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## The Relationship Between Engineering and Young Women's Occupational Priorities

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### ABSTRACT

While women's participation rates in formerly male-dominated professions have increased markedly over the past three decades, engineering is a notable exception to the trend. This study investigated whether gender differences in occupational priorities might contribute to the paucity of women in engineering. Grade 12 students who had made occupational plans were asked the reasons for their choices. Results revealed that interests were the highest priority for male students, whereas altruistic values were more important to female students. Contrary to expectation, working conditions were not a factor. Implications for career counselling are discussed.

### RÉSUMÉ

Le taux de participation des femmes dans les professions autrefois à prédominance masculine s'est accru remarquablement durant les trente dernières années. La profession d'ingénieur constitue cependant une exception notable à l'évolution constatée. Cet article étudie si la rareté des femmes dans le domaine de l'ingénierie peut être attribuée à la différence entre les sexes en matière de leurs priorités professionnelles. On a demandé à des étudiants de 12e année ayant établi des plans de carrière les raisons de leurs choix. Les résultats démontrent que l'intérêt pour un sujet jouait un rôle primordial pour les étudiants alors que les valeurs altruistes constituaient une motivation plus importante pour les étudiantes. Contrairement à ce que l'on aurait pu attendre, les conditions de travail n'influençaient pas leurs choix. L'auteur étudie les implications pour l'orientation professionnelle.

Over the past two decades, dramatic changes have occurred in the participation patterns of women in formerly male-dominated occupations. For example, in 1986 women made up 21.7% of lawyers and 21.0 % of physicians in Canada (Statistics Canada, 1988); by 1996 the participation rates had grown to 30.6 % and 29.6 % respectively (Statistics Canada, 1996). However, women have not appreciably increased their presence in engineering occupations. Between 1986 and 1996, their participation rate inched up from 8.2 to 8.8 % (Statistics Canada, 1988, 1996). Many researchers have explored this anomaly and several factors have been implicated. For example, there is evidence of a "chilly climate" for women in both academic programmes and occupations in science disciplines (Farmer, 1997; Knoke & Ishio, 1998; Maskell-Pretz & Hopkins, 1997; Seymour & Aikenhead, 1995). There is also evidence that male engineers tend to enjoy higher job status and salary than do female engineers with comparable qualifications (Holden, 1993; Robinson & McIlwee, 1991). In the face of these environmental barriers, it is perhaps not surprising that women who become engineers tend to leave the profession at higher rates than do men (Preston, 1994).

However powerful these environmental barriers might be for women who have already entered engineering, they do not fully explain why so few girls in high school even consider engineering, particularly in light of the many efforts to encourage girls to pursue engineering (e.g., special scholarships for women in engineering programmes). Furthermore, it has not been established that high school students are generally aware of and influenced by environmental barriers in university and on the job. Consequently, researchers have also explored intrapsychic factors, such as interests.

According to Holland's (1997) theory, people generally try to select occupations that best fit their own patterns of interests and personality characteristics. While his theory has been largely supported (e.g., Fouad, Harmon, & Borgen, 1997; Prediger, 1999; Spokane, 1985), there is some evidence that certain aspects of the theory may not be equally applicable to women and men. For example, Day and Rounds (1998) investigated Holland's structure of interests with a large sample of college-bound students; they concluded that people do generally share a common view of the organization of vocational activities regardless of race, ethnicity, or gender. However, Swaney and Prediger (1985) found that, for their large, nationally representative sample of young adults, the women were less likely than the men to make occupational choices that were consistent with their interests. In other words, men and women seem to agree on what activities characterize a particular occupation; however, men are more influenced by this information when choosing their occupations. One implication of these results is that some women may be interested in science-related activities but that some additional factor or factors exert a more powerful influence, leading them to make other occupational choices.

If interest in the activities associated with an occupation is a less influential factor for women than for men, the challenge is then to determine what factors besides interests influence the occupational decisions of women. One factor that has received attention in recent years is altruism, or a desire to help others. Previous research has shown that altruistic considerations exert a powerful influence on the occupational choices of women. Lightbody, Siann, Tait, and Walsh (1997) found that the women in their sample of college students tended to choose areas such as law and medicine over areas such as engineering, computer science, and physics because they viewed the former as contributing more to society, as well as providing more opportunities for social interaction. The authors suggest that women are not drawn to technical careers because they do not view them as possessing these characteristics. Similarly, Davey (1993) found that among a sample of senior high school students, the female students most frequently cited altruistic reasons (e.g., helping people) for their occupational aspirations; the male students most frequently cited interest in the work activities.

Another factor that merits consideration is multiple role involvement, i.e., women's participation in paid employment and family roles simultaneously. There is evidence of a growing trend over the past two decades for young women to expect to continue their participation in paid employment, even when their children are young (Davey, 1998). Since the coordination of work and family

roles has become a fact of life for most women with children, even women with young children (Statistics Canada, 1990), the expectations of these young women are realistic. Furthermore, since women typically assume primary responsibility for child care, it is reasonable to expect that young women would be more concerned than would young men in the working conditions (e.g., regular or flexible work schedules) that would facilitate balancing work and family roles. However, it is not clear when young women would move from vaguely expecting to combine work and family roles to actually planning the combination. Granrose (1985) found that the majority of women in her sample of female college students expected to combine child rearing with their careers but lacked an explicit plan for merging the roles. Similarly, McCracken and Weitzman (1997) found that the college women in their study tended to be both uncertain and relatively unconcerned about how they would combine work and family roles. These results suggest that young women may simply expect to combine work and family roles without actively planning and visualizing how they will manage the combination. However, both studies involved only college women, who are in a relatively privileged position. These young women may expect that their earning power will be sufficient for them to afford high-quality childcare. The question of whether young women in general share their lack of concern for how to combine work and family roles remains unanswered.

The purpose of this study was to investigate intrapsychic reasons for the occupational choices of young women and men. In accordance with Holland's (1997) theory, it was hypothesized that the occupational choices of both women and men would be influenced by interests. In light of previous findings (Davey, 1993; Lightbody et al., 1997; Swaney & Prediger, 1985), it was further hypothesized that women's occupational choices would be relatively more influenced by other factors as well. In particular, it was hypothesized that women would cite altruistic reasons for their choices more often than would men. Finally, it was hypothesized that more women than men would cite working conditions as a factor influencing their occupational decisions because of women's multiple roles.

## METHOD

### *Participants*

Participants were 401 grade-twelve students from high schools in Nova Scotia; 271 students attended regional high schools in small communities and the remainder attended rural high schools. The sample consisted of 206 female and 195 male students. The age range of the participants was 16 to 20 years, with a mean of 17.23 years.

### *Procedure*

Permission was obtained from school boards and principals to administer a brief survey in the schools. The researcher conducted the survey during class time and in the presence of the classroom teacher. Students were advised that they

were free to not participate, the alternative being to work quietly at one's desk, and that all materials were confidential. After obtaining informed consent, the researcher distributed the survey, which contained questions regarding their occupational plans and their reasons for their occupational choices. Specifically, they are asked to state the occupation that they expected to enter when they finished their schooling and to explain why this occupation appealed to them. Responses were anonymous, with students providing only their age, grade and gender. The survey required about twenty minutes to complete.

### *Results*

Only those surveys in which participants had stated concrete occupational goals and their reasons for those goals were retained for analysis. This resulted in a sample of 105 females and 80 males. The reasons given for their occupational choices were grouped into five categories. The first four categories were preselected, based on earlier research. Davey (1993) had found a logical correspondence between high school students' reasons for choosing an occupation and three categories: Work Activities, Altruism, and Lifestyle. The category "Work Activities" included both interest in the work done in an occupation and concern for working conditions. For the present study, this category was subdivided into two categories: Interest and Working Conditions. This was done to enable testing of the hypothesis that working conditions were of greater concern to the female students than to the male students. A fifth category, "Other," was added to accommodate the responses that did not fit into any of the other categories. Responses were categorized by the author. Some students gave more than one reason for their occupational choice; in these cases, all reasons were recorded.

Response frequency data for each category, by gender, are presented in Table 1. The first category, labelled Interest, includes responses that expressed either interest in, or expectation of satisfaction with, the particular activities associated with the occupation (e.g., "I love reading and writing."). The second category, labelled Altruism, contains responses that expressed a desire to help others, either people or animals, in some way (e.g., "I like to help people."). The third category, labelled Lifestyle, includes reasons such as high income, high status, or being one's own boss (e.g., "you make a lot of money"). The fourth category, labelled Working Conditions, includes reasons such as regular hours, working outdoors, meeting people, or opportunity for travel (e.g., "It's a 9 to 5 job"). The fifth category, labelled Other, includes all reasons which could not be classified elsewhere (e.g., "It's a high demand field"; "free training").

Five chi-square tests were conducted to compare the male and female samples for their overall patterns of reasons, and then to compare the sample on the relative frequency of citation for each category of reason (except "Other"). An alpha level of .01 was used for each test to yield an overall alpha of .05.

A gender difference was found in the pattern of reasons cited ( $\chi^2 = 38.71$ ,  $df = 5$ ,  $p < .001$ ). As hypothesized, interest in particular work activities was the most frequently cited reason for occupational choice overall, but much more often

TABLE 1  
*Reasons for Occupational Choice, by Sex*

Category	<i>Females (105)</i>	<i>Males (80)</i>	<i>Total (185)</i>
	Percent ( <i>n</i> )	Percent ( <i>n</i> )	Percent ( <i>n</i> ) <sup>a</sup>
Interest	44.76 (47)	80.00 (64)	60.00 (111)
Altruism	55.24 (58)	13.75 (11)	37.30 (69)
Lifestyle	2.86 (3)	13.75 (11)	7.57 (14)
Working Conditions	14.29 (15)	10.00 (8)	12.43 (23)
Other	5.71 (6)	8.75 (7)	7.03 (13)

<sup>a</sup>Some students stated more than one reason. Percentages reflect the number of respondents, by gender and in total, who cited reasons in each category.

by males than by females ( $\chi^2 = 8.51$ ;  $df = 1$ ,  $p < .01$ ). In contrast, the female sample cited altruistic reasons for their occupational choices much more often than did the male sample ( $\chi^2 = 21.91$ ,  $df = 1$ ,  $p < .001$ ). Lifestyle reasons, such as high earnings, were more frequently cited by males than by females ( $\chi^2 = 6.98$ ,  $df = 1$ ,  $p < .01$ ). Contrary to expectations, working conditions did not prove to be more important to the female sample than to the male sample ( $\chi^2 = 0.78$ ,  $df = 1$ ,  $p < .50$ ).

#### DISCUSSION

The results of this study lend support to Holland's (1997) theory that interest in work-related activities influences the occupational choices of both women and men. However, the results are also consistent with the findings of Swaney and Prediger (1985), who found that interests were a greater factor in the occupational choices of the men than of the women in their study. In this sense, Holland's theory might be viewed as a somewhat better predictor of choice behaviour for men than for women.

In the present study, altruistic values were clearly a stronger influence on occupational choice for the female students than for the male students, with the female students expressing altruistic reasons for their choices more often than interests. Again, this finding of the importance of altruistic motives to female students is consistent with previous findings at both the high school (Davey, 1993) and college (Lightbody et al., 1997) levels. The female students in this study typically expressed these motives in terms of performing some service, usu-

ally for people but sometimes for animals. Furthermore, they almost all specified an expectation of direct contact with those they would help, as opposed to a more general altruistic ideal such as "making a better world" by, for example, designing a better pacemaker. Since the stereotype of occupations in science and engineering is one of interaction with machines and/or data rather than with people, it is not surprising that these students failed to see a connection between their desire to be of service and a technological occupation. While these occupations may well offer the potential to satisfy altruistic ideals, they may not offer the interpersonal contact that these young women seem to be seeking.

Holland's (1997) theory proposes that people will seek work environments that are consistent with their interests. This means that people in a particular work environment will exhibit similar interests and work styles. Wampold, Mondin, and Ahn (1999) conducted a study with college students majoring in education, engineering, and physics. According to Holland's theory, education is categorized as Social (S) and engineering and physics are categorized as Investigative (I). Furthermore, in Holland's hexagonal scheme, these two interest areas are as different as possible. The purpose of the study was to determine whether, in carrying out a task, the students would prefer working on an S or an I task, with an S or I person, or alone. Not surprisingly, they found that the students most preferred to perform a task in their own interest area with like-minded people. However, they also found that the S students would prefer to perform an I task with S people than an S task with I people. Likewise, the I people preferred performing an S task with I people over an I task with S people, and the preference was even more pronounced for this group than for the S group. In other words, all of the students placed a higher priority on continuing to work with like-minded people on a task that they were not interested in, rather than work on a task of interest to them with people who had different interests. Furthermore, this preference was even more pronounced for the engineering and physics students than for the education students. The implication of these results is that it would be difficult for individuals to satisfy altruistic and social priorities in Investigative fields such as engineering, at least at the present time. It would be reasonable to expect a mismatch in both goals and work style. This discrepancy might be one factor contributing to the "chilly" atmosphere in Investigative environments such as engineering. Alternatively, people who are interested in engineering and have social/altruistic priorities might increase their chances of success and satisfaction if they seek a work environment where coworkers share their priorities.

Although no hypothesis was offered regarding the importance of lifestyle, it is noteworthy that male students were more apt than female students to cite lifestyle as a factor in their occupational choice. It would seem reasonable to expect that people who choose their occupations for altruistic reasons would be relatively unconcerned about a high salary or status.

Contrary to expectation, the females in this sample did not express interest in working conditions more frequently than did the males. Only one female student specifically cited working conditions that would facilitate caring for

children as a factor influencing her choice. Other researchers (Granrose, 1985; McCracken & Weitzman, 1997) have noted that their samples of college women expected to combine career and family roles but lacked specific plans for doing so. It appears that the present sample of female high school students share this lack of a felt need for explicit plans. Perhaps young women only begin to grapple with the logistics of combining these roles when their situations force them to do so. It is conceivable that they do not perceive a need to incorporate family plans into their career plans until then, or that they simply ignore the potential conflict between competing role demands because they do not know how to deal with it. Future research might address this question, as well as the consequences of failing to plan ahead. It seems reasonable to expect that advance planning would make the transition to multiple roles easier.

There are some limitations in this study that should be noted. First, the sample is very homogeneous. While it is representative of the area in which the study was conducted, it is not representative of the country as a whole. Thus, while the results are consistent with previous research findings, they should be used cautiously. Second, the data are based on self-report. It seems unlikely that the respondents would deliberately misrepresent themselves on information that is not very sensitive; nevertheless, it is widely acknowledged that a respondent's desire to "look good" can potentially introduce bias into data. Finally, the author alone assigned responses to categories; having more than one rater would have reduced the risk of bias.

#### CONCLUSION

The results of this study, in concert with previous findings, suggest that there are important gender differences in the intrapsychic factors that influence career decisions. In particular, the social-altruistic orientation of many female students may preclude participation in engineering careers. By the time female students reach their last year of high school, they are making career choices based on interests and priorities that are not generally associated with these occupations. This may help to explain why women have increased their participation rates more in areas such as medicine and law, and why strategies to encourage girls and women to consider the field of engineering have not been very effective. Furthermore, even if a guidance counsellor were to suggest an engineering occupation to a female student who is strongly motivated by altruistic goals, she would be unlikely to seriously consider the suggestion because she would see no connection between engineering and her priorities. It would seem that unless or until these occupations can be seen as offering more social contact and opportunity for social contribution, most young women will not seriously consider them.

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