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Research Notes

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Gender-Role Attitudes, Perceptions of Engineering, and Beliefs About Women in Engineering "Having it All": Are Male and Female Engineering Undergraduates Really So Different?

Two barriers to women's participation in engineering that have received considerable attention are stereotypes about women and women's work and stereotypes about engineering. As products of gendered socialization and role assignments, stereotypes about women and women's work instantiate the different expectations for women and men that are encapsulated in the breadwinner ideology: Men work for pay in the public sphere, and women occupy the private sphere of unpaid domestic labor, engaging in caring and nurturing of family members and housework. These gender roles and stereotypes are reproduced in the culture of engineering. Descriptions of this culture in the academic and work contexts document how it models the life and work patterns of "an engineer" on male engineers by valuing attributes more frequently held by men (e.g., competitiveness, technical self-confidence) and devaluing "women's work" (e.g., child care, housework) (Dryburgh, 1999; Hacker, 1981; Kleinmann, 1998; McIlwee & Robinson, 1992).

Some researchers suggest that women in engineering have overcome these barriers by internalizing attitudes that depart significantly from these stereotypes (Hawks & Spade, 1998; Kozimor-King & Leicht, 1999). This research predicts that these women will (a) have nontraditional gender-role attitudes, (b) reject the stereotype of engineering as masculine and, therefore, (c) believe that when it comes to careers and families, women in engineering can "have it all." Making comparable predictions for their male counterparts is more difficult but the weight of evidence suggests that men will hold more traditional gender-role attitudes, perceptions of engineering, and beliefs about women in engineering "having it all."

Theoretical and empirical arguments about critical mass and tokens (Kanter, 1977) suggest that these differences may be particularly consequential for women in male-dominated fields like engineering. Their numerical

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minority means that women continue to experience this interaction context differently than men. Many still find that they are the only woman in labs, research teams, and study groups (Dryburgh, 1999; McIlwee & Robinson, 1992). If knowing how to conform to the culture of engineering is as adaptive as this ethnographic research suggests, then to the extent that male engineering students support a culture of engineering that is gendered masculine, we predict that over time interactions with them may produce changes in women's gender-role attitudes, perceptions of engineering, and beliefs about women in engineering "having it all."

Method

To test our predictions we use data from a 1998 proportionate stratified sample of engineering undergraduates at a large, commuter university in Western Canada. Three criteria guided the selection of classes: year, specialization, and gender composition. Ninety-five percent of the 1,122 surveys that were administered in 18 classes were completed and of these 98% were eligible for analysis. Questionnaires were anonymous and confidential. Most questions were closed-ended, with participants checking off or circling the response that best described them. The measures of the variables used in the analysis are presented in Table 1.

Results

Panel A of Table 1 shows that compared with their male counterparts in engineering, women have more nontraditional gender-role attitudes in both the family and work domains and more nontraditional perceptions of engineering. They also believe more strongly than men that women in engineering can combine careers and families to "have it all." These results provide compelling evidence that male and female engineering undergraduates really are different.

Panel B of Table 1 tests our second set of predictions by exploring how women's attitudes differ by cohort by comparing women who are in at least their fourth year of engineering (fourth year) and women who have been in engineering school for less than two months (first year). The one gender-role attitude that differentiates these women is particularly instructive. Fourth-year women express significantly higher levels of agreement with the traditional breadwinner ideology than do their first-year counterparts. Our finding for perceptions of engineering is also consistent with our predictions about the consequences for women participating in a culture of engineering that emphasizes how the life and work patterns of an engineer are modeled on traditional gender roles in the work and family domains. Our results for beliefs about women in engineering "having it all" depend on the particular statement considered. There is no difference in levels of agreement with the statement that women may have both a family and engineering career. But when asked about women combining family with a top-level or a rewarding career in engineering, women in fourth year report significantly lower levels of agreement with these two statements.

Although our results must be interpreted with appropriate caution, they are consistent with our argument that men's gender-role attitudes, perceptions of engineering and beliefs about women in engineering "having it all" may shape

Table 1
Comparison of Female and Male Engineering Undergraduates' Gender Role Attitudes, Perceptions of Engineering, and Beliefs About Women in Engineering "Having it All"

	Panel A[1] *Women vs. Men*	*Panel B*[2] *4th vs. 1st Year Women*	*Panel C*[3] *4th vs. 1st Year Men*
Gender-Role Attitudes[4]			
A working mother can establish just as warm and secure a relationship with her children as a mother who does not work.	3.86 > 3.03*	3.70 = 3.93	2.91 = 3.14
Men should share the work around the house with women such as doing dishes, cleaning, and so forth.	4.63 > 3.96*	4.67 = 4.67	4.05 = 3.90
Men and women should be paid the same money if they do the same work.	4.85 > 4.41*	4.88 = 4.93	4.47 = 4.32
A woman should have exactly the same job opportunities as a man.	4.75 > 4.28*	4.72 = 4.79	4.34 = 4.24
It is much better for everyone if the man is the achiever outside the home and the woman takes care of the home and the family. (R)	4.61 > 3.57*	4.42 < 4.77*	3.62 = 3.51
Perceptions of Engineering[5]			
Engineering education is created for men, by men, and built on male attitudes and traditions. (R)	3.76 > 3.53*	3.44 < 4.23*	3.45 < 3.71*
Women in Engineering can "Have it All"			
Women can expect to be able to have both a family and a top level career in engineering if they want to.	4.26 > 3.79*	3.92 < 4.55*	3.64 = 3.78
It is possible for women to have a satisfying family life and a rewarding engineering career.	4.39 > 3.91*	4.17 < 4.67*	3.83 = 3.92
It is not realistic to expect women to have a family and hold down an engineering career. (R)	4.04 > 3.55*	3.98 = 4.17	3.53 = 3.56

Note. For all items higher scores reflect more nontraditional gender role attitudes. (R) indicates the item is reverse coded. * $p<.05$.
[1]Based on comparisons of 239 women and 798 men engineering undergraduates.
[2]Based on comparisons of 43 fourth-year and 82 first-year women engineering undergraduates.
[3]Based on comparisons of 203 fourth-year and 211 first-year men engineering undergraduates.
[4]Items adapted from Mason, Czajka, and Arber (1976).
[5]Item adapted from Brandell (1996).

those of the women with whom they interact in engineering school. This argument finds additional support in the lack of differences between fourth-year and first-year men reported in Panel C of Table 1. There is only one statistically significant difference, and this difference reproduces one change we found for women: Like their female counterparts, male students with more experience in engineering express more traditional, stereotypical views of engineering, a finding that underscores pressures to conform to the traditional culture of doing engineering. Cohort studies using longitudinal data are necessary to confirm our results.

Discussion

As a group, women enter engineering school with nontraditional attitudes (e.g., 81% of the first-year women either strongly disagreed or disagreed with the stereotype of engineering as masculine compared with 49% of women in fourth year, 62% of men in first year, and 50% of men in fourth year). But in their day-to-day interactions with members of the numerical majority, women continually encounter traditional gender-specific expectations that depart significantly from their own more egalitarian alternatives. They respond by "doing engineering" in ways that reproduce the very stereotypes of women and engineering that have been targeted by attempts to increase the participation of women in engineering. This suggests that policies and programs targeting women may get them into engineering. But developing and implementing policies and programs that target men may keep them there by changing the culture of doing engineering that currently excludes many women unless they conform.

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