careers Pathway, 2017). As such, one might expect a welcoming attitude towards women (Hockett, 2015) and other members of underrepresented groups as necessary contributors to meeting demand. Unfortunately, gender bias is pervasive; moreover, women in ID are experiencing the double-whammy of combined STEM and business biases, as both fields have been historically male-dominated (Benson, 2014; Copeland & Natarajarathinam, 2016).

Given the historic role of gender bias in male-dominated fields including ID (Martin & Bernard, 2013), this study's purpose is to investigate women's professional experiences in ID and is guided by the following research questions:

- What are the ways in which women in ID experience gender bias?
- How do perceptions of gender bias in ID differ based on participants' gender, years of experience, and role in the organization?

### **Conceptual Framework**

Feminist theory examines gender's role in society. Gender is socially constructed and feminist theoretical lenses focus on societal practices that create inequality (Tong & Botts, 2018). Of particular interest is how workplaces enact gender inequality. Acker (1990) posits a theory of gendered organizations. There is the division of labor where men are more highly paid and have more power in the organization. Gender divisions are maintained despite technological advances, with men controlling what is considered skilled work and women's work still being defined as unskilled. Power and privilege is reinforced through "language, ideology, popular and high culture, dress, the press, and television" (p. 146). Since technical skills are viewed as masculine, women learning technical skills threaten masculinity (Acker, 1990). Interactions between men and women in the workplace indicate men are in charge and women are "emotional support" (p. 147). Acker argues these factors influence what men and women choose as work because social factors affect individual identity. Last, gender is part of the organization's "logic," codified in rules and job evaluations which results in gender inequality regarding perceived worth (p. 147). Job hierarchies are gendered because skills traditionally held by men such as handling money are more valued than skills held by women such as human relation skills (Acker, 1990).

Given the challenges of gender inequality in the workplace and our desire to provide adult educators with a framework to address these disparities, we apply the Changing Mental Models framework (Agosto, Gasson, & Atwood, 2008) to our study and extend its application to the workplace. Originally used address the dearth of women and minorities in the field of information technology (IT) at the undergraduate level, this framework has four components: "mentoring, social cohesion and peer support, role modeling, and curriculum re-design" (p. 205). Mentors have a personal relationship with their mentees and help them learn how to learn. Mentoring women and minorities improves job retention (Tapia & Kvensky, 2004 as cited in Agosto et al., 2008). Community-building programs and peer support have resulted in increased interest and retention in technology and computer science programs (Cohoo, 2001; Dobosenski, 2001 as cited in Agosto, 2008). Role models are "provided by images and

discussions in the media or in classrooms, by shared mental models among social groups, or by casual acquaintances” (p. 210). Role models help women and minorities understand that they can pursue a career in a traditionally male-dominated field. Last, curriculum design that focuses on building social networks and explicitly provides activities that address cultural and gender differences helps change women and minorities mental models of IT (Agosto et al., 2008).

## **Methodology**

To address the purpose and questions of the present study, the last author conducted a survey of women in ID. The intent of the survey was to gain a broad understanding of women’s status in ID, as judged from a variety of perspectives, including those of men.

### **Survey Instrument**

The survey consisted of 29 questions and was designed to explore the gender-based experiences of women in ID. Open-ended questions included: “What are the three biggest challenges that affect your career?” and “My biggest opportunity for growth and development is: \_\_\_\_\_.” Multiple choice questions included: “What stereotypes about your gender have you experienced from others in the workplace?” The remainder of the survey was composed of five-point Likert scale questions. For example, the statement “I feel included in my work group” could garner a response of “Never” “Rarely” “Sometimes” “Usually” or “Always.” Respondents were asked baseline questions about their years of work experience, role in the organization, and the organization in general, including size and women in leadership. Respondents reported on their experiences in their organization and work groups related to gender and diversity.

### **Participants**

Individuals were recruited to respond to the survey via email through professional organization distribution lists. The survey was begun by 337 individuals in the ID industry, the majority between January and March of 2016. Incomplete surveys and surveys submitted by people who did not verify their membership in the ID industry were excluded, resulting in the data from 227 surveys included in the analysis. Sixty-one percent of the respondents identified as male and 39% identified as female. The number of years in Industrial Distribution ranged from 0-5 (21%), 6-20 (43%), and 21 years and over (36%). Most respondents were industrial distributors (73%), with the rest being ID manufacturers or representatives. Those with job titles of entry level or analyst/associate comprised 18% of the sample. Managers and Senior Managers made up 29% of the respondents. Directors and Vice Presidents, senior vice presidents, C-Level Executives (e.g. CEOs), Presidents, and Owners made up the remaining 53%.

## Analysis

Survey data were analyzed using descriptive statistics in Excel to generate response distributions. Preliminary findings from select multiple choice and Likert scale questions are presented in the following section.

## Results

Survey results showed limitations of professional advancement by gender with women much less likely to hold a position above vice-president than men. Hence, the ranks of senior vice president, CIO, COO, CTO, President or Owner were ranks much more often held by men. Women are groomed for leadership through support and administrative roles whereas men were apprenticed in the field through positions in warehouses or in sales positions. Women were more likely to see barriers to advancement, or a glass ceiling, than men were. It should be noted that the men in the survey were more likely to have more than sixteen years in the field and women were likely to have been employed less than sixteen years.

Regarding workplace climate, the perceived degree of unwelcome behaviors in ID, though low, is higher for women: 12% of women indicated they sometimes, usually or always experienced bullying or discrimination compared to 4% of the men. Women were less likely to feel included in group problem-solving: 67% of women selected sometimes, usually, or always feel included compared to 80% of men. Fifty-eight percent of the men were more likely to *always* feel they can talk about issues of diversity compared to 31% of the women. Men believed managers sometimes, usually or always challenge discrimination (45%) where women believed managers took up the cause less often (25%). Seventy-four percent of the men and 64 percent of the women said that managers always or usually treated employees with respect regardless of differences or positions. Both men and women saw a need for improvement in diversity training in order to deal with workplace and customer diversity with women voicing a greater concern. Twenty-eight percent of the women strongly disagreed or disagreed with the statement "The training I receive at work helps me deal with the diversity of our workforce and our customers" while the figure was 13% for men. Seventy four percent of the men and 62% of the women strongly agreed or agreed to the statement "I feel positive about diversity in this workplace." In sum, although both men and women tended to believe that the workplace climate was good, men's responses indicated they perceived the workplace climate to be better than women did.

Workplace satisfaction was measured by opportunities for advancement, mentors available, learning and growth opportunities, and work/life balance resources. While a majority of men and women reported being generally satisfied with these resources and opportunities, men reported being more satisfied than women. Women reported being satisfied or very satisfied with opportunities for advancement at a rate of 42% while men's rate was 60%. Thirty-six percent of women and 54% of the men surveyed said they were satisfied or very satisfied with the mentors available. Men also tended to be more satisfied with learning and professional growth opportunities with 64% satisfied or very satisfied compared to 43% of the women. It should be noted that women had a "no response" rate of 25% to these questions while men's "no response" rate was 15%.

Last, women were asked to name gender stereotypes that they experienced in the workplace. A majority of respondents did not answer this question. For those who responded to the question, the top four responses included being labeled as emotional, having their contributions discounted, being labeled as too aggressive, and being labeled as too passive.

In summary, while all workers were generally satisfied with workplace climate, findings show women's satisfaction consistently lagged behind men's satisfaction. Men reported less gender bias than women. Likewise, women were less satisfied than men with opportunities for advancement, learning and growth opportunities and work/life balance. Men generally had sixteen or more years of experience in the field and women had less than 16 years. Women in this study were employed in the lower ranks of the organizational hierarchy compared to men. This may be in part due to participant demographics in this survey but it also confirms the gendered roles women play in organizations.

### **Discussion, Conclusions, and Implications**

Survey findings indicate gender bias exists in ID. The findings partially support Acker's (1990) theory of organizations. Division of labor appears to be somewhat tracked according to gender—women are groomed for mid-level management through administrative and support roles whereas men are apprenticed through sales, warehouse, branch or counter positions. Women noted the "boys club" attitude of their workplace and the challenges they face because of gender. There may be a "gendered logic" (Acker, 1990, p. 147) to the workplace where men are consciously or unconsciously seen as more suited for higher leadership positions than women due to historic gender stereotypes including women being more "emotional" and less able to deal with pressure.

To address the organizational gender inequality in the ID workplace, several aspects of the Changing Mental Models Framework (CMMF) can be used (Agosto et al., 2008). Mentors are needed in the ID workplace. Only 36% of the women in the current study said they were satisfied or very satisfied with the mentoring opportunities. The CMMF model advises that mentors share their knowledge of the work context so mentees can avoid mistakes, learn skills, and gain emotional support (Agosto et al., 2008). Mentors are urged to teach their mentees how to learn which involves teaching “reflection-in-action” (Schöen, 1990 as cited in Agosto, et al., 2008) which is the ability to make sense of a situation as it is occurring. Since this problem-solving occurs in a particular context, the mentor needs to tell his or her advisee how best to approach problems in this context. Mentoring can improve career satisfaction and retention (DeCastro, Griffith, Ube, Stewart, & Jagsi, 2014).

Role models can encourage women to take managerial, warehouse or sales positions (Agosto, et al., 2008) and images of women working in these positions can become part of company culture. Women in these positions can be part of career fairs or speak at career events at high schools, colleges, and universities and men can encourage women to seek these positions. Men can be role models for how to create a positive work climate for women by including women in decision-making and avoiding sexist comments. Since many people learn through observation (Bandura, 1986), role models can also help others learn how to navigate the company culture.

Curriculum re-design aligns less clearly with ID workplace contexts but may have relevance to nonformal learning opportunities and ID students in higher education (Agosto et. al., 2008). In the workplace there is not a formal curriculum, but nonformal professional development and workplace trainings may perpetuate gendered norms. Additionally, small groups could discuss how to create a more women-friendly climate. Such discussions may include reviewing company policies and job descriptions, looking for ways to encourage women to apply for positions typically held by men, and encouraging men who support changing the culture to talk with other men. In the context of higher education, women and minorities respond to courses that use technology that solve issues in the community and form social support networks (Agosto et.al., 2008) so perhaps more service-learning based courses could help retain students.

Last, the CMMF recommends peer support which could come from mentors or a nonformal work group. In the traditional mentoring relationship, the mentor possesses years of experience and has a protégé, whereas in “step-ahead” mentoring the mentor is one hierarchical level above the protégé or in a position that would be the protégé’s next logical step in career progress” (Darling, 1986; as cited in Ensher, Thomas & Murphy, 2001, p. 421). Peer mentors



have the same level of experience and status (Kran & Isabella, 1985 as cited in Esher et al., 2001, p. 421). Studies in the higher education context have shown that peer mentors feel a sense of connection to each other as well as a sense of confidence (Kiyama, Raucci, Crump-Owens & Luca, 2014). Workers could benefit from peer and near-peer mentoring to learn the workplace culture and how to navigate the political challenges as well as gain confidence in their skills.

Future work should build from this survey and include detailed participant interviews, including visits to organizations and work sites. Additionally, learning more about the effect of role modeling, service learning and mentors in the ID workplace would help inform future educational efforts. As adult education works to bring social justice perspectives into STEM fields, such as ID, and a broad range of workplace contexts, studies such as this one that explore the women's experiences are needed to better understand the opportunities for adult education to make a positive impact.

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