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Publisher: Taylor & Francis

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European Journal of Engineering Education

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/ceee20>

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Published online: 21 Aug 2006.

To cite this article: Joanna Daudt & Paquita Perez Salgado (2005) Creating a woman friendly culture in institutes of higher engineering education, European Journal of Engineering Education, 30:4, 463-468, DOI: [10.1080/03043790500213060](https://doi.org/10.1080/03043790500213060)

To link to this article: <http://dx.doi.org/10.1080/03043790500213060>

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Creating a woman friendly culture in institutes of higher engineering education

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(Received 24 January 2004; in final form 27 May 2005)

This article describes the results of a workshop that was held in Valencia during the annual conference of SEFI in 2004. The authors give remarks on the results supported by relevant and recent research. In the workshop, where about 35 participants were present, the following questions were discussed and answered:

Which factors indicate that an institute of higher engineering education is woman friendly? How can we rank these factors and what is the weight of the factors? What initiatives did your institute or other institutions of your country make to increase the percentage of female academic staff and to attract and retain more female students?

Keywords: Higher engineering education; Gender; Culture

1. Introduction

For more than twenty years SEFI has had a working group Women in Engineering. At present the group focuses its work on identifying best practices to attract and retain female students and female staff in higher engineering education. The aim of the working group is to exchange and disseminate best practices and to contribute to changes in institutes and the curricula of higher engineering education. The working group comprises about 30 members from 12 different countries in Europe.

Despite a lot of efforts in the past to attract more female students and female staff in institutions and universities for higher technical education the results are still disappointing. Male students and male staff mainly populate institutions and universities for higher technical education. Although a lot of men realise that technology should also be a matter for women and are willing to contribute to actions to attract more women, most men at universities tend to focus on their own research projects first. In a culture where research is the main priority, where mainly men teach technical subjects and where mainly men are members of the board, it is a difficult challenge to change the recent culture into a woman friendly culture.

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Table 1. Numbers and percentage of female academic staff and students in higher technical institutions (SEFI, Working group Women in Engineering).

Country	Institute	Board	Women	Ac. Staff	Women	Students	Women	PhD stud.	Women
Germany	Frauenhofer Gesellschaft	4	0	312 (Leading position)	10 (3%)				
	Microelectronic			743	66 (8%)	102	15 (15%)	74	8 (11%)
	Production			610	47 (7%)	97	38 (39%)	66	10 (15%)
	Life sciences			190	50 (26%)	14	14 (100%)	28	25 (89%)
	I&K			1528	219 (14%)	266	53 (20%)	241	59 (24%)
	Photonic, Material			333	23 (7%)	159	29 (18%)	159	33 (21%)
Ireland	Institute of Technology, Tallaght	19	7 (36.8%)	49 (Engineering)	5 (10.2%) (Engineering)	500	24 (4.8%)	5	1 (20%)
	Dublin City Univ.					476	66 (14%)		
	Electronic Eng. Mechanical Eng.					427	54 (13%)		
The Netherlands	Delft ¹ , Univ. of Technology	3	0	944	94 (10%)	13,189	2779 (21%)	680	197 (22,5%)
	Open University Heerlen (natural sciences and computer sciences)	1	1 (50%)	55	13 (24%)	2757	577 (21%)		
	Fontys University of Professional Education	5	1 (20%)	323	45 (13,9%)	4569	468 (10%)		
Spain	Escuela Técnica Superior de Ingeniería – ICAI, Universidad Pontificia Comillas de Madrid	18	1 (6%)	108 Full-time Ac. staff	18 (17%)	2068	428 (21%)	41	8 (19,5%)
Sweden	Uppsala University (Faculty of Science and Technology)	17	4 (24%)	1322	344 (26%)	5040	1915 (38%)	870	299 (34%)
	Halmstad University	20	11 (55%)	201	49 (24%)	2906	1052 (36%)	24	6 (17%)

¹Reference date board and staff: June 2004; other: December 2002. All other figures as actual as possible: 2002–2004.

For bridging the gap between technology and users of technology, it is not only desirable but also necessary.

At recent annual conferences the working group has organized workshops. At the last annual conference in September 2004 in Valencia, the working group has organized a workshop with the theme: Creating a woman friendly culture in institutes of Higher Engineering Education. As preparation for this workshop the members were asked to collect some statistical data from their own institute/school. The results can be seen in table 1.

Table 1 shows the amount and percentage of female directors, staff and students. Most institutes from this small sample are male dominated. No women in the board of directors and only a small minority of female staff.

We also asked institutes which engineering studies attract the least and the most female students. The results of this question show that electrical/electronics engineering, mechanical/manufacturing engineering and information technology attract the least female students (less than 10%). Medical mechanical engineering, biomedical engineering, industrial design engineering, building sciences and architecture, life sciences, environmental sciences, management engineering and innovation engineering attract in some cases even more than 40% female students.

2. Results workshop

About 35 participants attended the workshop in Valencia. About one third were male and two third were female. The following countries were represented: Austria, Croatia, Czech Republic, Denmark, Finland, Germany, Italy, the Netherlands, Norway, Turkey, Sweden, Switzerland, United Kingdom.

For the workshop the whole group was divided in four smaller groups and they were asked to discuss and answer the two questions. Although the challenge of making engineering education institutes more woman friendly was clear to most participants, also other voices were heard as well. Two female deans from universities in Turkey and Croatia told us that attracting female students to engineering studies in their countries was not a problem. They had even more female students than male students at their departments.

After the small groups had written down their answers on a large sheet of paper, the sheets were displayed on the wall and everyone was asked to rank the suggestions so as to discover the most effective factor according the participants. Based on the experience at their own institutes the following top 5 was found. Combined with the indicators of a woman friendly culture in institutions of Higher Engineering Education, the answers to the second question regarding the institutions initiatives to attract and retain female staff and students are also given.

2.1 Possibilities for interdisciplinary education

The small research sample has already showed that in the short term institutes can attract more female students when they broaden their traditional programmes and link them to other fields such as, for instance, medical sciences, environmental sciences and management studies. Those engineering studies that put technology in a societal and realistic context manage to give a signal to female students that technology is useful and how it can be applied to solve problems. Institutions which have chosen to link technology to other sciences often use also more modern educational methods to reach the goals like problem based learning, project work etc. One of the participants from Germany stated that research in Germany shows that modern

educational methods, where female students are also challenged to use their communicational and social skills, attract more female students than those institutions that stick to traditional educational methods with the focus on theory. In this respect the use of IT can contribute because it was found that female students use computer conferencing on the world wide web far more often than their male colleagues (Gibson, 2002). Participants of the workshop gave the following examples of initiatives to attract more female students.

- In Germany interdisciplinary courses are offered and single sex programs.
- In Denmark a new study was introduced: export engineering.
- In the Netherlands: Biomedical engineering, technical medicine study, environmental sciences.
- In Czech Republic: financial mathematics.

2.2 There is special support to bring women in higher academic positions

This factor refers to special programs for female staff to coach and facilitate them to higher positions. This factor is especially important because the more female role models there are, the greater the chance to attract more female students. Special support prevents drop out of female staff. Most universities and schools of technology in Sweden have a support system for female staff to bring them in higher academic positions. At universities and schools in Germany they have equal opportunity officers to improve the percentage of female staff. In the Netherlands extra money was given to faculties to coach female assistant professors to become associate professors.

2.3 There are sufficient female staff role models for female students

This factor is closely related to the previous one. Statistics show the low percentage of female staff at institutions of higher education. But universities and schools are very reluctant to choose positive or affirmative action to recruit only female staff during a period of transition. None of the participants mentioned an activity like this at the workshop.

2.4 The institute has a strategic long-term action plan to attract female staff and students

As is known, many projects and activities have taken place in the last 20 years to attract and retain more female students to engineering studies. A lot of those activities are not properly evaluated and were also not embedded in the policy of the institute.

An example of such a strategic plan is described in the book 'Unlocking the Clubhouse: Women in Computing' (Margolis and Fischer, 2002). And the policy was very effective: in four years time the percentage female students in the Information Science Department of Carnegie Mellon University was raised from 7 to 42%. Management literature shows that when the administration is committed and really wants to change the culture in institutes of engineering education, it can be done. Even in the short term as is shown at Carnegie Mellon. But most male dominated institutes will need to take a deep breath before they can change the culture and the balance between male and female staff. At the moment diversity is for industry a magic word. Industry has discovered that while their target groups have become more and more diverse; their employees are mainly white males. Industry is very interested in helping universities of technology to attract more female students. A good example is the

FEMTEC network in Berlin. Universities, schools and industry together have created special practical/training, apprenticeships for highly motivated female students. They learn a lot about the context in which technology takes place and, when they are successful, a job is almost guaranteed when they have finished their study.

2.5 The institute emphasizes the social relevance of engineering themes and subjects

According to the participants of the workshop institutes can show the social relevance of engineering themes and subjects at girls' days, girls' weekends and open house arrangements. An interesting initiative was named at the workshop: technology course for kindergarten employees.

We have already seen that linking technology to societal issues makes the curricula more attractive to women. The Bachelor master structure also gives more room for male and female students to create their own curriculum and link technology with other knowledge domains. Industry as well can be helpful in showing the social relevance of technology.

3. Conclusions

The small percentages of female students in traditional engineering studies in Europe are the result of a long history and it will take a lot of effort to change the image of engineering studies and the culture in institutes of higher engineering education. The results of the workshop in Valencia were fruitful. A lot of activities are mentioned to make institutes of Engineering Education more woman friendly. Institutes can contribute to changing the culture and make their curricula more attractive to female students. It is obvious that several actions and of mix of these actions can be effective.

4. Postscript

In the fall of 2004 a new EC project has started named TREE (Teaching and Research in Engineering Education). One of the project lines is attractive curricula. In this line, one of the Special Interest Groups is concerned with attracting and retaining female students. The aim of this Special Interest Group is to describe best practise in Europe with respect to attractive engineering curricula and institutes with a strategic long-term action plan to attract and retain female students and staff. If you know examples in Europe I invite you to contact the authors. We'd like to thank all the participants that have contributed to this workshop.

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