FACTORS AFFECTING ENGINEERING STUDENTS: SIMILARITIES AND DIFFERENCES FOR FEMALES AND MALES IN THE SFU PROGRAM

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ABSTRACT

The number of women entering engineering has increased substantially in the last decade. This study examined the experiences of female and male engineering students. Thirteen female undergraduate engineering students and 76 male undergraduate engineering students completed a 28-item questionnaire that focussed on issues of support, discouragement, role models, expectations for marriage and family, and demographic information. Thirteen female and 10 male engineering students also were interviewed about these topics. Both female and male students came from similar family backgrounds; received support for their choice of career; had role models in science, engineering or technology who influenced their career choice; did the same type of household chores; made the decision to study engineering at the same time in their lives; and were willing to move after completing school to obtain employment. However, female students reported more discouragement than male students; performed more hours of housework; were more likely to work part-time while in university; were less certain of their plans for marriage and children; were less certain about the type of engineering they wished to enter; and expected to work part-time or in the home while their spouses worked full-time when children were young. Among the students interviewed, females also were more likely to view role models as important to other students, although the males reported more role models than did the females. Descriptions of sex role conflict were more common among females. It was concluded that although there are many similarities between female and male engineering students, the differences between them tend to place the females at a disadvantage that may reduce the women's chances of success in this male-dominated field.

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CHAPTER I

INTRODUCTION

Many women now enter the job market, both because of economic necessity and interest. Many of these women are either entering nontraditional careers or undertaking a course of education that will lead to a degree in a nontraditional field. Statistics Canada (1985) shows that the number of women receiving degrees in traditionally male-dominated areas of study has increased since 1971. In mathematics and the physical sciences women made up 29% of graduates at the bachelor's level in 1982, whereas in 1971 only 19% of graduates at this level were women. In engineering women made up 9% of bachelor's recipients in 1982 compared with approximately 1% in 1971 (Statistics Canada, 1985). Dagg and Thompson (1988) report that in Canada in engineering and applied sciences, 12% of full-time undergraduates were female.

Although the percentage of women in nontraditional fields has been increasing, it has been suggested that when there are few women present in a given discipline, it will come to be seen as appropriate that it should remain so, and furthermore, attempts to rectify the imbalance with an influx of women into that field will be seen as "wrong" (Simeone, 1987, pp.10-1, as cited in Dagg and Thompson, 1988). In a British study following women university graduates in nontraditional areas such as science and engineering, Chisholm and Woodward (1980) found that since 1960 traditionally male dominated professions have remained resistant to the entry of women in that sexist attitudes still prevail, schedules and career paths remain inflexible for women with children, and that women are not promoted beyond a certain level. On the other hand, traditional female work has become less resistant to male entry. Women who decide to

enter a nontraditional area despite such resistance will, then, face a number of challenges and difficulites.

Engineering as a field is one that implements much of the technological change in society, and on the whole, helps to determine the very nature of the work done in society through the design and construction of everything from the buildings in which we live to the machines we use day to day (Hacker, 1983). However, perhaps more than any other field, engineering has been viewed as a male domain, perpetuated by the stereotypically masculine work engineers are thought to do, such as bridge building and the designing of electrical systems. Thus it is important to examine women's reasons for entering engineering, and how the experiences of women as engineering students and engineers differ from those of their male counterparts. It is important that we understand these factors in order to be able to encourage more women with mathematical and scientific talents to enter this field.

Greenfield (1972), in an early paper discussing the low number of women entering engineering, believed that women did not consider engineering as an option because of lower levels of performance in mathematics and science courses in high school, discouragement by parents, teachers, counsellors and friends, a lack of female role models, and a masculine stereotype associated with the engineering profession. Hacker (1983) argues that engineering increasingly relies on prerequisites in mathematics to screen out women and minorities, and outlines the historical development of the "culture of engineering" as male (pp. 38).

Women who have already entered an engineering program will have demonstrated an ability in math and science, but discouragement (or lack of

encouragement), lack of role models and the masculine stereotype of engineering may continue to be important negative influences. Stemming from these ideas, the areas that emerge as important for further discussion are support, including encouragement and role models, and the possible conflict between career and sex-role that women may encounter in pursuing engineering.

Support and Encouragement

Students who enroll in and persist with engineering report support and encouragement from their families and others. Both Houser and Garvey (1983) and Fitzpatrick and Silverman (1989) compared female engineering and science students to female students enrolled in humanities and social sciences and found that parental support for career choice was stronger for the women in the male-dominated fields. In a study that examined the factors influencing women engineering students' career choice, Valyo (1986) found parents to be supportive of their daughters career choice. Johnson (1975) reported that female engineering students received strong support from parents for their career interests. This survey of female and male first year engineering students found that only a small percentage of parents were unconcerned about their daughters' educational interests, and that parents of female students seemed to express greater interest in the educational plans of their offspring than did the parents of male students. Ott (1975), in a similar study, found that female engineering students expressed closer family ties than did male engineering students. Greenfield, Holoway and Remus (1982), in a study of female and male engineering students, found that male students reported more frequently than female students that their parents expected high achievement and excellent performance. This could be interpreted to mean that the parental support offered to male students was conditional, or that

parents expected more of their sons than their daughters.

Although female students may be experiencing support from parents, when mixed support is reported, it more often comes from women in the students' lives. Ellis (1981), who conducted questionnaire and interview studies of female engineering students, found results emphasizing the role of support, but with mixed results. The first year students participating in her study often reported that mothers and other women had discouraged them, or had tried to dissuade them from entering engineering. However, when the same women were in their fourth year, they reported that their mothers had become supportive of their daughters' choices. Male relatives in Ellis' study were encouraging throughout. Haworth, Povey and Clift (1986a) investigated the educational experiences of women in engineering and discovered that the mothers of engineers were more frequently discouraging of their daughters' career choices than the mothers of women who chose a traditionally female area of work. Plas and Wallston (1983), in a study of women enrolled in a workshop promoting women's involvement in science and engineering careers, found that inconsistent support was more often associated with mothers than fathers. On the other hand, Plas and Wallston found that if a parent was thought to be rarely or never supportive, it was more frequently the father who held that attitude. It should be noted that in this study, the women involved were not yet enrolled in a course of study toward a career in science or engineering, but were only at the stage of finding out more about such a career. As such, the differences in results concerning mothers and fathers may be due to a difference in sample populations. Those women who do enter engineering or science may do so because the support they receive is somehow different from the support received by the majority of women in Plas and Wallston's study.

The results concerning support by teachers and counsellors are not consistent. Johnson (1975) found that female engineering students received strong support from counsellors in pursuing their nontraditional interests. Greenfield et al. (1982), and Auster (1984), in studies of female and male engineering students, found that both groups reported support from family, friends and teachers. However, in Ellis' (1981) study the women students recalled receiving very little encouragement from teachers, counsellors or principals in high school, and of the few who could recall receiving encouragement from a teacher, it was a male teacher.

With regard to support of female engineering students by peers, Ott (1975) found that female students were more likely to rely on friends or peers for support and advice, and generally, more readily acknowledged greater peer dependence than did male students. Ellis (1981) also reported that female students found their male peers to be supportive. However, other studies have found that peers may not be consistently supportive of female engineering students. In a study exploring, in part, the perceptions held by engineering students about their peers, Rotter (1982) reported that female engineering students were thought to be less friendly, less attractive, less flexible, and to have a poorer sense of humour than female liberal arts students. This evaluation was made by male engineering students. Female engineering students held a similarly negative image of their male peers. In support of these findings, Lyons-Lepke (1986) found that women who persisted in mathematics or science majors reported their male peers to unfriendly and competitive.

Based on the above studies, both male and female students seem to receive support for their career choice, but discouragement seems to be more of a problem for females. Families are encouraging, with the exception of mothers

sometimes, but the information on teachers, counsellors and peers is mixed. When students are discouraged it is more frequently female students, and they are discouraged by other women, although they may also be discouraged by their male peers. Related to discouragement, Dagg and Thompson (1988) found in a study of Canadian universities that many male professors believe that the number of women in science and engineering is lower than actually exists, and that those women who are in engineering and sciences will not make committed workers. If this attitude is being communicated to female students in engineering, directly or indirectly, it could be regarded as discouragement, and the male professors who hold such views would be unlikely to encourage or support their female students. It is interesting to note that although many studies discuss support and encouragement, only Dagg and Thompson (1988), Haworth et al, (1986a), and Ellis (1981) mention discouragement specifically. The differences between lack of support, inconsistent support, and discouragement need to be explored further.

In the studies finding that female engineering students enjoy parental or familial support it is interesting to note that the majority of female engineering students have one parent, usually the father, who has a post-secondary or graduate education, and is employed as a professional (Ott, 1975; Holstrom, 1975; Ott, 1978; Ellis, 1981; Greenfield et al. 1982), in some cases as an engineer (Holstrom, 1975; Ellis, 1981; Greenfield et al. 1982; Houser and Garvey, 1983; Haworth et al. 1986a; Lyons-Lepke, 1986; Fitzpatrick and Silverman, 1989). This raises the question of who is acting as a role model to the female engineering student.

Role Models

In an article discussing the paucity of women in science, engineering and technology, Sheinin (1981) argues that the lack of female role models in postsecondary education, industry and government postitions associated with science, engineering, and technology gives young women the message that women are not needed or wanted in these fields. Ott (1975) did not address the issue of role models directly, but did find that the female students involved in her study considered accessible, sympathetic faculty and teaching assistants to be of greater importance than did the male students. It could be argued that faculty are more likely to be sympathetic to the different needs of the female engineering student if they have had similar experiences. Women faculty members, then, would be the most sympathetic, and important as a role model for the female engineering student. Helms (1982) attempted to assess the effects of role models on the occupational selection of high school girls. She found that girls who received information from women employed in nontraditional areas were more likely to chose nontraditional work on tests of occupational preference.

Few of the female engineering students in Ellis' (1981) study had heard about women engineers, or knew a woman engineer personally, but many did have a female relative or friend of the family who was in a traditionally masculine field. The role of female faculty as possible role models is not addressed in this study, but it is unlikely that there are many female role models available among faculty as the number of female engineering professors at Canadian universities is less than one percent (Dagg and Thompson, 1988). Greenfield et al. (1982) found that for both male and female engineering students, 12% had fathers who were engineers, and 70% had siblings who were either

working or being educated as engineers. The authors conclude that for females and males who persist in engineering role models were important. Fitzpatrick and Silverman (1989) support this conclusion, and believe that having a father as a role model plays an important part in women's selection of engineering as a career.

Although the availibility of role models for female engineering students is assumed to be important, the importance of role models is difficult to assess. Students who have role models may cite their importance, whereas those who do not have them may regard role models as unneccesary or have no way to assess whether having a role model would make a difference to them. Those students to whom a role model is important may seek out individuals who can serve as role models, whereas students who have no role models may not have sought them out. Some women students may be able to look upon their male relatives or faculty as role models, but other women may feel it necessary to know that women have been successful as engineers before. Success in a nontraditional field does not guarentee that a woman will be sympathetic or supportive to young women who come after her. Dagg and Thompson (1988) found that the few successful women professors in engineering felt pressured to conform to the existing values of their departments and to accept the status quo in order to be accepted by their male colleagues. These women were reluctant to admit that female students might be at a disadvantage because of their sex. Although such a woman might be a symbol of the potential for women to succeed, this does not necessarily make her a role model. This issue needs to be explored in greater depth in order to assess whether or not role models are of importance to engineering students, and if the importance of role models differs for female and male students.

Conflict

Finally, the idea that female engineering students may experience some conflict between their role as a female and their role as a student in a traditionally masculine field needs to be explored. A common assumption is that the female role conflicts with the expectations one holds of an engineer. However, the actual relationship between sex role identity and identity as an engineer may be complex.

Greenfield et al. (1982) found that for both female and male students there was congruence of self-image and the image of the engineer. In other words, female engineering students did not view engineering as exclusively masculine, and saw themselves as able to take on the role of engineer without personal conflict. Galejs and King (1983) compared women in engineering to women in social science programs and found that although female engineeering students had different (less traditional) perceptions of their role in life than did female social science students, the engineering students expressed some traditional values also, for example, they wanted to be good mothers. The authors speculated that female engineering students perceived themselves as capable of performing well in nontraditional and traditional roles, and did not experience these roles as incongruent. Jones and Lamke (1985), in a study that examined the relationship between sex role orientation, self esteem and feminine or masculine occupational choice, found that women with a masculine sex role orientation were more likely to select an occupational field conguent with their self perceptions. They also noted that women might come to perceive themselves as more feminine or masculine as a result of selecting a sex-typed major. If either situation is the case, women in engineering would not experience conflict between their

perception of their sex role and their choice of a traditionally masculine career.

Some studies explored the effects of stereotyping. Plas and Wallston (1983) reported that women in their study identified with stereotypic female characteristics, rather than male characteristics. This could be conflicting for women choosing a male-oriented profession. However, Keenan, Newton and Logue (1986), in a study of the effects of stereotyping in the workplace on female engineers found that women's perceptions of sex role stereotyping were related positively to tension at work; that is, the more female engineers felt they were stereotyped according to their gender, the more tension they felt in the workplace. The women in this study did not seem to identify with a stereotypic or traditional view of women. Once again, the differences in the results of these two studies could be due to differences in the experiences of the women involved. Working female engineers may be more sensitized to stereotyping than women considering an engineering career, as the latter have yet to deal with the negative effects of stereotyping in the workplace that the women engineers already face.

Related to perceptions of sex roles, Ott (1975) found that female and male students misperceived each other's preferences for marriage and career. The male engineering students thought that the female students were more career oriented than the female students reported themselves to be. The female students thought that the male students' would prefer their future wives' to be more traditionally family oriented than the male students actually desired. However, the male students' preferences for their future wives' career involvement were significantly more traditional than the female students' preferences for themselves. Although the female students were choosing a career that was nontraditional for women, they did not see this as implying that their careers were exclusive of other

committments. They did, however, see themselves as different from more traditionally oriented women, and, accurately, as different from the type of woman their male colleagues wanted to marry. In addition to this, Haworth, Povey and Clift (1986b) found that male engineers had a traditional view of what was considered acceptable behaviour for their female peers, and activities such as drinking and swearing by women engineers elicited disapproval.

In conclusion, conflict does not arise between sex role identity and the female student's identity as an engineer, per se. However, a potential for conflict may exist in the differential demands and expectations placed on young men and women aside from their studies. In a study of factors relating to the persistence of women in engineering, Whigham (1985) found that one reason women gave more frequently than men for not completing a degree in engineering was financial concerns. Also, it has been shown that employed, married women, especially those with children, do significantly more housework and have less leisure time that their husbands (Cherpas, 1975; Hendricks, 1977; Luxton, 1981; McPherson, 1985; Meissner, Humphreys, Meis and Scheu, 1975). If young women living with parents, living with peers, or living with partners are also expected to contribute more time to household maintenance than others, then they have less time to study. This may be critical in a program that places high demands on the student. Supporting this idea is the finding that among grade eight, nine and ten students girls reported having significantly more chores and duties at home than did boys (Hadaway, 1987).

Conflicts may also arise from future expectations. Being a good mother, in the traditional sense, to many women means working part-time or in the home, especially while children are young. Conversely, being a good engineer means working full-time and may involve a considerable amount of overtime as well.

Young women want to be able to combine working in the home, as a wife and mother, with a career. However, young women expect to work part-time and their partners to work full-time while their children are young, whereas young men expect to work full-time and their partners to work part-time or in the home (Casserly, 1980; Hawley, 1972; McLure and Piel, 1978; Sherman, 1983). More specifically, girls in high school science programs hold traditional expectations regarding staying at home with young children, whereas their male peers expect their wives, but not themselves, to cut back on their work involvement while their children are young (Mura, Kimball and Cloutier, 1987). Parents of young women who have exceptional abilities in science and mathematics share these ideas, expecting that their daughters will work part-time or in the home while they have young children (Brody and Fox, 1980). Even though young female engineering students do not view a career in engineering as exclusive of other, more traditional commitments, their expectations about their careers and work lives are not as traditional as the preferences their male peers have for future spouses (Ott, 1975). Lyons-Lepke (1986) and O'Connell, Betz ands Kurth (1989) reported that female engineering students acknowledge that they may have to deal with a conflict between work and family, and this conflict is of concern to them.

Given these findings it is not surprising that women in math and science careers report conflict between their family and professional roles. Both Luchins and Luchins (1980) and Helson (1980), found that older women mathematicians reported problems in combining motherhood with a career in mathematics. Chisholm and Woodward (1980) found that although the women in their study were primarily hampered in their careers by sex discrimination, they were also held back by marriage and family committments interrupting their career paths.

Jagacinski (1987) reported that women working as engineers are less likely to be married than their male colleagues, and more likely to be childless. The author also found that the spouses of male engineers were less likely to be professionals than the spouses of female engineers, and she suggests that the men are therefore more likely to have a spouse who is willing to take primary responsibility for childcare. Thus women engineers more frequently have to deal with the problems of a two-career marriage (Jagacinski, 1987). For female engineering students, conflicts between sex role and their chosen career may not arise until women are faced with the actual demands presented by trying to combine career and family.

The Present Study

In order to help women who have chosen engineering as a career complete their course of study and be successful in their profession, it is important to understand how factors such as support, encouragement, discouragement, role models, and conflict affect female engineering students. Also, we cannot assume that female and male students face the same problems in engineering. It is also of interest to compare the factors influencing women to those influencing men. Clearer information is required about the problems of either or both genders, and how both women and men cope with these problems. Additionally, more Canadian data is required, as the bulk of current information comes from studies conducted in the United States.

The purpose of this research is three-fold. First, the study will provide current information on a Canadian cohort of female engineering students. Second, the research will examine sex-related differences in the support, the extra-school

obligations, and the future family and work expectations of engineering students. Third, the research will attempt to replicate sections of Ellis' (1981) study dealing with issues of support and demographic information for female engineering students.

A number of questions will be addressed in this research. Is the support of family, friends, teachers, and counsellors important to engineering students, and are female students receiving support that is in some way different from the support the male students receive? Based on studies that considered support in the form of encouragement, it is hypothesized that both male and female students will be offered support, but where support is lacking it will be the female students who report the lack, specifically, from other females. (Johnson, 1975; Ott, 1975; Ellis, 1981; Greenfield et al. 1982; Auster, 1984; Haworth et al. 1986a; Valyo, 1986)

Role models will also be examined. Specifically, who they are, the importance of role models to both male and female engineering students, and the relevance of the role model's gender. Following from the literature (Ott, 1975; Ellis, 1981; Greenfield et al. 1982; Houser and Garvey, 1983; Haworth et al. 1986a; Lyons-Lepke, 1986; Dagg and Thompson, 1988; Fitzpatrick and Silverman, 1989) it is hypothesized that both male and female students will have more male role models, and that more female than male students will have a female role model.

Finally, the issue of role conflict will be examined. Questions to be addressed include whether engineering students experience any conflict between how they see themselves as male or female and how they see themselves as engineers, what expectations they have for their lives in the future, and what

factors contribute to or help to minimize any felt conflit between roles. Based on previous research (Hawley, 1972; McLure and Piel, 1978; Casserly, 1980; Sherman, 1983; Mura et al, 1987) it is hypothesized that more females than males will expect to work part-time or in the home while their children are young, and more males than females will expect their spouse to work part-time or not at all while their children are young. Also, based on Hadaway (1987), it is expected that female engineering students will be responsible for more chores and duties in the home, and will do more hours of housework than male students.

It is hoped that by addressing these questions a clearer picture of the lives of female and male engineering students will emerge, and that from this picture we can gain a better understanding of what women expect and experience as engineers.

CHAPTER II

METHOD

Participants

Participants were 89 (13 females and 76 males) undergraduate students registered in the engineering program at Simon Fraser University during the 1987/88 and 1988/89 academic years. In 1987/88 there were 153 males and 9 females registered, and in 1988/89 there were 163 males and 11 females. All the male participants and 10 of the female participants were registered during the 87/88 academic year. The additional female participants entered the program in 88/89. Students were approached during classroom and laboratory time, and all of those approached agreed to complete the questionnaire. In addition to answering the questionnaire, all of the females and 10 of the males were also interviewed. The male students were chosen at random from those who volunteered to be interviewed (n = 55).

Students were contacted by phone, and, with the exception of one male, all students who were approached by the researcher agreed to participate. The mean age of all the female participants was 21 years and 6 months (standard deviation = 4.5 years). The median age was 21 years, and the range was from 17 to 29 years. The mean age of all the male participants was 19 years and 2 months (standard deviation = 1.8 years). The median age was 18 years, and the range was from 16 to 27 years. Broken down by year in school, 42 male participants were first-year, 13 second-year, 11 third-year, 3 fourth- year, and 7 fifth-year students. Eight females were first-year, 1 second-year, 2 fourth-year, and 2 fifth-year students.

Measures

A 28 item questionnaire (see Appendix A) incorporating the questionnaire used by Ellis (1981) was designed. The Ellis questionnaire included questions about family, friends and home life, how these people and situations influenced career choice, and how and when the students decided to enter engineering. Twelve additional questions regarding participants' expectations for future family role and current family situations were added. The complete questionnaire asked students to provide information about how they became interested in engineering as a course of study, when they made the decision to enter engineering, which individuals supported their decision, and information regarding their long-term family and career plans.

A structured interview consisting of open-ended questions was also used in this study (see Appendix B). Interview questions focussed on issues of support and discouragement, role models, and role conflict. The interview was designed to gather more detailed information about issues addressed in the questionnaire.

Procedure

The study was conducted in two stages; questionnaire administration, and follow-up interview. The questionnaire was administered in groups of approximately 50 students, during class time. Students were told that they were participating in research designed to gather information about engineering students in Canada, and that the researcher was interested in exploring any differences between male and female students. It was stressed that participation was voluntary, and informed consent was indicated by completion of the

questionnaire. The questionnaire took about 15 minutes to complete. Participants were encouraged to add any comments of their own at the end of the questionnaire, and asked to indicate on a separate piece of paper if they were interested in participating in the interview. The researcher was available to answer questions while participants filled out the questionnaire, and they were given the opportunity to ask questions about the research afterward. Anyone interested in receiving a copy of the results of the study was requested to provide their mailing address on a piece of paper separate from the questionnaire.

The interview was conducted on a one-on-one basis, with students randomly selected from those who volunteered to discuss their choice of career in more detail. The interval between the questionnaire and the interview varied. Some interviews took place immediately following the administration of the questionnaire, others were scheduled up to five days later. Every effort was made to minimize the interval between completion of the questionnaire and the interview. The interview took approximately 30 minutes, and students were once again told about the research they were participating in. Participants were asked to sign an informed consent form indicating they understood that the contents of the interviews were to be kept confidential and that the tapes would be erased after they had been transcribed. Although the interview was structured, participants were encouraged to discuss any other issues they felt to be of importance at the end of the interview. The interviews were taped and the conversations were later transcribed verbatim. Again, the researcher was available to answer any questions about the study at the end of the interview.

CHAPTER III

RESULTS

Questionnaire Data

A total of 89 engineering students completed the questionnaire (76 males, 13 females). The data were tallied and percentages were calculated for the participants' responses. The percentages were then examined for differences between the responses of the female participants and those of the male participants, and for patterns of response within each group. Those questions to which a dichotomous (eg. yes/no) answer was requested were subjected to a chi-square procedure to determine whether or not there were significant differences between the responses of females and males. For non-dichotomous responses, answers were categorized and proportions were calculated in order to compare the responses of the males and females. A z-score was then used to test the significance of the difference between the two proportions (Ferguson, 1981).

Demographic Information

A number of questions asked participants for demographic information. Table 1 shows the levels of education achieved by the students' parents. Mothers and fathers did not differ significantly in level of education. Very few participants were only children. Fifteen percent of female students and 7% of male students had no siblings, 38% of female students and 46% of male students were oldest children, 23% of females and 17% of males were middle children, and 15% of females and 30% of males were youngest children. Females and males did not

Table 1.

Parental Education

	Females		Males	
	Mothers	Fathers	Mothers	Fathers
Less than Grade 6	15% (n=2)	0	1% (n=1)	1% (n=1)
Grade 6	0	15% (n=2)	5% (n=4)	4% (n=3)
Grade 12	31% (n=4)	31% (n=4)	41% (n=31)	32% (n=24)
Baccalaureate	46% (n=6)	46% (n=6)	43% (n=33)	51% (n=39)
Masters	8% (n=1)	8% (n=1)	7% (n=5)	4% (n=3)
Doctorate	0	0	1% (n=1)	7% (n=5)

differ in birth order.

Role Models

This study examined the importance of role models, and explored who served as role models for engineering students. It was hypothesized that all engineering students would have more male role models than female role models. Furthermore, it was hypothesized that more female students than male students would have female role models. To explore these questions, participants were asked if they had any relatives in engineering or technical jobs, as these people would serve as potential role models for engineering students. Results were very similar for male and female respondents. Fifty-seven percent of male participants reported having a male relative in such a job, as did 46% of female participants. Males and females had approximately the same percentage of fathers in engineering or technical jobs (males: 21%, females: 23%). Seventeen percent of males and 15% of female participants had a female relative in an engineering, technology related, or male-dominated field of work. Although none of the females had a mother in such a field, 5% of the males did. Twenty-three percent of females had siblings in engineering (all brothers), whereas 13% of males had siblings in engineering (10.4% brothers, 2.6% sisters). These results support the hypothesis that engineering students have more male than female role models. The hypothesis that more female than male students would have female role models was not suppported here, but was supported by the interview data.

Twenty-three percent of females and 34% of males reported that role models had been influential in their decisions to enter engineering. These data were examined further according to the gender of the infuential person. Eight

percent of females indicated that another female had been an influence, and 15% indicated that a male had been an influence. For the male respondents the results were confounded, as many of those answering yes to this question did not specify what gender the role model was (for example, writing "friend" rather than "male friend"). As a result, these data could not be analyzed.

Support and Discouragement

The degree to which students were supported or discouraged in their choice of engineering as a career was a central question to this research. It was hypothesized that both male and female students would be offered support, but where the support was lacking it would be the female students who reported this lack; specifically, from other females. In order to explore these questions participants were asked to indicate how a number of individuals reacted to their decision to study engineering by checking 'Supportive', 'Not Supportive', or 'Not Applicable'. A response ratio was calculated dividing the total number of 'Supportive' responses by the number of 'Supportive' and 'Not Supportive' responses for each item. As the ratio approached one this indicated a greater degree of unqualified support from the specified individual. Female participants received slightly more support than male participants; fathers (.83), mothers (.92), and brothers (.85) were the only individuals who were not completely supportive. Male participants reported that fathers (.97), sisters (.97), school counselors (.96), male math teachers (.98), other male (.90) and female (.93) teachers, male employers (.92) and female friends (.98) were not completely supportive. Participants reported receiving complete support from all other individuals according to this descriptive measure.

In contrast to the similar levels of support reported by males and females, significant differences were found between females and males when they were asked if anyone tried to dissuade them from entering engineering. Overall, females experienced more discouragement than males. Fifty-four percent of females and 16% of males indicated that someone had tried to dissuade them, χ^2 = 14.123, $p<.001$. Generally, more people tried to dissuade the females from entering engineering, t(22) = 1.25, p = .01 (female mean = 1.714, male mean = 1.118). Table 2 shows that female students were discouraged from entering engineering more than male students and that different reasons for not entering engineering were given to males and females. Although these results were not hypothesized, they are important.

Role Conflicts

To assess the degree to which students experienced conflict in balancing the various roles they assumed, information about the students' home lives was of interest. One hypothesis was that female students would do more work in the home in the form of household chores. The living situations of female and male students were very similar. The majority of participants lived with their families. The majority of students were from families with two parents (92% of females and males), and those who were not were from families headed by their mothers. No differences were found in the type and number of chores participants reported doing around the house. Few reported doing no chores (eight percent for males and females), and a small percentage reported doing all household chores (females 23%; males 19%). There were, however, differences in the number of hours of housework the students reported doing. While 54% of males reported that they did no housework on a daily basis, 31% of females

Table 2.

Experiences of Discouragement

	Females	Males	Level of Significance
Discouragement from:			
Fathers	15% (n=2)	1% (n=1)	p =.005
Mothers	8% (n=1)	0	p =.006
Friends	23% (n=3)	7% (n=5)	p =.03
Reasons for discouragement:			
Engineering poor prospect for work	23% (n=3)	1% (n=1)	p <.001
Program too long	8% (n=1)	0	p =.006
Not suitable because of gender	15% (n=2)	0	p =.001
Engineering too hard	8% (n=1)	8% (n=6)	nonsignificant
Should enter other discipline	0	4% (n=3)	nonsignificant

reported the same, $z = 1.53$, $p = .063$. Eight percent of females said they did 5 to 6 hours of housework per day, and no males did this, $z = 2.532$, $p = .006$. Fifteen percent of females said they did more than 7 to 8 hours of housework a week, and 4% of males also said this, $z = 1.58$, $p = .057$. It would seem that although male and female students do the same type of work in the home, females spend more time doing that work.

Given the potential for conflict between career and home life, participants were asked about their plans for marriage and family. There were a number of differences found in these plans, as reported in Table 3. Overall, more males than females planned to marry and planned to have children. More females than males were uncertain of their plans regarding both marriage and children.

Those planning to have children were asked about their plans for work, and what they expected of their spouses. Two hypotheses were related to these questions: 1) that more females than males would expect to work part-time or in the home while children were young; and 2) that more males than females would expect their spouses to work in the home while children were young. The hypotheses were supported by the results. Table 3 also shows that both males and females had traditional expectations for their own and their spouses' work lives. Interestingly, although a small number of males (2%) said they would be willing to work in the home when their children were young, they indicated that they planned to do engineering work at home. The females who responded that they would be willing to work in the home while children were young (10%) did not indicate any specific activities. Also, 28% of males said that the decision about whether or not their spouse would work in or out of the home was their spouses' decision, whereas no females said this. Females and males, would seem to have different expectations for both their own and their spouses' work lives

Table 3.
Future Plans

	Females	Males	Level of Significance
Plans for self (with young children)			
Work full time	50% (n=5)	88% (n=56)	x^2 =15.830, p <.001
Work part time or in home	50% (n=5)	11% (n=7)	
Plans for Spouse (with young children)			
Work full time	89% (n=8)	10% (n=6)	x^2 =49.753, p <.001
Work part time or in home	11% (n=1)	61% (n=37)	
Plan to Marry	62% (n=8)	84% (n=63)	p =.03
Uncertain about marriage	23% (n=3)	9% (n=7)	p =.07
No plans to marry	8% (n=1)	5% (n=4)	nonsignificant
Plan to have children	54% (n=7)	86% (n=62)	p =.003
Uncertain about children	38% (n=5)	6% (n=4)	p <.001
No plans for children	8% (n=1)	7% (n=5)	nonsignificant

once children enter the picture. These expectations supported the hypotheses.

Career and Work Choices

Other information was of interest in this research, although not directly related to the hypotheses specified above. Participants were asked to answer some questions regarding how they chose to enter engineering. When asked if they had ever worked in engineering, thirty-one percent of females and 41% of males said they had. Participants chose to study engineering at approximately the same time in their lives; during the final years of high school (females; 54%, males; 51%). Small percentages chose to study engineering in the early years of high school (females; 23%, males; 30%), and during the first two years of university (females; 15%, males; 16%). Three percent of males decided to study engineering at an unspecified younger age, whereas no females made their decision at that time. Eight percent of females decided to study engineering after working or after completing another university degree, whereas no males did this, $z = 2.532$, $p = .006$. Participants' reasons for entering engineering were different. Thirty-nine percent of females said they chose engineering because they enjoyed mathematics and science; 13% of males indicated this as their reason, $z = 2.32$, $p = .01$. Fifteen percent of females said they entered engineering because it was a good route to other careers, 3% of males cited this reason, $z = 1.93$, $p = .03$. Fifteen percent of females thought that engineering suited their personality, whereas 4% of males said this, $z = 1.58$, $p = .057$. Fifty-one percent of males entered engineering because it was interesting, whereas 23% of females gave this reason, $z = 1.068$, $p = .14$. Fifteen percent of females entered engineering because they liked working with men. No males gave this as their reason, $z = 3.371$, $p < .001$. Males said they entered because of an interest in electronics

(4%), because of the reputation of the Simon Fraser program (4%), and because of the many practical applications of engineering (7%). No females gave any of these answers. In general, there were few differences in the timing of career decisions, except that female students were more likely to be taking a second degree than were males. There were differences in the reasons for studying engineering; females chose engineering because they enjoyed math and sciences, whereas males entered engineering because it was an interesting field.

Female and male students were financing their educations differently. Both groups were relying on scholarships (females 77%; males 88%) and on savings (females 54%; males 53%), and both groups were also relying on family support (females 38%; male 35%) and student loans (females 31%; males 19%). However, 73% of males were relying on money from summer work compared to 31% of females, $z = 2.99$, $p = .001$. Thirty-eight percent of females, compared to 11% of males were relying on part-time work during the school year to finance their education, $z = 2.55$, $p = .005$.

When asked to indicate where they wanted to work, participants were very similar in their preferences. The majority said they would work anywhere (females 46%; males 51%), while others indicated a desire to remain in British Columbia (females 23%; males 26%), the Lower Mainland (females 15%; males 15%), and Vancouver (females 15%; males 8%). There were differences in the type of engineering participants wanted to do. Many males, 46%, were interested in electrical engineering compared with 15% of females, $z = 2.10$, $p = .02$. Thirty-one percent of females were unsure of the type of engineering they wished to do, whereas no males indicated uncertainty, $z = 4.99$, $p < .001$.

In summary, there were many similarities between female and male engineering students. Demographically, the students participating in the research were similar. In general, both males and females received support for their career choice. Both males and females had role models who were in science, engineering or technology, and role models influenced the students similarly in the decision to enter engineering. Students made the decision to study engineering at approximately the same time in their lives. Males and females did the same type and number of chores at home, and students were similar in their willingness to work anywhere once qualified as engineers. There were also important differences between female and male engineering students. Females were discouraged more than males from entering engineering. Females performed more hours of housework than males did. With regard to future plans, more males than females planned to marry and have children, and females more than males expected to work part-time or in the home once they had young children. Males more than females expected that their spouses would work part-time or in the home while they had young children. Also, females more than males were financing their education in part through jobs they took on during the school year, and females were less sure about what kind of engineering they wished to pursue.

Interview Data

After completing the questionnaire, a subset of participants was interviewed. These questions (see Appendix B) were open-ended, and related to issues raised in the questionnaire (see Appendix A). Ten males and 13 females participated in the interviews. Male participants were chosen at random from those who volunteered, and all the female students in the engineering program at Simon

Fraser were interviewed.

Support and Discouragement

Participants were asked to describe their relationships with individuals who were supportive of their decisions to enter engineering. Responses were similar for female and male students, and were consistent with the results of the questionnaire showing similar support for both male and female sudents in their choice of career. Nine of the male students said that their parents were supportive. A typical comment was:

> "My parents have always been supportive...we had a close family, and they always support me in whatever I do." (5th year male student)

Descriptions were similar from the female students. Nine of the female students reported supportive parents.

> "My family was really supportive, they were pretty surprised, but they were really supportive." (5th year female student)

Five males and 3 females mentioned teachers as supportive, 1 male and 3 females said friends had supported them, and 2 males and 1 female reported a supportive sibling. Two females also mentioned other relatives, and the only married student said her husband had been supportive.

Although the engineering students reported that others had wholeheartedly supported their decisions to enter this field of study, six females and 2 males experienced discouragement from somebody in their lives. None of the students interviewed said that both of their parents were discouraging, but the mothers of one male and one female student had misgivings. It is interesting to note the different themes in the descriptions given by the students of their mothers' reactions.

> "My mother...wasn't really supportive of my going into it...she was indifferent more or less. She sees I do a whole lot of work and says 'why do you do this to yourself?'" (2nd year male student)

> "My mother is apprehensive because she's more traditional, and for a woman she would expect me to to get a job as a secretary or in the factory, and then go and look after babies." (3rd year female student)

Three female students, but none of the male students, had fathers who were not supportive of their career choice. In each of these cases, the fathers did not object to their daughters having professions, but were not happy that the women had chosen engineering.

> "My dad was really on my case...he didn't like the idea as much as being a doctor because he's an engineer and he's out of work right now." (1st year female student)

In all 3 of these cases the students' mothers remained supportive, telling the women that they should do what they were happiest doing. One of these women felt pressure from many of her relatives who supported her father's position.

> "He had relatives write me letters all over the place...my uncles...it was incredible." (1st year female student)

One female student mentioned a lack of support from a boyfriend with whom 4 she was no longer involved.

> "My boyfriend got pretty pissed off that I didn't have any time to spend with him, but that's life." (4th year female student)

None of the males mentioned this kind of a reaction from their girlfriends or partners. One male student did report relatives who were not supportive.

> "My uncle said...all you are doing is bashing your head against the wall. My grandma didn't like me going to university at all. They were both pretty discouraging." (5th year male student)

These results, showing that the female students were more frequently discouraged from entering engineering, are also consistent with the questionnaire results.

For those students who were receiving support no-one experienced a withdrawal of that support once they had begun their studies, although every

student, male and female, commented that someone in their life had 4 expressed concerns regarding the heavy workload:

> "Nobody was negative, but here and there my mum or a brother would question 'Is it really worth it? Not seeing your family, staying up so many nights in a row?' But not saying 'You shouldn't be doing this'." (3rd year female student)

The students themselves acknowledged the workload as heavy, but were willing to accept this as a fact of life while in the engineering program. None of the students experiencing discouragement reported any change in attitude on the part of the discouraging person.

Role Models

Participants were asked a number of questions dealing with the issue of role models. The hypotheses that these questions dealt with were: 1) that all students would have more male role models than female role models; and 2) that more female engineering students than male engineering students would have female role models. These hypotheses were partially supported by the questionnaire results, and were also partially supported by the results of the interviews.

Nine of the male students and 7 of the female students interviewed said that they had a role model. One male student and 6 female students said that they had no role models. Of the students with role models, none of the male participants had a female role model, but four of the women reported 5 females who were role models. According to these data then, more males than females had role models, but the females were more likely than the males to have a female role model. These results differ from the results of the questionnaires, in which similar percentages of males and females reported having role models.

However this difference may be in part due to the fact that some data could not be analyzed because male participants did not identify the gender of their role models.

The interviews revealed other interesting information about the role models of engineering students. Four males and 3 females said a parent or both parents were their role models, 4 males and 3 females mentioned other relatives, 4 males and 1 female mentioned someone they had worked with, and 1 male and 2 females said that a famous individual was their role model (e.g. Lee Iaccoca, Marie Curie). Of those participants who said that they had role models, six of the males described their role models as connected with engineering. Four of the females said their role models were connected with engineering, and 2 of these role models were females (one woman was a cousin of the participant, and the other woman was a co-worker from an internship placement). Both the male and female students thought that the fact that their role models were connected with engineering was an important factor.

> "If I didn't know anyone in engineering I would not have chosen it...it's hard to choose something you know nothing about." (1st year female student)

> "...one of my profs...he's the one that has kept the the interest alive in engineering, because engineering is alot of grunt work, nothing glamourous about it... [he] just made it seem like a career that was worthwhile going into." (5th year male student)

In general, the participants with role models, whether those role models were connected to engineering or not, thought that it had made a difference to them to have a role model.

> "...it's something that they achieved that you can achieve, set as a goal for yourself...if I didn't have [her] in mind I wouldn't try to strive for doing as well." (1st year female student)

Eight of the female participants and 8 of the male participants thought that role models were important, whether they themselves had role models or not.

> "...it's that somebody has made it...just the fact that they've done it and they seem to be happy." (5th year female student)

Two of the males said they did not think that role models were important, but no females said this. Five females said that they were not sure if role models were important, and no males said this. Three males and 8 females thought that it was important for others to have role models.

> "...it would make them work harder, it would be useful...alot of people might not have someone they could look at...they just seem to float around and they don't seem to know exactly what they want to do. That's not going to work unless you're really smart." (5th year male student)

One male thought that it was not important for others to have role models, but no females said this. Six males and 5 females did not know if it was important for others to have role models. Of those who did not have role models or did not think that role models were important, a common theme in their comments was independence.

> "I've always had alot of faith in my ability...I've always been comfortable with allowing myself to do that and not relying on anybody else..." (5th year male student)

In general, male and female students have similar attitudes towards role models, whether they themselves have them or not, except for the question of the importance of role models for other students. Female engineering students are more likely to think that role models are important for other students, and in particular for other female students (6 females were specific about this, no males mentioned it).

> "It's beneficial...unless the woman is extremely strong, and even then [the support] must come from somewhere...along the way there must be some reinforcement. What we need is an 'old girls' network." (3rd year female student)

Role Conflicts

On the questionnaire, participants were asked a number of questions about their plans for combining work and family in the future. These questions began to explore the potential for conflict in their lives, given the various roles the participants assume as students and the nature of the profession they have chosen. These issues were pursued in the interview. Students were asked if they felt any conflict between how they saw themselves as male or female, and how they saw themselves as engineers. Two male students and 6 female students experienced this kind of conflict. When asked what factors contributed to these feelings, the females mentioned the attitudes of family, peers, and teachers, and also remarks made about women in general. The males experiencing conflict, and one of the females, said that conflict was heightened for them because of expectations held by society of how men and women should act. Typical comments from the students were:

> "There's some conflict, I tend to avoid things that make me look female...I kind of go out of my way to avoid it. People comment on it, like 'can't you ever wear dresses'." (5th year female student)

> "I think being a male right now in this society is complicated...being an engineer is rough and rugged, and 'Mr. He-Man' all the time, and that definitely opposes what I want to do with my life." (5th year male student)

Eight male students and 7 female students said they felt none of this kind of conflict. Both male and female students said that family, peers, and a general feeling that they were capable and suited to the work contributed to minimizing any conflict in their lives. Male students also mentioned that the engineering program was set up in such a way that they felt very comfortable there, and that being male was a factor in eliminating any felt conflict between roles. It is interesting to note, however, that although the female students often said they

experienced nothing conflicting about being a female in a traditionally male dominated area, they then went on to describe situations that were uncomfortable for them for precisely that reason.

> "If a man had my personality it wouldn't be rejected as much I think. I once got asked out by somebody I wasn't thinking of that way...I felt uncomfortable... that made the whole situation uncomfortable for everybody associated with that group of people. One of the women the guys tend to tease alot because she gets into a knee-jerk reaction, sexually, they tend to do it just to get a rise out of her. (4th year female)

> "I was the only female in my class most of the time and there were occassions when either a speaker or professor would start to tell some joke and then see me in the class and stop telling it. It draws attention to yourself...and the old saying that you have to do twice as well to get noticed is quite true too. I think that's something that women have to realize is going to happen, and try not to take it personally." (5th year female student)

Although many of the female participants admitted to feeling conflict, or described situations in which they felt uncomfortable, surprisingly, only four of the women said that they thought other women in the program felt conflict too. Also, only three of the male students said they thought the female students felt any conflict.

> "...you build up releases...you do goofy things, and it's harder for the girls to do that sometimes because you can't tell dirty jokes or you feel uncomfortable. Because of that kind of exclusion doing engineering by yourself is tough. One of the girls said to me 'Do you know how hard it is to be a girl in this program?', and I said 'I guess I'm not making things any easier for you.' She said 'No, most of the time you don't'." (5th year male student)

Nine male students and 11 female students thought that the male students in the program felt nothing conflicting about being a male in engineering. Given the low number of male students reporting any such feelings, and the lack of contradiction in the male students' descriptions of being in the program, this would seem to be an accurate assessment.

Students were asked if they thought that they might feel more or less conflict as they grew older. Two males and 4 females said they thought they would feel more conflict with age. The same numbers said they would feel less conflict, and 6 males and 5 females did not know. Participants were then asked about their plans for parenthood. All of the males and 4 of the females said they planned to have families. Eight of the women were unsure of whether or not they wanted to be parents, and one woman already was a parent. Here again there were contradictions between the answers people gave and the stories they told. Although few people had said that they thought they would feel more conflict as they grew older, many (all of the females, five of the males) expressed concerns about balancing parenthood and careers later in life. Although participants may not identify such problems as 'conflicts', per se, they do recognize that such situations are conflicting.

> "I'm quite sure I'll get married, but as far as children go, every year I change my mind...I think it would conflict a fair amount...except for this one guy who said he would alternate [working in the home] I don't think there are too many guys who would do that." (3rd year female student)

> "I anticipate it (being a parent) might be a problem, but I don't want it to be like that, I want to have weekends free and a nine to five job. I know alot of engineers don't have that. I'm not looking forward to that time, I don't know what I'm going to do...I realize that a family is more important when it comes down to it." (1st year male student)

The different numbers of males and females who said they were definitely planning on having families lends weight to the questionnaire findings that males and females have different expectations about marriage and parenthood. In addition to this, the fact that so many females (eight) said they were uncertain about having families may be indicative of feelings of conflict that the male students did not experience.

The data from the interviews show, as did the data from the questionnaires, that male and female engineering students are similar in many ways. Consistent with the data from the questionnaire, the majority of students received support from family and others in their choice of career, and in all cases this support was tempered by realistic concerns about the heavy workload the engineering program entails. Most of the participants felt that having a role model was important, and those who had role models found it to be a positive experience. The attitudes that male and female students had about role models were, in general, similar.

There were also differences between the male and female engineering students. Again, consistent with the questionnaire data, females were discouraged in their choice of career more than the male students were. Although attitudes towards role models were similar, an exception to this was that the female students were more likely to believe that role models were important for other students. Also, males actually had role models more frequently than females did, and the males' role models were all male. The females who had role models had both male and female role models. These data differed somewhat from the questionnaire data, which showed that similar proportions of male and female students had role models. Male and female participants differed in the degree to which they experienced conflict in their lives. More females than males felt conflict between their gender role and their career choice, and more females than males described situations where they experienced conflict even though they did not define it as such. More of the male students planned to have families, whereas most of the females were unsure of their plans and recounted worries about balancing families and careers. These data was consistent with the questionnaire data.

Generally speaking, there would seem to be both differences and similarities for males and females making the choice to enter engineering. The differences tend, however, to present the females with disadvantages the males do not face in terms of greater discouragement, more time spent on both housework and financial support while in school, and more conflicting feelings about roles.

CHAPTER IV

DISCUSSION

Engineering is a demanding discipline for any student who choses to study it. Both male and female students find the work hard and the hours demanding, but welcome the chance to apply their abilities in mathematics and sciences. Studying engineering is a challenge met and answered by all the students who progress through the program and emerge qualified engineers. This study reveals that although the experience of becoming an engineer is similar in many ways for female and male students, the experience can be more negative for female students as a result of different experiences.

The questionnaire and interview data supported the hypothesis that both male and female students would receive support for their decision to enter engineering. Students reported similar levels of support from a wide range of people. Female students, however, also reported discouragement from a number of people, and from more people than did male students. Parents, family and friends all discouraged female students more than they did male students. When male students reported discouragment it was by individuals to whom they did not have close ties, for example, teachers and employers. It could be argued that such discouragement would not be taken as seriously as the discouragement from an individual with whom one has a closer relationship, such as a parent. Haworth et al. (1986a) found mothers to be discouraging of their daughters in engineering, and Ellis (1981) found that mothers and other women were initially discouraging of the career choice of young women entering engineering. It is difficult to compare these results with the results of this study, as the above studies do not compare female to male engineering students. Although female students in

this study were discouraged by mothers, as reported in previous research, they were more frequently discouraged by fathers. Other studies (Rotter, 1982; Plas and Wallston, 1983; Lyons-Lepke, 1986; Dagg and Thompson, 1988) report that women in nontraditional fields experience lack of encouragement, inconsistent support, or unsupportive academic environments. However, because they do not discuss the issue of discouragement directly, one must infer that female students feel discouraged in such situations. Discouragement needs to be investigated more thoroughly, and a distinction should be made between the effects of inconsistent or nonexistent support, and direct discouragement.

The questionnaire data showed that, in addition to being discouraged more frequently than male students, female students were given more reasons why they should not enter engineering. In particular, some women were told that an engineering program would take too long, and that engineering was not suitable for women. Both of these reasons appear to be based on an underlying idea that there are other things women should be doing that a career such as engineering might prevent or at least interfere with.

Interviews revealed that women in engineering did have an awareness that their choice of career could conflict with other choices they might wish to make in their lives. Specifically, female students felt more conflict than males between their chosen career and their gender role, females were less certain than males about their plans for having a family, and the questionnaires showed that females spent more time than males on housework and on financing their education by part-time work during the school year. These results are consistent with studies that found that women who study for a career or who work outside the home have greater demands made on their time than do their male peers (Cherpas, 1975; Meissner et al. 1975; Hendricks, 1977; Luxton, 1981; McPherson,

1985; Whigham, 1985; Hadaway, 1987). Previous research (Greenfield et al. 1982; Galejs and King, 1983; Jones and Lamke, 1985; Keenan et al. 1986) indicated that female students did not feel conflict between their career and their gender, and those results were, in part, supported in the present study. Women in this study did not report feeling conflict, although they did report incidents from which conflict can be inferred. In addition, the women in the study were aware that combining a career and a family would be difficult, and they anticipated that they would feel conflict over this in the future. The women in this study had a realistic idea of the problems faced by women entering the workforce today. It is interesting, then, that on the questionnaires both female and male students indicated they had traditional expectations about combining their work and family lives, and had traditional expectations about their spouses' work lives, results consistent with previous research (Hawley, 1972; McLure and Piel, 1978; Casserly, 1980; Sherman, 1983; Mura et al. 1987). The female students, when interviewed, reported that these expectations regarding plans for work and future family were a source of concern, but this was not the case for the male students. As in the studies by Lyons-Lepke (1986) and O'Connell et al. (1989), the women acknowledged that there would be a problem juggling work and family roles, but in the present study did not directly identify this as conflict.

It was interesting that although seven of the women interviewed said they felt no conflict about being female in a male dominated profession, they described situations in which they felt uncomfortable because of the fact they were women, for example, when their male peers or professors told sexist jokes, or expressed sexist attitudes. What seemed to help minimize conflict for these women was a sense of independence and a belief in their own abilities. It is also a possibility that to some degree these women were trying to fit in by

denying that they are treated differently than their male peers, and by their male peers. The female students strongly identify with their male peers in order to fit in, and therefore do not see themselves as targets of sexism. This would be consistent with Dagg and Thompson's (1988) findings regarding women professors conforming within their departments. The female students also did not recognize that many of their female peers felt conflict between their gender and their career. This would be consistent with identifying all students as the same group rather than as male students and female students. If this is so, the continuing conflict and discomfort that some women in the program feel would indicate that this attempt to fit in is not entirely successful, nor will the conflict lessen with age, based on previous research (Luchins and Luchins, 1980; Chisholm and Woodward, 1980; Helson, 1980; Jagacinski, 1987).

Almost all the female students and about half of the male students who were interviewed expressed concerns about balancing their careers with family lives. Given that both male and female students had traditional expectations about their own and their spouses' work lives if they had families, it is not surprising that almost all male students still planned to marry and have children, and many female students were unsure about their plans. Although they recognized that balancing family and career would be problematic, male students for the most part still expected that their wives would be the primary caretakers of small children. Those men who said they would consider working at home while children were young made it clear they planned to do engineering work at home, and not work in the home doing housework. The majority of women in the study said they would work part-time or in the home while children were young, consistent with previous findings discussed above, and as such it is no surprise that these women (who are working very hard to qualify for a difficult

career) are reluctant to say that they will give up their career to stay at home. The women in the study were very cognizant of the fact that the nature of a high-tech career did not leave much room for parental leave of absence, and perhaps as a result they recognize that they may have to make a choice between career and family rather than stuggle to balance the two. Jagacinski's (1987) findings that women engineers were more likely to be unmarried and childless than male colleagues would lend weight to the idea that women in this field do make such a choice.

In summary, the findings from this study regarding conflict do not support previous research showing that female students in engineering experience little or no conflict (Ott, 1975; Greenfield et al. 1982; Galejs and King, 1983; Jones and Lamke, 1985). Rather, the findings are consistent with research indicating the potential for conflict that exists between women's careers and family life (Cherpas, 1975; Meissner et al. 1975; Luchins and Luchins, 1980; Hendricks, 1977; Chisholm and Woodward, 1980; Helson, 1980; Luxton, 1981; McPherson, 1985; Hadaway, 1987).

Given that women entering this field face greater discouragement and feel more conflict between their choice of career and other aspects of their lives than men do, role models may be useful or beneficial to female students. The data indicate that there are differences between female and male students in their relationships with role models.

Female interviewees in this study thought that it was important that other students have role models, and in particular they thought that other female students would find role models helpful. The female engineering students in this study, whether they had role models themselves or not, would seem to recognize

that women in this field may face greater difficulties than do their male peers, and therefore have a greater need for role models. Assuming that the arguments of Ott (1975), Sheinin (1981), Helms (1982) and Fitzpatrick and Silverman (1989) are correct and female engineering students would benefit from having role models connected with their field, the finding that more males than females interviewed in this study had role models connected to engineering is disturbing. For these students, the role models' connections to engineering were important factors as the knowledge of the work engineers do made a difference to the students' career choices. Female students deciding on a career might be less likely to consider engineering if they view it as a male domain, and have no information about what it is that engineers do. A distinction should be made, however, between potential role models such as relatives in engineering, and those that individual students in engineering identify as role models. Although potential role models provide information about engineering, these people may not function as role models for individual students. In this study male and female students knew individuals in engineering, but it may be more important that a female engineering student have a role model rather than merely a source of information.

The data from both the questionnaires and interviews supported the hypotheses about role models. Generally, participants had more male role models than female role models, and more female than male participants had female role models. Also, for engineering students with relatives working in the fields of engineering or technology, those relatives were more likely to be male than female. These results were consistent with previous research (Ott, 1975; Ellis, 1981; Greenfield et al. 1982; Houser and Garvey, 1983; Haworth et al. 1986a; Lyons-Lepke, 1986; Dagg and Thompson, 1988; Fitzpatrick and Silverman, 1989).

Both male and female students with role models considered role models to be important. This could be explained in one of two ways. The experience of having a role model may lead students to appreciate the positive effect that a role model has had on their lives. Alternatively, it may be that those individuals who need role models will seek them out and continue to regard them as useful. Students who do not need role models, then, would never acquire them and perhaps not understand why it is they might be useful to other students.

The questionnaire data showed that engineering students who considered others to be influential of their decision to enter engineering were in the minority, but the interviews revealed that over half of the female students and almost all of the male students had role models. Questions about role models were phrased differently in the two parts of the study. On the questionnaire, students were asked about individuals they knew personally who were involved in engineering, science or technology, and if the decision to enter engineering had been influenced by anyone. In the interview, students were asked directly whether or not they had a role model, and the matter was explored in some depth. The discrepancy in the data could be due to the difference in the questions asked, or it is possible that although these students made the decision to enter engineering independent of other's opinions, role models played an important role once the students had begun their studies. The high number of men who said they had role models when they were interviewed could also be due to self-selection bias in the male interviewees; for example, those whose experience as an engineering student was out of the ordinary might be more inclined to want to discuss it. The same cannot be said for the women as all the female engineering students in the SFU program participated in both aspects of this study.

For all the gains that women have made enabling them to more easily contemplate a career such as engineering, there are still many problems female students face in this field. Women are less likely to select engineering as a course of study because they lack the necessary background in highschool mathematics and sciences (Hacker, 1983). Women are more likely to be discouraged about their choice if they do decide to enter engineering, and the reasons they are given are based on traditional ideas of what are suitable occupations for women in our society. Once enrolled in engineering, women not only have to deal with the intense workload, but also are more likely than their male peers to do more housework, and to work part-time to fund their education. Most engineering faculty have a reputation among students for giving their attention and assistance to those students who consistently demonstrate outstanding ability and dedication; it is difficult to be consistently outstanding and dedicated when one has to divide one's energies between school work, housework and paid work.

The women who participated in this study experience conflict between how they see themselves as females in society and how they see themselves as engineers, although they do not always label it as such. Identifying with male peers who may be contributing to the conflict does not make that conflict disappear, although it may be easier to live with in the short term. Heightened awareness of the factors that continue to make engineering a more difficult choice for women, and addressing these issues within the engineering program at SFU in tangible ways such as assigning mentors to female students and forming a women's support group, would benefit female engineering students there in the long term. The problem with instituting such ideas is that the female students wish to fit in with their male peers, not be singled out from them. The recent

tragic shooting of fourteen female engineering students at Montreal's Ecole Polytechnique has served to focus attention on the problems facing women who enter engineering, and as such, female students in the field may be more willing to group together in support of one another. Female engineering students recognize both their need for role models, and their lack of them. Providing female role models is difficult to address as it is a circular problem; if the women who go on to become engineers faced difficulties and overcame them alone they may not be prepared to mentor other women who enter engineering later.

In order to formulate a more thorough response to the problems faced by women who choose to study engineering, further research should be conducted to add to the information gathered here. In order to understand why women may avoid engineering and applied sciences, women who have the prerequisites to enter these fields but choose other areas of study could perhaps shed light on this. Similarly, women who enter engineering but who then drop out, either to change disciplines or discontinue their studies altogether, would provide valuable information about factors discouraging women already in an engineering program. To understand how women who enter engineering are similar to or different from women in other nontraditional disciplines, and from women in other disciplines in general, a study using a number of comparison groups would be useful. Such a study could include women from engineering, various sciences, mathematics, and a number of the disciplines in the arts. Perhaps some of the issues facing women in this study are common to many women choosing careers, no matter what the area. Finally, a study such as this but with access to a larger population, and at other universities, would be useful in order to determine whether the problems faced by the women in this study are unique to the group

at Simon Fraser University. With knowledge about the unique problems that women face when they enter engineering, universities can better ensure that women who wish to apply their skills in math and science are given an equal opportunity to succeed in their chosen field, and these women can begin to engineer the future as they see it.

REFERENCES

Auster, C. J. (1984) Nontraditional occupational choice: A comparative study of women and men in engineering (Doctoral dissertation, Princeton University, 1984). Dissertation Abstracts International, 44, 3511A.

Brody, L., & Fox, L. (1980) An accelerative intervention program for mathematically gifted girls. In L. Fox, L. Brody, & D. Tobin (Eds.), Women and the Mathematical Mystique (pp. 164-192). Baltimore, MD: Johns Hopkins University Press.

Casserly, P. (1980) Factors affecting female participation in advanced placement programs in mathematics, chemistry, and physics. In L. Fox, L. Brody, & D. Tobin (Eds.), Women and the Mathematical Mystique (pp. 138-163). Baltimore, MD: Johns Hopkins University Press.

Cherpas, C. (1985) Dual-career families: Terminology, typologies, and work and family issues. Journal of Counselling and Development, 63, 616-620.

Chisholm, L. and Woodward, D. (1980) The experiences of women graduates in the labour market. In R. Deem (Ed.), Schooling for Women's Work (pp. 162-176). London, England: Routledge & Kegan Paul.

Dagg, A. I. & Thompson, P. J. (1988) Miseducation: Women and Canadian Universities.Toronto: OISE Press.

Ellis, D. (May, 1981) A long term study of some female engineering students. Proceedings of the 95th Congress of the Engineering Institute of Canada, 7-10.

Ferguson, G. A. (1981) Statistical Analysis in Psychology and Education. New York: McGraw-Hill.

Fitzpatrick, J. and Silverman, T. (1989) Women's selection of careers in engineering: Do traditional-nontraditional differences still exist? Journal of Vocational Behavior, 34, 266-278.

Galejs, I. and King, A. (1983) Sex-role perceptions of traditional and nontraditional college women. The Journal of Psychology, 113, 257-263.

Greenfield, L. (1972) Women in engineering education. Contemporary Education, Vol. 43, 224-226.

Greenfield, L., Holloway, E. and Remus, L. (1982) Women students in engineering: Are they so different from men? Journal of College Student Personnel, Vol. 23, 508-514.

Hacker, S. (1983) Mathematization of Engineering: Limits on women and the field. In J. Rothschild (Ed.) Machina Ex Dea: Feminist Perspectives on Technology (pp. 38-58). New York: Pergammon Press.

Hadaway, P. (1987) Smoking-Modelled or adaptive behaviour? Unpublished doctoral dissertation, Simon Fraser University, Burnaby.

Hawley, P. (1972) Perceptions of male models of femininity related to career choice. Journal of Counselling Psychology, 19, 308-313.

Haworth, G., Povey, R., and Clift, S. (1986a) Girls and engineering: Perceived influences on career choice amongst female craft technician engineers and non-engineers. British Journal of Guidance and Counselling, Vol. 14, No. 2, 196-204.

Haworth, G., Povey, R., and Clift, S. (1986b) The Attitudes towards Women Scale (AWS-B): A comparison of women in engineering and traditional occupations with male engineers. British Journal of Social Psychology, 25, 329-334.

Helms, N. E. (1983) The effects of role modelling as a technique in counteracting sexual stereotyping in the occupational selection of high school girls (Doctoral dissertation, The College of William and Mary in Virginia, 1982). Dissertation Abstracts International, 43, 2237A.

Helson, R. (1980) The creative woman mathematician. In L. Fox, L. Brody, & D. Tobin (Eds.), Women and the Mathematical Mystique, (pp. 23-54). Baltimore, MD: Johns Hopkins University Press.

Hendricks, J. (1977) Women and leisure. In L. Troll, J. Israel, & K. Israel (Eds.), Looking Ahead: A woman's guide to the problems and joys of growing older. Englewood Cliffs, NJ: Prentice-Hall.

Holstrom, E. (June, 1975) The new pioneers: Women engineering students. In M. Ott and N. Reese (Eds.) Women in Engineering...Beyond Recruitment. Proceedings of the conference. Cornell University, Ithaca, N.Y.

Houser, B.B., and Garvey, C. (1983) The impact of family, peers and educational personnel upon career decision making. Journal of Vocational Behavior, 23,, 35-44.

Jagacinski, C. (1987) Engineering careers: Women in a male dominated field. Psychology of Women Quarterly, 11, 97-110.

Johnson, D. (June, 1975) The chronology and support of educational choices. In M. Ott and N. Reese (Eds.) Women in Engineering...Beyond Recruitment. Proceedings of the conference. Cornell University, Ithaca, N.Y.

Jones, S. and Lamke, L. (1985) The relationship between sex role orientation, self esteem, and sex-typed occupational choice of college women. Psychology of Women Quarterly, 9(1), 145-152.

Keenan, A., Newton, T.J., and Logue, C. (1986) Work needs, sex role stereotyping, and affective reactions of female professional engineers. Journal of Occupational Behaviour, Vol. 7, 67-73.

Luchins, E. H. and Luchins, A. S. (1980) Female mathematicians: A contemporary appraisal. In L. H. Fox, L. Brody, and D. Tobins (Eds.) Women and the Mathematical Mystique, (pp. 7-22). Baltimore, MD: Johns Hopkins University Press.

Luxton, M. (1981) Taking on the double day: Housewives as a reserve army of labour. Atlantis, 7, 12-22.

Lyons-Lepke, E. M. (1986) Choosing majors and careers: An investigation of women persisters and defectors in mathematics and science majors in college (Doctoral dissertation, Rutgers University The State University of New Jersey, 1986). Dissertation Abstracts International, 47, 2325A.

McLure, G. & Piel, E. (1978) College bound girls and science careers: Perceptions of barriers and facilitating factors. Journal of Vocational Behaviour, 12, 172-183.

McPherson, B. (1985) The meaning and use of time across the life-cycle: The influence of work, family and leisure. In E. Gee & G. Gutman (Eds.), Canadian Gerontological Collection IV. Winnipeg, Man: The Canadian Association on Gerontology.

Meissner, M., Humphreys, E., Meis, S., & Scheu, W. (1975) No exit for wives: Sexual division of labour and the culmination of household demands. Canadian Review of Sociology and Anthropology, 12, 424-439.

Mura, R., Kimball, M., and Cloutier, R. (1987) Girls and science programs: Two steps forward, one step back. In J. Gaskell and A. McLaren (Eds.) Women and education: A Canadian Perspective, (pp.133-149). Calgary, Alta: Detselig.

O'Connell, L., Betz, M., and Kurth, S. (1989) Plans for balancing work and family life: Do women pursuing nontraditional and traditional occupations differ? Sex Roles, Vol. 20, Nos. 1/2, 35-45.

Olson, L. (1978) Sex-linked values: Their impact on women in engineering. In K. Blumhagen and W. Johnson (Eds.), Women's Studies: An Interdisciplinary Collection. Greenwood Press, Westport, Conn.

Ott, M. (June, 1975) Attitudes and experiences of freshman engineers at Cornell. In M. Ott and N. Reese (Eds.) Women in Engineering...Beyond Recruitment. Proceedings of the conference. Cornell University, Ithaca, N.Y.

Ott, M. (1978) Differences between male and female freshman engineers. Journal of College Student Personnel, Vol. 19, 552-557.

Plas, J. and Wallston, B. S. (1983) Women oriented toward male dominated careers: Is the reference group male or female? Journal of Counseling Psychology, 30, No. 1, 46-54.

Rotter, N. (1982) Images of engineering and liberal arts majors. Journal of Vocational Behavior, 20, 193-202.

Sheinin, R. (1981) The rearing of women for science, engineering, and technology. International Journal of Women's Studies, Vol. 4, 339-347.

Sherman, J. (1983) Girls talk about mathematics and their future: A partial replication. Psychology of Women Quarterly, 7, 338-343.

Statistics Canada. (1985) Women in Canada: A statistical report. Ottawa: Catalogue No. 89-503E.

Valyo, J. A. (1986) Factors which influence career choice of first year women engineering students (Doctoral dissertation, Columbia University Teachers College, 1986). Dissertation Abstracts International, 46, 2590A.

Whigham, M. A. (1986) Variables related to the academic success of women engineering students (Doctoral dissertation, Iowa State University, 1985). Dissertation Abstracts International, 46, 2591A.

APPENDIX A: QUESTIONNAIRE

1. What year are you currently enrolled in?

   1st____ 2nd____ 3rd____ 4th____ 5th____

2. Your sex: Female____ Male____

3. What is your date of birth?

   Day____ Month____ Year____

4. Give the numbers of your brothers and sisters.

   Older brothers___ Older sisters___

   Younger brothers___ Younger sisters___

5. Have any of your brothers or sisters ever enrolled in an engineering degree programme?

   yes____ no____

   If 'yes', please give details (e.g. brother graduated from U.Vic in 1986, sister enrolled in 2nd year at U.B.C.)

   _____

6. What are your parents' educational backgrounds? (e.g. high school, university)

   Mother _____

   Father _____

7. Citizenship: (please check the correct catagory)

   Canadian citizen___ Landed immigrant___ Visa student___

   If you are a Canadian by birth, which province do you consider your home province? _____

   If you are a naturalized Canadian or a landed immigrant, in what country were you born? _____

   If you are a visa student, of what country are you a citizen?

   _____

8. Education: (please check the correct catagory)

All elementary and secondary in B.C._____

All elementary and secondary in Canada but not all in B.C._____

One or two years of secondary education in Canada_____

Never attended any Canadian secondary school_____

Other (please specify) _____

9. Are any of your MALE relatives or acquaintances graduates of university degree programmes in engineering, college programmes in technology, or similar programmes?

yes____ no____

If 'yes', please explain _____

_____

_____

_____

(e.g. father is a graduate in chemical engineering, a brother graduated from an electronics course at a community college, a friend's father who is a mechanical engineer).

10. Do you have any FEMALE relatives or acquaintances who are, or were, actively engaged in a profession which is predominantly male?

yes____ no____

If 'yes', please explain _____

_____

_____

_____

(e.g. mother is an engineer, an aunt who is a doctor, a friend of the family who is an engineering technologist)

11. Was any person (or were any persons) especially influential in your decision to enroll in an engineering programme?

yes___ no____

If 'yes', please indicate the person's relationship to you (teacher, neighbour, relative, parent, school friend, etc.), her/his work or profession, and the reasons given for encouraging you to become an engineering graduate.

_____

_____

_____

_____

_____

12. How did the following people react to your decision to study engineering?

	Supportive	Not Supportive	Not Applicable
Father:	_____	_____	_____
Mother:	_____	_____	_____
Brother(s):	_____	_____	_____
Sister(s):	_____	_____	_____
School principal:	_____	_____	_____
School counsellor(s):	_____	_____	_____
Male science teacher:	_____	_____	_____
Male math teacher:	_____	_____	_____
Female science teacher:	_____	_____	_____
Female math teacher:	_____	_____	_____
Other male teacher:	_____	_____	_____
Other female teacher:	_____	_____	_____
Male university professor:	_____	_____	_____
Female university prof.:	_____	_____	_____

Male employer:	_____	_____	_____
Female employer:	_____	_____	_____
Spouse/partner:	_____	_____	_____
Male friend:	_____	_____	_____
Female friend:	_____	_____	_____

13. Did anyone try to dissuade you from enrolling in an engineering programme?

yes_____ no_____

If 'yes', indicate the person's relationship to you, her/his work or profession, and the reasons given for trying to dissuade you.

_____

_____

_____

_____

14. If you have ever worked in an engineering concern (summer, part-time, etc.) please give details.

_____

_____

_____

_____

(e.g. factory work, secretatial work in an engineering consultant's office, laboratory assistant, etc.)

15. When did you decide to study engineering?

Within a couple of months of enrolling in university_____

During the final year of secondary school_____

During the earlier grades of secondary school_____

Other (please explain)_____

16. What is your main reason for studying engineering?

_____

_____

_____

17. How are you financing your education (please check all that apply)?

Scholarship/grant_____

Savings_____

Summer employment_____

Working part-time while in university_____

Family support_____

Student loans_____

18. Are you from a single parent family?

yes_____ no_____

If 'yes', please specify which of your parents was the family head, and for how long.

_____

_____

19. What is your living situation:

Alone_____ With family_____

With female friend(s)_____ With male friend(s)_____

Other (please specify) _____

_____

20. What household duties are you responsible for doing?

_____

_____

_____

(e.g. cooking, cleaning, laundry, garbage, yard work, etc.)

21. How many hours of housework do you do?

Per day:

none___ 1-2___ 3-4___ 5-6___7-8___ more___

Per week:

none___ 1-2___ 3-4___ 5-6___ 7-8___ more___

22. What are your plans concerning marriage?

Already married_____

Planning to marry in the future_____

Do not plan to marry_____

Other (please specify) _____

23. What are your plans concerning children?

I am a parent now___ Number of children___

I plan to have children___ Number of children___

I do not plan to have children___

24. If you plan to have children, when they are under 5 yrs. old do you expect to:

Work full-time____

Work part-time____

Not work outside the home____

25. If you plan to have children, when they are under 5 yrs. old do you expect your spouse to:

Work full-time____

Work part-time____

Not work outside the home____

26. When you are looking for employment as an engineer:

Do you want to stay in the Vancouver area?____

Do you want to stay in the Lower Mainland?____

Are you willing to move anywhere?____

Are you willing to move, but wish to stay in B.C.?____

27. What type of engineering do you expect to pursue?

Electronics___

Computing____

Robotics____

Systems____

Other (please specify) _____

28. Please give any other information that you think would be of interest to those trying to encourage students to enroll in engineering courses in B.C. universities (please feel free to write on the back of this page if you need more space).

_____

_____

_____

_____

_____

APPENDIX B: INTERVIEW

Support

When did you decide you wanted to become an engineer?

How did you make that decision?

(If necessary: For example, was it a difficult decision for you to make, and if so, how did you decide; or did you always know that was what you wanted to do?)

Who supported your decision to become an engineer?

1. How did they express that support?
2. Was the support whole-hearted, or did you feel it was conditional in any way?
3. Did anyone who was initially supportive become discouraging later on?

Did anyone discourage your decision to become an engineer?

If Yes:

1. Who was (were) this (these) person(s)?
2. How did they discourage you?
3. Did this discouragement effect your decision in any way?
4. Did anyone who initially discouraged you become supportive later on?

Role Models

I am going to ask you a few questions regarding role models, please answer in as much detail as possible.

Do you think that having a role model to emulate or look to as an example is important for you while you are studying to become an engineer?

If Yes:

1. What is it about a role model that is important?
   (If necessary: For example, is it knowing that there is someone you can talk to about problems you may be having, is it knowing that someone else has 'made it' despite the difficulty, is it direct encouragement from that person, or something else?)
2. Who is (are) your role model(s)?
3. Can you describe the kind of relationship(s) you have with this (these) person(s)? In what way are they a role model to you?
4. Do you think it would make a difference to you if you did not have a role model? If so, in what way?
5. Is your role model connected with engineering?
   If so is this an important part of why they are a role model to you? Do you think having a role model not connected with engineering would serve as well, or would this change the relationship in some way?
   If not would you prefer to have a role model who is connected with engineering?
6. Do you think that it would be important or beneficial for most engineering students to have a role model?

If No:

1. Why do you think you do not need a role model?
2. Do you think other engineering students need or have role models? If so, how do you think those students are different from yourself?

Conflict

Now I would like to discuss the interaction between your sex-role identity and your identity as an engineering student (If necessary: define sex-role identity).

Do you feel there is any conflict between your identity as a woman/man and your identity as an engineer?

If Yes:

3. How do you view yourself outside of being an engineer?
4. How do you view yourself as an engineer?
5. What is it about these two roles that is conflicting for you?
6. Is there any way that you would change yourself in order to reduce this conflict?
7. Is there any way that you would change the role of engineer in order to reduce this conflict?
8. Are there other factors, such as parents', peers' or teachers' attitudes, that cause you to feel heightened conflict between these two roles?
9. How do you think this conflict might change as you grow older?

If No:

1. What is it about these two roles that feels congruent to you?

2. Are there other factors, such as parents', peers' or techers' attitudes, that help you to feel that these two roles are congruent?
3. Do you anticipate any conflict as you grow older?

Do you think that your female peers feel conflict between their sex role identity and their identity as engineers?
If so what do you think is conflicting for them?
If not what do you think is congruent for them?

Do you think that your male peers feel conflict between their sex role identity and their identity as engineers?
If so what do you think is conflicting for them?
If not what do you think is congruent for them?

Are you planning on being a parent?
If so how do you think this might effect your work as an engineer?

Other Questions

What things do you like about the engineering program at SFU?

What things do you dislike about the engineering program at SFU?

Is there anything that you can think of that might cause you to drop out of the engineering program (either to transfer to another program or to drop out of university altogether)?