Introduction

Nowadays, the role of women in engineering becomes more and more clear but unfortunately their under-representation in senior and leadership positions remains a worldwide phenomenon. The Faculty of Technology of Aristotle University of Thessaloniki (AUTH), Greece, decided to carry out a study on the performance of female students during the education years and during the first years of employment, aiming at improving their contribution to the engineering profession in the country.

The facts of Greek girls in education are quite satisfactory. More than 50% of higher education degrees are for many years granted to women and one third of Greek engineers are women. The under-representation still holds for the fields of Electrical and Mechanical engineering thus the study is focused on these two departments.

The educational system in Greece is quite competitive. High School Graduates are admitted to the higher education system after very demanding entrance examinations held in the last year of elementary school. The departments of Electrical and Computer Engineering (ECE) have been for decades amongst the most popular ones in Greece, a fact which renders the admission standards particularly high.

The study for the undergraduate education in the two departments of AUTH is based on the student records for the years of 1980 to 2008. The investigation referring to the professional development of female graduates, as well as the one referring to the post-graduate studies, has been assessed by means of a questionnaire addressed to a reliable sample of female graduates. The sample size and the statistical analysis of the data has been done by standard statistical methods [1, 2] well studied in the curricula of the engineering departments.

Facts in Undergraduate Studies

Entrance to the Department

As demonstrated in figure 1, an important upward trend in the female population admitted to ECE has been observed the last decades. In the period 1979 to 2008 a total number of 5962 students have been registered in the department, 1123 of which are female (18.84%). In detail the variation of students per decade is given in figure 2.
An interesting comparison between ECE and the department of Mechanical Engineering is presented in figure 3. In the years 1983 to 2008 a total number of 3042 students have been registered in the Department, 14.38% of which are women, a ratio slightly lower than that of the ECE.

Further, as derived by figure 4 the presence of women among the top 5 of students in the entrance to ECE with the national examinations is quite satisfactory. The top grade usually belongs to girls.
Performance and Graduation

In the period 1988 to 2008, 2978 students have graduated from ECE and 487 of which were female, a percentage of 16.35%. Data in detail are given in figures 5 and 6. It seems that women leave the department without completing their studies more frequently than males.

Some more information regarding the performance of the two genders is provided in figures 7 and 8, where the duration of the studies and the mean graduation grade are presented, respectively.
Figure 7: Mean duration of undergraduate studies over the three last decades.

Figure 8: Mean final grade of undergraduate studies throughout the three last decades.

One less optimistic statistical result is demonstrated in figure 9 where the top 5 graduation grades are presented. The number of girls is suppressed and the first grade almost never belongs to a girl. In comparison to figure 4, it can be seen that girls are entering ECE with top grades, though this does not happen with their graduation grades.

Figure 9: Top five of male and female ECE graduates.
Further Activities

The study revealed some very interesting features for the participation of girls in the various activities of the student life. Girls are more active in many optional or parallel educational activities during their student life, as for example, they participate in practical training courses, to advanced/electronic educational pilot courses, and they are involved in the organization of student conferences and student contests, to student theatrical teams, etc., always with very successful performance.

Facts in Postgraduate studies

ECE offers a high quality postgraduate program leading to a PhD degree. As seen in figure 10, the candidates currently attending the program are 152, 27 of which are women. Thus the ratio of female PhD candidates (18%) is almost equal to the ratio of the female graduates. The corresponding percentage of the Mechanical Department is 11%, once again slightly lower.

![Figure 10: Number of male and female students that have completed a PhD study.](image)

The duration of the PhD studies, as observed in figure 11, is constantly a bit longer than the one of male PhD candidates.

![Figure 11: Mean duration of postgraduate studies in ECE.](image)

Afterwards, post-graduate students have been asked to fill-in an additional questionnaire focused in issues such as self awareness, entering the scientific world as professionals, facing family challenges etc., all under the perspective of gender. In this survey 27 out of the 125 post-graduates students, meaning the 21.60% of the total, have participated. Given the fact that the total of 125 corresponds to the officially registered post-graduates, some of which are not active, the level of the participation has been considered to be satisfactory. The number of women answering the
questionnaire is 7, meaning the 25.93% of the whole sample. Since the percentage is close enough to the percentage of the women attending a PhD course in ECE, the results are regarded representative of the general trend.

The first part of the questionnaire refers to the self awareness of the participants. Students were asked to reveal the way they perceive themselves by answering whether their personalities can be described by some basic aspects or not. Characteristics such as hard work, competition and the others seen in figure 12 are considered to be rather common among researchers. By analysing the questionnaire, the fact that certain features are traditionally attributed to women seems to be contradicted. For example as observed in figure 12 intuition and emotionality is less indicative of the women personality with respect to the total sample. Moreover, unfortunately women seem to lack in confidence and hard work in comparison to their colleagues.

A following question refers to originally choosing the direction of undergraduate studies during the national admittance examinations. To no surprise the 88% of the participants answered that ECE was their first choice but unfortunately 93% thinks that the information on professional orientation offered by the state was inadequate.

![Figure 12: Answers to the question: “How do you describe yourselves?”](image)

But what was the motive that drove a youngster into choosing such a demanding science if not an official information process? Figure 13 tries to give an answer to this question. Determination seems to be the strongest motive among all participants. Moreover, a really interesting conclusion is reached by a closer look to the influence by prototypes and especially to the parent prototype of both genders. It is clear that the participants were basically influenced by their male parent. This should not cause any kind of surprise since in the years when our current post-graduates were being brought up, women in Greece as in all Mediterranean countries had just entered the professional world claiming careers in equal terms with men. Consequently, the figure of the mother attending only to matters basically domestic had not been yet completely overturned.
Figure 13: Answers to the question: “Determine the level of influence of the indicated aspects in choosing your career.”

Figure 14 reflects the way students imagine their future careers as engineers. Specifically they were asked if they agree that certain suggestions stand for engineering. Some male participants find that femininity and engineering are contradicting while the family issue seems to concern both genders. Moreover female participants seem to be less eager to take over technical duties in the future profession.

Figure 14: Answers to the question: “Do you agree with the above suggestions?”

A more elaborate view on the professional perception of our post graduate students is given in Figure 15. Here the professional expectations of the participants are demonstrated. Issues such as life quality, social status and challenge are confronted with the same manner by both genders. Nevertheless women are more prepared to face heavy duties in the future, while they seem more eager to pursue an international career or a state position. Both genders prefer to stick to the scientific professions.
Finally the last question focuses directly in the gender issue of the professional engineering after the graduation, in figure 16. Most participants think that women do get jobs with promotion prospects, they are offered posts as good as men but nevertheless they do not get the same professional opportunities.

Investigating the Professional Development

The questionnaire investigated (among other issues) the time needed for attaining the first job (figure 17), the main difficulties encountered during the career figure 18 and the main requirements set by women in their career selection figure 19. The classical problem of the balance of family life and career is questionable if it is the main obstacle of women engineers in Greece.
Figure 17: Time interval between the graduation and the professional opening for women.

Figure 18: Main difficulties that women face in the professional world.

Figure 19: Most important requirements that need to be fulfilled when choosing a professional position according to women asked.

Discussing the Engineering education and Gender Issues in Greece

The quantitative results of this study are quite optimistic compared to the same average results of many countries. For example, the female percentages reported for Israel is about 15%, for the States about 10%, for UK about the same, though for the Mediterranean countries it seems to receive better results, as well as for countries such as Iran, Oman etc. Further, in Greece, one third of the professional engineers in general are women [8].

The main reasons for the satisfactory performance of Greek female population can be given as follows:
First, education is a strong value in the culture of the modern Greek society. The family in Greece is very supportive and protective for the children of any gender and tries the best for them. Education is the top priority in the Greek family.

Second, the discrimination of females has been impressively relaxed in Greece the last decades. The loyal system is very democratic, one of the best in EU. The young generation of parents has relaxed the different treatment of children thus the girls do not face exclusions of social activities up to their marriage. The modern Greek father is very supportive to the daughters. It is strange that this changes with marriage. The Greek wife is still more suppressed and discriminated compared to the Greek daughter. Thus, the difficulties in life balance will appear in the young couples.

Third, the public educational system is fair, improved in supporting any Greek young student and despite its good or low quality it is a very social system.

Fourth, the Greek society was not as competitive the last decades as in the developed countries, thus the women could align the family and labour responsibilities more easily. Taken into consideration the family support, they have been able to participate to the social and professional life, even if not at completely satisfactory and equal terms. It is noticeable that the large public sector is the top preference as an employment solution for women engineers.

Now, that the globalized society becomes more competitive and the Greek society is changing, it is questionable if these percentages will be maintained. It seems that mentoring programs on graduation and special social measures for supporting them during the productive years, that is, at the ages of 30-45, are becoming very important. Above all changes in the role definition in young couples are still of great importance.

Acknowledgements

We would like to thank:
1) the Administration Board of the Faculty of Technology of AUTh, which supported financially this investigation.
2) the Electrical Engineers: N.Andreadou, A.Papaioannou and E.Karapistoli for helping in the execution of the study.

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