

PROMOTING CHANGE THROUGH FACULTY SELF-ASSESSMENT: THE RESULTS OF AN INITIAL SURVEY

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Abstract — *Regardless the success of the University of Puerto Rico at Mayagüez in recruiting and retaining engineering female students, women are significantly underrepresented in the faculty. This could be a direct result of the limited number of women pursuing PhDs in engineering and science and, particularly, of the university's failure in motivating its best undergraduate female students to continue doctoral studies and join academia. Furthermore, less than half of the female faculty holds positions higher than Assistant Professor, resulting in a lack of representation at decision-making levels. To initiate change, the College of Engineering is promoting a faculty self-assessment. This paper presents the initial results of such effort. In a survey administered to female faculty, several issues were examined including work and family balance, and work environment. The results point at an overwhelming need for institutionalized support to help female faculty face its particular problems and responsibilities.*

Index Terms *Faculty self-assessment, program statistics, survey, women in engineering and science life cycle.*

INTRODUCTION

Puerto Rico has a combined public and private system of higher education with an enrollment of over 170,000 students. Of these, 64,000 are in the University of Puerto Rico's state multi-campus system. The Mayagüez Campus of the University of Puerto Rico (UPR-M), with approximately 12,000 students enrolled, houses the only College of Engineering within the state university system. It offers programs in Civil, Chemical, Electrical, Computer, Industrial, and Mechanical, all ABET accredited. Master's programs in all basic sciences, mathematics, and engineering, and PhD programs in Civil, Chemical, and Computer Science Engineering are also offered. The UPR-M has approximately 5,000 students enrolled in science programs and more than 4,500 in engineering.

Students at UPR-M are minority students who, in general, come from disadvantaged schools where access to advanced science and math courses may be less likely to occur [1]. Still, UPR-M boasts an above-national-average enrollment of women in engineering. Enrollment statistics

reveal that on the average 34% of the engineering students at UPR-M are female as shown in Fig. 1. These numbers contrast with national statistics revealing that only 13% of women states that they are going to pursue fields of natural science, math, or engineering, and that only 18% of those enrolled in undergraduate engineering programs are women [1].

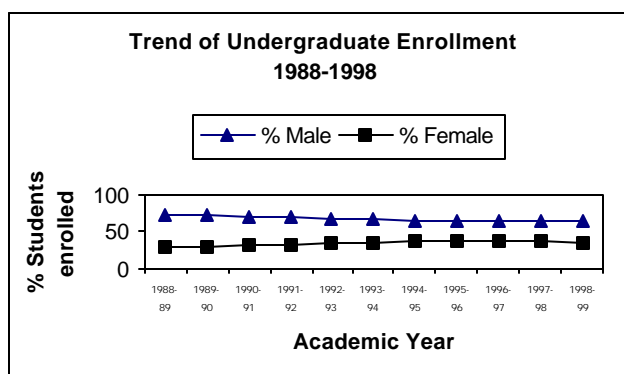


FIGURE 1

TREND OF UNDERGRADUATE ENROLLMENT FROM 1988-1998.

In the year 2000, among American universities, the UPR-M ranked first, percentage wise, in Engineering Bachelor's Degrees awarded to women [2]. For that year, ASEE reported that 20.8% of the BS degrees in engineering, awarded by American universities, went to women. Compare to this average, it is noteworthy that 40% of such degrees awarded by the UPR-M went to women, followed by Massachusetts Institute of Technology (MIT) and Northwestern University with 34% and 29%, respectively. Reference [3] points out that women represent only about 9% of the engineering workforce. A comparable situation is the reality at UPR-M.

Despite the UPR-M success in the recruitment and retention of engineering female students, women are significantly underrepresented in the engineering faculty workforce. Presently, less than 11% of the faculty members at the College of Engineering (COE) are females with tenure or on tenure track. This percentage is well below the national average.

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FEMALE FACULTY PROFILE AT UPR-M

The faculty of the *COE* is comprised by 148 professors of which only 16 are female with tenure or on tenure track. Table I shows the distribution of female professors by ranking, while Table II presents the distribution by department and academic preparation. Of concern is that less than half of the female faculty has positions higher than Assistant Professor. This results in a lack of representation at administrative levels including departmental and faculty personnel committees.

TABLE I
ENGINEERING FEMALE FACULTY BY RANK

	Tenure	Tenure track	Total
Instructor	0	3	3
Assistant Prof.	3	3	6
Associate Prof.	4	0	4
Full Professor	3	0	3
Total	10	6	16

TABLE II
FEMALE FACULTY DISTRIBUTION BY DEPARTMENT AND ACADEMIC PREPARATION AT UPR-M

Department	No. female professors	Academic preparation	
		Masters	PhD
Chemical	1	1	0
Civil	3	2	1
Electrical/Computer	2	1	1
General	4	3	1
Industrial	4	0	4
Mechanical	2	0	2
Total	16	7	9

The *COE* has not succeeded in attracting female faculty with PhD degrees as suggested in Table II. This could be a direct result of the limited number of women pursuing PhDs in engineering and, particularly, of UPR-M's failure in motivating its best undergraduate female students to continue doctoral studies and return as members of the faculty.

Enrollment statistics per engineering department of the UPR-M for Fall 2000 are included in Table III. This table shows for the IE Department an impressive female student percentage (54%) but, on the other hand, an extremely high female student-to-female professor ratio. A more dramatic case takes place at the ChE Department, where, while having the highest number of female students in any department of the *COE*, has an appalling female student-to-female professor ratio of 419:1. The most recent UPR-M Middle States engineering progress report refers to a general student-to-professor ratio of 20 [4]. None of the ratios presented on Table III are close to this general ratio.

Evidently, in order to assure a proper number of role models for female students and, consequently, promote in them the pursuit of an academic career, the number of women in the engineering faculty at the UPR-M needs to increase.

TABLE III
RATIO OF FEMALE FACULTY TO FEMALE STUDENTS BY ENGINEERING DEPARTMENT AT UPR-M

Engineering Department	Female professors	Total No. of students	Total No. of Female students	Percentage of Female students	Student/ professor ratio
Chemical	1	691	419	61	419:1
Civil	3	890	285	32	95:1
Electrical/Computer	2	1293	346	27	173:1
Industrial	4	579	315	54	79:1
Mechanical	2	784	161	21	81:1
Total	12	4237	1526		

A common practice at the *COE* is to rely on service contracts, mostly with master degrees, to satisfy the high demand for engineering courses. Statistics presented in Table IV show that approximately 67% of the female faculty have tenure or are on tenure track. The remaining 33% are female professors working under a service contract renewed every semester based on demand. Inputs and concerns from this group were included in the initial assessment and will be considered in search of initiatives for organizational changes supporting the recruitment and retention of female faculty. However, since most of them work on a part-time basis and are not present throughout the duration of the average student path through the *COE*, statistics and initiatives in future work will focus on full-time female professors.

TABLE IV
FEMALE FACULTY BY RANK INCLUDING SERVICE CONTRACTS

Rank	Female Professors on:			Total	%
	Tenure	Tenure track	Service Contract		
Instructor	0	3	8	11	45.80
Assistant Professor	3	3	0	6	25.00
Associate Professor	4	0	0	4	16.70
Full Professor	3	0	0	3	12.50
Total	10	6	8	24	
%	41.67	25.00	33.33		

SURVEY: A STEP TOWARD ASSESMENT

An initial step towards self-assessment was accomplished through the design and distribution of a preliminary survey among female faculty members. This survey contained pre-defined alternatives as well as open-ended questions to

which respondents answered freely. These questions were similar to those presented in reference [5]. An outstanding response rate of 75% was obtained.

When asked for reasons motivating the consideration of leaving academia, none of the respondents expressed dislike in being a professor and stated that their primary reasons for having considered leaving were salary, better opportunities in industry, discrimination, and a desire to spend more time with their family. Statistics on this question are presented in Figure 2. Other responses were the long time required to get tenure and the environment.

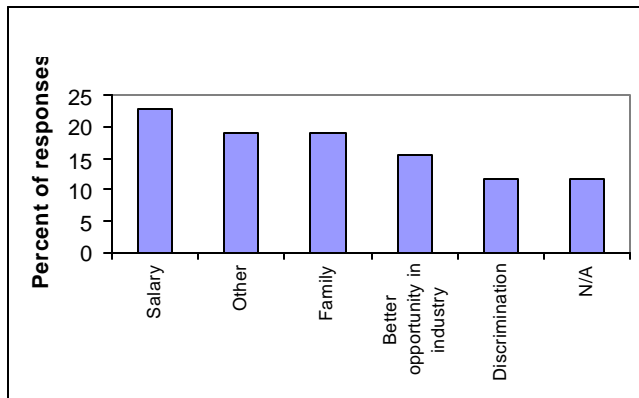


FIGURE 2
REASONS FOR LEAVING ACADEMIA

According to female faculty responses, balancing work and family is a major issue, with 53% saying that it is either difficult or very difficult to maintain such a juggling act (see Figure 3). The primary concerns of these female academics in trying to balance work and family are having enough time with children, stress of trying to do too much, and compromising career advancement. Figure 4 shows all the concerns and their corresponding percentages.

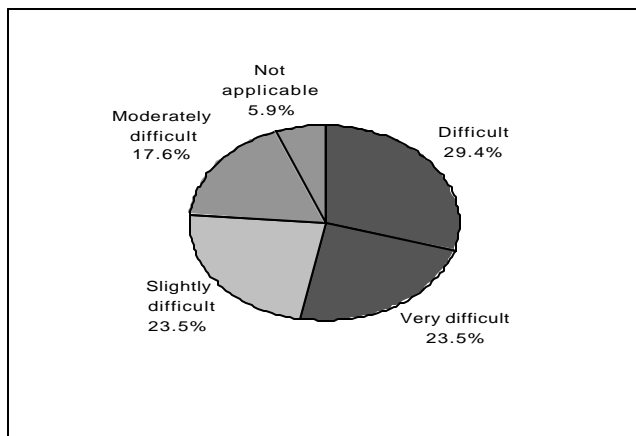


FIGURE 3
DEGREE OF DIFFICULTY IN BALANCING WORK AND FAMILY

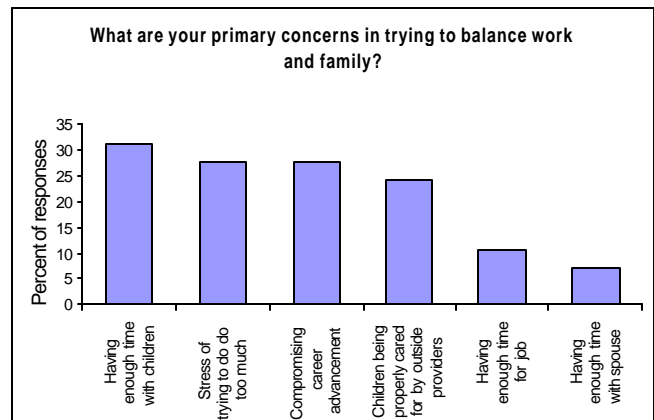


FIGURE 4
PRIMARY CONCERNS IN BALANCING WORK AND FAMILY

Upon being asked what the institution could do to offer encouragement to maintain its engineering female faculty, respondents offered a variety of suggestions. Among them: flexible attitudes and schedules, better salaries, development opportunities, childcare facilities, support groups, teacher assistants, mentorship, and split/shared positions.

The survey was administered for the purpose of testing and getting a glimpse of the general concerns of the population of interest. Work is still needed in addressing these concerns and in identifying other hidden problems.

The most significant conclusion from this survey is an overwhelming need for institutionalized support to help female faculty face its particular problems and responsibilities.

NEXT STEPS

The design and development of a Center for Women Engineers and Scientists in Academia (CWESA) at the UPR-M is being foreseen as part of future work. The ultimate mission of the center would be to encourage and support women in academia by creating a supportive structure and institutional transformation conducive to academic professional progress and success.

Significant improvement in the participation and advancement of women in academia can be accomplished by focusing efforts at the different stages of a Women Engineers and Scientists in Academia Life Cycle (WESALIC). As depicted in Figure 5, the cycle initiates in pre-college years and reaches its maturity with the fulfillment of tenure and full professorship.

The CWESA would consider and monitor all these stages as well as manage all the efforts accordingly. The long-term objectives will be to:

- encourage the participation of young girls in programs promoting scientific knowledge such as “Future Scientists and Engineers of America”, science clubs, and after school tutoring;

- promote through student chapters of professional societies the participation of high school students in science fairs and science and engineering programs such as NASA space camps and SMET (Science, Math, Engineering, and Technology) summer programs, among others;
- sponsor the participation of high school students in university research programs;
- implement programs to support female students throughout their undergraduate and graduate studies;
- promote academia as a career for female in engineering and science through mentorship, role modeling, and networking programs;
- contribute to the advancement of women on tenure track positions by creating an institutional environment where female faculty can achieve their full potential; and
- promote the increased participation of female faculty in administrative positions.

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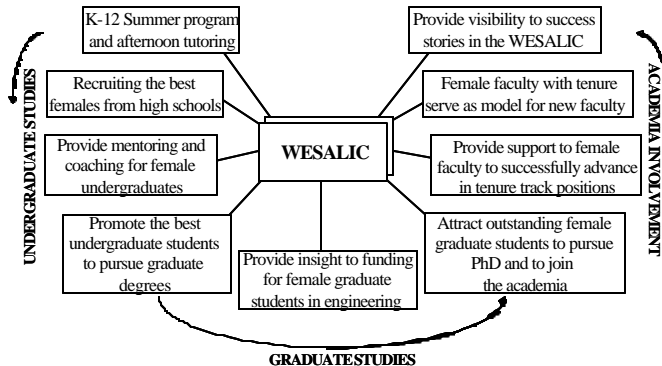


FIGURE 5
WOMEN IN ENGINEERING AND SCIENCE IN ACADEMIA
LIFE CYCLE

The focus of future efforts will be a more exhaustive self-assessment to identify the major problems faced by female faculty in engineering and science, and initiate an institutional transformation through workshops for awareness on gender related issues. This is a starting point towards the accomplishment of the more ample vision described.

The process will serve as a catalyst for the initiation of changes in the academic culture and environment leading to institutional transformations for the support and promotion of females in the engineering faculty. Another significant contribution of this initiative will be the development of a framework for decision-making for administrators. The main goal of the framework will be to provide a mechanism for revisiting and, thus, improving the current strategies for recruitment and retention of engineering and science female professors.