On the popularity of engineering among Brisbane high school girls

Bouchra Senadji
Queensland University of Technology, Brisbane, Australia
b.senadji@qut.edu.au

Abstract: *The main objective of this study was to measure the interest high school girls have in pursuing a career in engineering, and correlate this interest to the beliefs held by these girls, as well as their family and friends, with respect to women in engineering. A questionnaire was distributed to 92 year 11 and year 12 girls, at Stuartholme School, in Brisbane. The girls were Maths B and Maths C students, and had the required mathematical skills to pursue a career in engineering. Also, as Stuartholme School is a girls-only school, these girls were not exposed to male competition, which has been found to undermine girls' self-efficacy beliefs with respect to pursuing a career in a male orientated profession. The results showed that none of the girls who were already decided about their career path were planning a career in engineering. The results also showed that only a small minority of those still undecided about their career were interested in engineering. It was also found that this lack of interest couldn't be attributed to any negative beliefs about women in engineering, as most of the girls (as well as their family and friends) didn't believe that women engineers were any different from other women, or that the profession of engineering should be restricted to the male population. However, it was found that the girls lacked exposure to female role models, which could explain their lack of interest.*

Keywords: *women, engineering, popularity*

Introduction

Women still constitute a minority in the engineering profession. Despite efforts from equal opportunity programs, the engineering profession attracts significantly smaller numbers of women than other traditionally male orientated professions. Several reasons exist for these unsuccessful attempts to increase the involvement of women in engineering. Firstly, high school boys seem to display higher problem solving skills and visual-spatial abilities than high school girls (Meinholdt, 1999). Secondly, several studies seem to attribute girl's lack of interest in science and engineering to their self-efficacy beliefs (Meinholdt, 1999; Lapin Zeldin & Pajares, 2000; Heyman, Bryn & Sangeeta, 2002; Mazen & Lemkau, 1990). High school girls seem to doubt more than boys their ability to succeed in mathematically oriented programs and professions, particularly when constantly outperformed by boys in mathematics and science subjects. However, a study carried out in (Blaisdell, 1998) failed to confirm this theory. Thirdly, girls lack female role models, (Blaisdell, 1998) and, as a result, tend to associate the engineering profession with a male only environment.

This study aims to investigate the level of interest high school girls, enrolled in a girls-only school, and with the required level of mathematical skills, show in the engineering profession. It also attempts to correlate their level of interest to their knowledge about the engineering profession, their social beliefs about women in engineering, and their level of exposure to female engineers.

Method

Participants

The sample comprised 92 high school girls from a girls-only Brisbane school, StuartHolme. The participants were year 11 and year12 girls, and were enrolled in Maths B and Maths C subjects, i.e, had the mathematical prerequisites required for undertaking engineering studies and becoming professional engineers. Also, being in a girls-only school, these girls did not have the opportunity to compare their mathematical skills or visual-spatial abilities with other boys. It is therefore assumed that their confidence in undertaking mathematics or science oriented professions would not have been undermined by boys' performance.

Measures

A questionnaire, designed to measure the girls' level of interest in engineering, was distributed to the participants. The questionnaire was kept short following instructions from the Maths teacher. It consisted of fourteen questions. The first two questions targeted the girls' knowledge about the engineering profession. In question three, the girls were specifically asked if they wanted to pursue a career in engineering. Question four was designed to measure the level of opposition family and friends had towards their girl becoming an engineer. Questions five to twelve were designed to investigate social beliefs about women in engineering. The basis for the questions was to investigate whether the girls, as well as their family and friends, carried any preconceived ideas about a stereotype of women engineers, or about social consequences of becoming an engineer. Question thirteen was designed to investigate the girls' level of exposure to women in engineering, and the last question was on the career path they intended to pursue. The format of the first twelve questions followed the Likert scale (strongly disagree, disagree, neutral, agree and strongly agree). In question thirteen, the girls were asked if they knew at least one woman engineer, and, in case they did, were asked to specify where they met them. In the last question, the girls were asked if they knew which career path(s) they were interested in following, and, in case they did, to specify their preferred career path.

Procedure

A questionnaire was sent the StuartHolme Maths teacher, with instructions to distribute the questionnaire to his Maths B and Maths C students. The teacher wouldn't allow me to come to his class as he was on a tight schedule. The girls were instructed to take the questionnaire home, answer it and take it back to their teacher. All girls returned the questionnaire, i.e. the response rate was 100%. The teacher mailed the questionnaires back to me a week after they were sent. Confidentiality was respected.

Results

Interest in engineering

From question 14, it appeared that 53% of the surveyed girls were still undecided about their career path. Answers to question 3 further revealed that, among those 53%, only 8% showed an interest in engineering, while 78% were not interested and 14% were neutral. Among the 47% who knew which career path(s) they wanted to pursue, only 4% replied they were

interested in engineering, against 82% not interested and 14% neutral. Among these 47%, 51% were interested in a career in health, 12% in arts, 9% in business and/or law and 9% in science. 19% expressed interest in various other careers such as architecture, police or journalism. Interestingly, the 4% who were seemingly interested in engineering didn't mention engineering as a possible career path. These results are summarized in table 1 below.

Undecided about their career path (53%)			Know their preferred career path (47%)				
Not interested in a career in engineering	Neutral	Interested in a career in engineering	Not interested in a career in engineering	Neutral	interested in a career in engineering		
78%	14%	8%	78%	14%	8%		
			Health	Arts	Business/ Law	Science	Other (no engineering)
			51%	12%	9%	9%	19%

Table 1: Possible career path

Knowledge about engineering

59% of the surveyed girls claimed they knew what engineering involved, 36% were undecided and only 5% agreed that they didn't know much about engineering. When asked if, in their opinion, engineering was mainly about building bridges, 74% disagreed, 13% were undecided and 13% agreed.

Beliefs about women in engineering

The results about the girls' personal beliefs and the beliefs of their family and friends are summarized in table 2 below:

Personal Beliefs			Beliefs of family and/or friends		
"Engineering is better suited for men"			*"Engineering is better suited for men"*		
Agree	Neutral	Disagree	Agree	Neutral	Disagree
5%	18%	77%	4%	22%	74%
"Women engineers are generally unattractive"			*"Women engineers are generally unattractive"*		
Agree	Neutral	Disagree	Agree	Neutral	Disagree
4%	7%	89%	4%	7%	89%
"Women engineers generally behave like men"			*"Women engineers generally behave like men"*		
Agree	Neutral	Disagree	Agree	Neutral	Disagree
5%	11%	84%	5%	11%	84%
"It is hard for women engineers to get married"			*"It is hard for women engineers to get married"*		
Agree	Neutral	Disagree	Agree	Neutral	Disagree
3%	5%	92%	2%	11%	87%

Table 2: Beliefs

The results also showed a strong correlation between the girls' personal beliefs and the beliefs of their family and friends.

Pressure from family/friends

To the question, "I would like to pursue a career in engineering but my family and/or friends don't want me to", 91% disagreed, 8% were neutral and 1% agreed.

Exposure to women in engineering

The results to the question, "Do you know at least one woman engineer", are summarized in table 3 below:

No	Yes			
50%	50%			
	Through Family/friends	Through School	Through Media	Other
	70%	22%	13%	2%

Table 3: Exposure to women engineers

The last row adds up to more than 100% as some girls have been exposed to female engineers in different environments.

Discussion

The results show that, among of the 47% who knew which career(s) they wanted to pursue, 4% were interested in engineering. However, none of those who claimed being interested had indicated engineering as a possible career path. Among the 53% who were still undecided about they career path, only 8% could be considering a career in engineering. These results could not be attributed to the girls' lack of mathematical ability or interest, as they were Maths B and Maths C students. Also, these girls have not been exposed to male competition. As a result, it is assumed that their self-efficacy beliefs have not been undermined by boys' performance in science and mathematics. This is confirmed by the fact that a strong majority of the girls (77%) did not believe that engineering is better suited for men, and 92% of the girls did not perceive that women in engineering were any different from women in general. Neither could this result be attributed to social pressure, as only 1% of the girls surveyed indicated that they were interested in a career in engineering against the advice of their family and/or friends.

How, then, can this lack of interest be explained? Firstly, 41% of the surveyed girls do not know or are unsure about what engineering is. Also, although 59% claimed they knew what the engineering profession was about, they probably don't know the full spectrum of engineering. For example, 13% of the girls who thought they knew what engineering involved, also answered that engineering was mainly about building bridges. 51% of the girls who knew about their career path, were interested in a career in health (medicine, nursing, natural therapies, speech pathology, etc…). Many probably don't know that biomedical engineering is also devoted to improving the health and well being of the community, through the development and use of appropriate technological devices. More programs should be developed to inform high school girls about all the possibilities engineering offers. However, these programs should not target high school girls only. The results show a strong correlation between the girls' beliefs and the beliefs of their family and friends. These programs should therefore target the whole community.

The other result that could explain this lack of interest is that 50% of the surveyed girls have never seen a female engineer. Also, 70% of those who know at least one female engineer, have met them through family and/or friends, i.e. in a non-professional environment. It is therefore obvious that there is a need for female role models. This need has also been outlined in other studies (Hackett, Esposito & O'Halloran, 1989; Stringer & Duncan, 1985).

The difficulty is to be able to expose these girls to different role models, despite the small number of female engineers. School visits are one option, but there is a limit as to how many schools one female engineer is able to visit. Video programs picturing female engineers and distributed to different high schools are another option. Further research will focus on the different ways high school girls can be exposed to female role models, and the effect on their interest in the engineering profession.

References

Blaisdell, S.(1998). Predictors of women's entry into engineering: Why academic preparation is not sufficient. *Proceedings of the Frontiers in Education Conference*.

Hackett, G., Esposito, D., & O'Halloran, M.S. (1989). The relationship of role model influences to the career salience and education and career plans of college women. *Journal of Vocational Behavior,* **35 (2)***,* pp164-180.

Heyman, Gail, D., Bryn, M., & Sangeeta, B. (2002). Gender and achievement-related beliefs among engineering students. *Journal of Women and Minorities in Science and Engineering,* **8***,* pp. 41-52.

Lapin Zeldin, A., & Pajares, F. (2000). Against the odds: Self-efficacy beliefs of women in mathematica, scientific, and technological careers. *American Educational Research Journal*, **37**, pp 215-246.

Mazen, A. M., & Lemkau, J.P. (1990). Personality profiles of women in traditional and non-traditional occupations. *Journal of Vocational Behavior*, **37**, pp 46-59.

Meinholdt, C., (1999). Why aren't there more women engineers? *Journal of Women and Minorities in Science and Engineering*, **5**, pp 239-263.

Stringer, D.M., & Duncan, E. (1985). Nontraditional occupations: A study of women who have made the choice. *The Vocational Guidance Quaterly,* **33**, pp241-248.

Acknowledgements

The author would like to acknowledge the Stuartholme year 11 and 12 girls, as well as their Mathematics teacher for kindly agreeing to help with this study.