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Abstract

Serious under-representation of women exists in the Industrial Technology (ITECH) faculty ranks. Only 9.8% of those ITECH faculty that hold the rank of instructor or above in baccalaureate degree granting institutions are women. The purpose of this study was to examine the relationship between sex-role generalizations and characteristics perceived as necessary for faculty success in Industrial Technology tenure-track faculty positions.

This study investigated relationships among three profiles generated from responses by male Industrial Technology faculty in the U.S.A using the Schein Descriptive Index. These profiles described the characteristics as perceived by male ITECH faculty of (1) a successful Industrial Technology (ITECH) faculty member who has or will advance through the ranks, (2) men in general and (3) women in general. To accomplish the purpose of the study, 600 Industrial Technology faculty members were selected and received copies of the instrument. This study utilized Analysis of Variance (ANOVA) and intraclass correlation coefficients (r') to determine the degree of similarity between the three profiles.

The results from this study lend strong support to the view that sex-role generalizations exist in Industrial Technology. The profiles generated by this study placed women in a nurturing role and men in an assertive role. The results indicated that the profile of men in general is significantly more similar to the profile of a successful ITECH faculty member.

Recommendations for ITECH departments and for the NAIT leadership are included in the summary. Recommendations for future research
were to investigate the responses from female faculty members in ITECH and responses from faculty members in other technical disciplines to gain further insights into sex-role generalizations from a broader perspective. Also, there is a need to identify and develop strategies to improve opportunities for women in ITECH.

Gender Equity in Industrial Technology: The Challenge and Recommendations

Serious under-representation of women exists in Industrial Technology. Women comprise 9.8% of Industrial Technology faculty at the university level in the US. (NAIT, 1999). In spite of a dwindling supply of prospective faculty that has lead to excellent opportunities for faculty positions, Industrial Technology programs have been unable to effectively attract women into their ranks. Why so few women faculty in Industrial Technology? What are the effects of societal myths that include sex-role stereotypes and gender-based characteristics of women, in the under-representation of women in Industrial Technology? This study looks at stereotypes and stereotyping and then discusses the relationship between sex-role stereotypes and characteristics perceived as necessary for faculty success in Industrial Technology.

Industrial Technology and women

In 1990, Women constituted 52 percent of the U.S. population and 46 percent of the labor force in all occupations, but only 22 percent in the science and technology related fields including Industrial Technology (NSF, 1994). Industrial Technology continues to have a disproportionately low number

of women. Industrial Technology, like other technical fields, has one of the lowest numbers of female students, faculty, and departmental executive officers (Kulatunga, Shaw and Nelson, 1999). Women faculty members have been unable to pierce the upper strata, especially in the science and technology areas. In attaining tenure and rank, women faculty members do not fare well compared to their male counterparts. Women faculty constitute only 4 percent of those in technology related fields including engineering and Industrial Technology (NSF, 1994).

In the Industrial Technology faculty listing published in 1999 by the University Division of the National Association of Industrial Technology (NAIT), there are 159 (9.8%) women faculty and 1461 male faculty listed. This paper will explore the relationship between gender and characteristics needed for success as a faculty member in ITECH.

Stereotypes and stereotyping

Walter Lipmann (1922) first used the term "stereotype" to identify beliefs about groups. He suggested that stereotypes are pictures in our heads of groups and they are created by culture and we use them to give meaning to the behavior of others. Lipmann, and much later Gordon Allport (1954), felt that stereotypes were more than cognitive generalizations- they involved emotional elements, and people would go to any length to defend their stereotypical thinking despite the presence of contradictory evidence. Katz and Braly (1933, 1935) added an empirical element to the study of stereotypes and they suggested that a person's cognitive systems produce "stereotypes" and culture provide its content and impetus. Later research by Deaux and LaFrance (1998) suggested the notion that stereotypes are attached to people rather than to cultures and irrationality and emotional dispositions are part of stereotyping. In summary, earlier views of stereotypes assumed that a stereotype was a set of beliefs about people in other groups and that they were resistant to empirical refutation. The stereotype was held as

part of general cognitive style and it was driven more by emotion than by reason. In addition, the culture provides the content and the rationale for these shared beliefs.

Brigham's (1971) review of stereotypes contended that there was not enough research on how stereotypes function in our social lives and how they shape social policies. He argued that we spend too much time on non profitable debate about what stereotypes are and therefore do not focus on what we can do, knowing that stereotypes exist in society. Brigham's views are similar to now familiar social cognitive perspective, which assumes that stereotypes are beliefs we have about people in groups and we may or may not share these beliefs with other people. In this sense, stereotypes are derived from the general cognitive processes we all share and understanding this mechanism will help us to discuss objectively the implications of stereotyping and to make decisions without a need to fulfill a larger social agenda.

Hamilton (1981) stated that stereotypes are cognitively driven, inaccurate, harmful, and resistant to change, and that everyone uses them. Research suggests that stereotypes may be positive or negative and it is not easy to understand stereotypes purely on a cognitive basis. Stereotypes do appear to serve an important individual, as well as social, function. Also, it is clear that stereotypes as beliefs about groups play an important role in guiding perception, thinking, remembering and behavior. When one has established beliefs about a certain group, he or she uses these beliefs in forming impressions about individuals that are members of the group. This impression formation can be termed as stereotyping. This stereotyping involves the perceptions we form about the individuals who belong to the stereotyped group.

Sex-role stereotypes and stereotyping of women in technology

Sex-role stereotypes are beliefs about the nature of men and women. Such beliefs are widely held by members of society (Deaux, 1976).

Sex-role stereotypes do not describe how men and women actually differ as a matter of fact, but how society thinks they do (Franks and Rothblum, 1983). Traditional models of sex-roles assumed that there exists a collection of behaviors, attitudes, and competencies that are associated with one's biological gender and that an individual should exhibit these attributes associated with his or her gender in order to be fully adjusted (Kelly, 1983).

The Schein Index

In the early 1970s, Schein developed an innovative 92-item descriptive index to gather data regarding sex-role stereotyping. An early study using this index demonstrated a relationship between sex-role stereotyping and characteristics needed for management success. Both male (Schein, 1973) and female (Schein, 1975) managers were shown to perceive successful managers as possessing characteristics more commonly attributed to men in general than to women in general. Such characterization which view women as less qualified for management positions can impact the selection and promotion of women into managerial positions (Schein, 1978). Brenner's (1989) research of the relationship between sex-role stereotypes and perceived requisite management characteristics among men using the Schein Index indicated that male managers perpetuate a male managerial stereotype while female managers do not. In another Schein Index study, the slow rate of advancement of women entering science and engineering professions was attributed to sex-role stereotyping and perceived discrimination (Elkeles, 1995).

Stereotyping of women in science and technology

Throughout most of its history, science and technology in the U.S. has been principally the domain of men. A few women made some progress early in the 20th century in entering technical fields. But the Great Depression, World War II and its G.I. Bill, and the general tenor of the culture during the subsequent years produced barriers to women and relatively few women were able to surmount these barriers. During the

1970s and early 1980s, American women made remarkable inroads into the community of scientists and engineers (Vetter, 1995). A recent National Research Council study (Journal of Metals, 1998) concluded that working conditions for women in industry are perceived as being less favorable. According to the U.S. Department of Labor, the ranks of women engineers have grown from less than two percent in 1978 to nine percent of engineers today in the United States (Journal of Metals, 1998).

Despite the gains by women, their participation has leveled off in many areas including Industrial Technology and they have not yet achieved demographic parity or occupational equality with men.

Valian (1998) in her compelling book "Why so slow? -The advancement of women" provides strong evidence with data that women in academia are substantially under rewarded in pay, promotion, and tenure. Her data on high-status positions in business, medicine, law, and sports indicate less than stellar progress of women in terms of salary, promotion, and ability to reach the top. The central thesis of Valian's (1998, P.2) book is that "a set of subtle, implicit hypotheses about sex differences plays a central role in shaping men's as well as women's professional lives." Valian (1998, P.2) suggests that these gender Schema or stereotyping hypotheses "affect our expectations of men and women, our evaluations of their work, and their performance as professionals." She contends that although most of us profess egalitarian beliefs, our unacknowledged beliefs about gender differences color our interpretations of others' performance and condition our reactions to men and women as individuals.

This study will attempt to identify whether unacknowledged beliefs about women by male faculty in industrial technology exist. The Schein Index was used in this attempt to uncover these unacknowledged beliefs about men and women.

Need for the study

This study explores whether there is a relationship between sex-role stereotyping and characteristics needed for success as an Industrial Technology faculty member. Sex-role stereotyping of the successful ITECH faculty member can engender the view that women are less qualified than men are for ITECH faculty positions, and can impact negatively on the recruitment, selection and promotion of women into such positions. The goal of this study was not to ascertain whether sex-role stereotyping is good or bad, but to impact policy changes when such stereotyping creates barriers for certain groups to succeed at the same rate as other groups. Given that males make up 90.2% of ITECH faculty and are the major players as decision-makers, it is important to determine whether they sex type the ITECH faculty position. There is a need to identify the challenges faced by women faculty in ITECH and to identify initiatives needed to attract and keep women in Industrial Technology (Liedtke, 1997).

Statement of the problem

Serious under-representation of women exists in Industrial Technology. The National Association of Industrial Technology (NAIT) demographic studies conducted in 1997 by Kulatunga, Shaw and Nelson (1999) found "the ratio of male to female faculty was about twelve to one (12:1) while the ratio of male to female students was about six to one (6:1)." The study suggested that there is a need to hire more qualified female faculty members to help encourage even greater female student enrollment in Industrial Technology programs. At the university level, very few women hold Industrial Technology faculty positions. It is important to determine the role of sex-role generalizations, if any, in this under-representation. It is also essential to explore new initiatives to improve the career climate for women faculty in Industrial Technology.

Purpose and procedures of the study

The purpose of this study was to examine the relationship between sex-role generalizations and characteristics perceived as necessary for faculty success by male ITECH faculty members. Intraclass correlation coefficients were calculated to understand the role of sex-role generalizations in Industrial Technology. Descriptive and inferential statistics were used to answer the following research questions:

1. What is the Schein Index profile of men in general as perceived by male ITECH faculty?
2. What is the Schein Index profile of women in general as perceived by male ITECH faculty?
3. What is the Schein Index profile of a successful ITECH faculty member who has or will advance through the ranks as perceived by male ITECH faculty?
4. Do sex-role generalizations exist in Industrial Technology?
5. If such generalizations exist, do they contribute to fewer women faculty members in ITECH?
6. What are the recommendations for policy makers in Industrial Technology?

Surveys were sent to 600 male ITECH faculty who had faculty responsibilities in the fall semester of 1998. The 92-item Schein Descriptive Index was used to gather data for this study. Certain demographic characteristics, including percentage of time spent on different faculty activities, faculty status, academic rank, years of experience as a faculty member in higher education, age, and supervisory experience were also obtained.

Results of the study

The intention of this section is to provide an overall picture of the results to understand the gender dimension in Industrial Technology. Conclusions are summarized in terms of research questions and hypotheses of this study. The research questions were analyzed in terms of demographic characteristics reported by the faculty members and data

collected from the faculty on 92 descriptive items found on the Schein Index.

Demographic characteristics

Industrial technology faculty members reported spending more time in teaching and administrative activities and less time in research and academic advising. The data suggested that teaching was the most important activity for the majority of the ITECH faculty members. Academic advising was given more attention than research activities. Dugger and Paige (1986) developed a profile of Industrial educators and a classification system for grouping faculty activities. The comparisons from both studies are given in Table 1.

The results from Dugger and Paige's (1986) study and this study suggested that ITECH faculty members were heavily involved in teaching and showed a minimal emphasis in research related activities. This might suggest that demands of teaching did not allow time for other activities including research.

General perspectives on Schein Descriptive Index

During the past twenty-five years, the 92 item Schein Descriptive Index had been used in several studies (Brenner, Tomkiewicz and Schein, 1989; Schein, 1973, 1978; Schein and Mueller, 1992; Schein, Mueller and Jacobson, 1989; Schein, Mueller, Lituchy and Liu, 1996; Elkeles, 1995). However, the previous studies did not have reliability calculations for the instrument. In this study, the reliability index for the instrument was calculated and the cronbach's Alpha was 0.8945, based on all respondents. The Alpha value indicate that the 92-item Schein Descriptive Index is reliable and it can be used with confidence even when the sample size is small.

General perspectives on faculty profiles

The faculty profiles for the following were generated: (1) a successful ITECH faculty who has or will advance through the ranks, (2) men in general, and (3) women in general. The 15 descriptive items with the highest means

Table 1: Percentage of time spent on specific activities

Activity	Mean % of time spent (1986)	Mean % of time spent (1998)
Teaching	67.3	59.5
Research	6.0	10.1
Administration	15.5	19.1
Service activities (Other)	16.9	11.3

Table 2: Very characteristic of "A successful ITECH faculty"

Rank order	Item description
1	Competent
2	Consistent
3	Logical
4	Helpful
5	Self-reliant
6	Industrious
7	Persistent
8	Emotionally stable
9	Analytical ability
10	Well informed
11	Self-controlled
12	Objective
13	Curious
14	Self-confident
15	Leadership ability

Table 3: Very characteristic of "Men in general"

Rank order	Item description
1	Competitive
2	Curious
3	Independent
4	Strong need for achievement
5	Strong need for monetary rewards
6	Adventurous
7	Hides emotion
8	Authoritative
9	Self-reliant
10	Assertive
11	High need for power
12	Self-confident
13	Vigorous
14	Industrious
15	Analytical ability

and 15 descriptive items with the lowest means for each profile mentioned above were identified (Tables 2-7):

The profiles from this study suggested the existence of sex-role generalizations as perceived by male ITECH faculty members. The profile of women in this study placed women in a nurturing role. The profile of men in this study portrayed men as the assertive gender. The results suggested the following: (1) men are perceived to be goal oriented, competitive, assertive, with a high need for individual identity, and (2) women are perceived to be sympathetic, sociable, sentimental, kind, possess a strong need for social acceptance, and a high need for social identity. The profile of a successful ITECH faculty who has or will advance through the ranks was more similar to the profile of men in general. The profiles for "a successful ITECH faculty" and "women in general" had 3 matching descriptive items in the mail survey. However, the profiles for "a successful ITECH faculty" and "men in general" had 13 matching descriptive items in the mail survey. These observations suggested that the profile of men in general is more similar to the profile of a successful ITECH faculty who has or will advance through the ranks. This study suggests that male ITECH faculty members perceive that a successful ITECH faculty member possessed characteristics and attitudes more commonly ascribed to men in general than to women in general.

Test of hypothesis on sex-role generalizations

It was hypothesized that male faculty would perceive a successful ITECH faculty who has or will advance through ranks as possessing characteristics more commonly ascribed to men in general, based on 92-Item Schein Descriptive Index, than to women in general. Intraclass correlation coefficients (r') were calculated to test this hypothesis.

The intraclass correlation coefficient (r') is used to express whether observations in the same group or category are related, or tend on average to be more like each other than obser-

vations in different categories (Hays, 1963, p. 424). This form of analysis is appropriate when our primary interest is in size of intraclass correlation coefficient as a measure of group homogeneity (Snedecor and Cochran, 1996). For this study, a higher intraclass correlation will suggest that the ratings will have less variation within the 92 descriptive items compared to variation between the 92 descriptive items.

As shown in Table 8, the r' values indicated that there was a large and significant resemblance between the

ratings of the profile of "a successful ITECH faculty who has or will advance through the ranks" and the profile of "men in general." Also, there was an insignificant resemblance between the ratings of the profile of "a successful ITECH faculty who has or will advance through the ranks" and the profile of "women in general."

If women were perceived not to have the characteristics similar to a successful ITECH faculty member, it might create barriers for women in faculty selection and promotion. Overall, the results lend strong support

Table 4: Very characteristic of "Women in general"

Rank order	Item description
1	Sympathetic
2	Interested in own appearance
3	Values pleasant surroundings
4	Neat
5	Helpful
6	Humanitarian values
7	Courteous
8	Sociable
9	Desire for friendship
10	Aware of feelings of others
11	Sentimental
12	Kind
13	Creative
14	Strong need for social acceptance
15	Strong need for security

Table 5: Not characteristic of "A successful ITECH faculty"

Rank order	Item description
1	Deceitful
2	Vulgar
3	Bitter
4	Devious
5	Selfish
6	Quarrelsome
7	Timid
8	Wavering in decision
9	Hasty
10	Dawdler and procrastinator
11	Uncertain
12	Nervous
13	Submissive
14	Easily influenced
15	Frivolous

to the view that sex-role generalizations may exist in Industrial Technology. These sex-role generalizations in Industrial Technology among ITECH male faculty members should be of concern to those interested in promoting gender equality in faculty positions.

Recommendations

The purpose of this study was to examine the relationship between sex-role generalizations and characteristics perceived as necessary for faculty success in Industrial Technology. The results from this study lend support to the existence of sex-role generalizations by male faculty members in Industrial Technology. Male ITECH faculty members appeared to perceive a successful ITECH faculty member who has or will advance through the ranks as possessing characteristics, attitudes, and temperaments more commonly ascribed to men in general than to women in general. The reasons to have more women in ITECH are presented. This section contains recommendations to combat sex-role generalizations and suggestions to improve the career climate for women faculty in Industrial Technology. Also, this section proposes policy initiatives for the leaders in the field that can be implemented to improve opportunities for women faculty in ITECH. This section concludes with recommendations for future research.

Why we need more women in ITECH?

Liedtke (1997) observed that serious under-representation of women exists in technology education with the greatest shortage at the faculty and administrative levels. There are many reasons to have more women in ITECH. Some of them are as follows:

- Women comprise close to 52% of population and only 9.8% of ITECH faculty members are women.
- With the limited number of women in technology related areas, Industrial Technology can be a pioneer in helping women to achieve gender equity in the areas of technology.

Table 6: Not characteristic of "Men in general"

Rank order	Item description
1	Timid
2	Submissive
3	Wavering in decision
4	Devious
5	Deceitful
6	Passive
7	Uncertain
8	Bitter
9	Easily influenced
10	Fearful
11	Exhibitionist
12	Demure
13	Reserved
14	Not comfortable about being aggressive
15	Frivolous

Table 7: Not characteristic of "Women in general"

Rank order	Item description
1	Vulgar
2	Bitter
3	Feelings not easily hurt
4	Deceitful
5	Dawdler and procrastinator
6	Selfish
7	Quarrelsome
8	Aggressive
9	Speedy recovery from emotional disturbance
10	Exhibitionist
11	Able to separate feelings from ideas
12	Hasty
13	Forceful
14	Hides emotion
15	Dominant

Table 8: Analyses of variance of mean item ratings and intraclass Correlation coefficients (r')

Source	df	MS	F	r'
Successful ITECH faculty and Men				
Between items	91	1.70	14.17*	0.87*
Within items	92	0.12		
Successful ITECH faculty and Women				
Between items	91	0.63	0.97	-0.02
Within items	92	0.65		

* $p < 0.01$

- ITECH and the larger society can benefit tremendously from the contributions of women.
- Learning about sex-role generalizations can help the ITECH community devise programs and policies to improve the environment for women faculty and students in ITECH.
- It is important to provide equal opportunities and equal access to all groups including women.
- It makes business sense to fully utilize the human capital in a competitive global economy.
- Women can add additional perspectives to make ITECH fully ready to meet the challenges of 21st century.
- The issue of fairness is relevant.

The unexpressed and subconscious nature of sex-role generalizations requires subtle remedies that are beyond affirmative action policies and legislation. The understanding of the subtleties of sex-role generalizations will help to include men and women fairly in ITECH.

Recommendations for campus policy makers

It is important to acknowledge that men and women alike have implicit attitudes about gender differences that create sex-role generalizations. Such sex-role generalizations contribute to our ideas about how men and women are expected to behave. In this study, men faculty members generated profiles for men and women in general using the Schein Index. The profiles generated for men were quite different than for women. This outcome suggests that sex role generalizations exist among the decision-makers (faculty) in industrial technology programs.

The most important consequence of sex-role generalizations in faculty selection and advancement is that there is a tendency to evaluate men and women faculty differently. Campus policy makers should be aware of the subtle ways in which sex-role generalizations may impede the progress of one group at the expense of the other. This study suggested that ITECH male

faculty perceived a successful ITECH faculty member as more similar to men in general than to women in general. Although sex-role generalizations are present, there may be other factors contributing to the lower number of female faculty in ITECH. It is important to create a hospitable environment so women can be successful once they are attracted to the field of Industrial Technology.

The following suggestions are proposed to campus policy makers to improve the recruitment, integration, retention, and advancement of women in industrial technology.

- Share the results of this study on the role of sex-role generalizations with ITECH administrators and faculty.
- Discuss in academic units what can be done to improve the climate in ITECH to attract more women.
- Discuss how faculty consciousness about the need for equity can be raised.
- Provide well-documented information about sex-role generalizations and evaluation of others to faculty members. Examples of sex-role generalizations are meaningful but there is no substitute for objective data.
- Seek out women faculty members for administrative positions and key committees within departments and institutions.
- Involve women faculty members in the selection of administrators.
- The tips and elements of success, provided by Sonnert (1995) is a good starting point for women faculty members.

Recommendations for national leaders in Industrial Technology

The National Association of Industrial Technology (NAIT) can play an active role in the recruitment and integration of women into Industrial Technology professions including faculty positions as we begin the 21st century. The role of committed leaders to initiate change can not be underestimated. The results from this study

lend strong support to the view that sex-role generalizations create barriers for women faculty members in Industrial Technology.

The following recommendations are submitted to national leaders in NAIT and other professional associations connected with Industrial Technology:

- Share the results of this research with the NAIT community.
- Generate ideas to improve the environment for women in ITECH.
- Develop a proactive vision statement advocating recruitment, integration, and retention of women in Industrial Technology.
- Develop an action plan for the recruitment, integration, and retention of women faculty in Industrial Technology.

The pervasive nature of sex-role generalizations in technical fields including Industrial Technology should be an ongoing concern of leaders in Industrial Technology. Industrial Technology can be a pioneer and a leader in helping women to achieve gender equity in the areas of technology where women face barriers. It makes practical, legal, and moral sense to promote gender equality in Industrial Technology.

Recommendations for future research

This research on the relationship between sex-role generalizations and characteristics perceived as necessary for faculty success in Industrial Technology should be expanded to include the responses from women faculty members in ITECH and responses from faculty members in other technical disciplines. This approach will give more insights into sex-role generalizations from a broader perspective.

This research can be expanded to investigate the relationship between sex-role generalizations and requisite personality and other descriptive characteristics for success in Industrial Technology among ITECH male and female students. This approach will give insights into what can be done to

recruit and to integrate female students into Industrial Technology. Further research on identifying and developing strategies to improve opportunities for women in Industrial Technology will be critical in the 21st century.

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