

# FEMALE FACULTY AT GREEK COMPUTING DEPARTMENTS: 2003-2012

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## Abstract

This study investigates the representation of female faculty in Computing departments in Greek Universities and Engineering schools during the decade 2003-2012. The data, the number and the percentage of female faculty members are derived from the Hellenic Statistical Authority (EL.STAT). These data refer to faculty members of all ranks, (professors, associate professors, assistant professors and lecturers) in: (a) every department of University and Engineering school in Greece, and (b) in 14 Computing University departments and 8 Electrical & Computer Engineering Schools, in Greece, which have been characterized as Computing departments according to the International Standard Classification of Education (ISCED) developed by Unesco. The analysis of the data shows that: (a) female faculty members in every department of Universities & Engineering Schools in Greece are less prevalent than male in every rank, (b) female faculty members in every department of Universities & Engineering Schools are better represented at the rank of lecturer, followed by the rank of assistant professor, associate professor and professor, (c) female faculty members in Computing departments are less prevalent than male at every rank, (d) female faculty members in Computing departments are better represented at the rank of lecturer, followed by the rank of assistant professor, associate professor and professor, (e) female faculty in every department of Universities & Engineering Schools are better represented compared to female faculty members in Computing departments at every rank, (f) the female representation at every rank, both in every University department & Engineering School and in Computing departments, appears an ascending trend, through the decade, and (g) there are Computing departments where there are no female faculty members.

Keywords: Faculty, Tertiary Education, Computer Science & Engineering, Gender.

## 1 INTRODUCTION

Despite the efforts that have been done the last years on recruiting and retaining young women into Computing and other STEM fields (Science, Technology, Engineering and Mathematics), women have been continuously underrepresented in those disciplines in both; higher education and the workforce [5, 6, 9, 14]. Especially, Computing remains a heavily male-dominated field even after several years of extensive efforts to promote female participation [6].

Numerous factors that contribute to women's low participation in Computing have been mentioned in various studies over the past two decades, revealing that the reasons for that low participation are multilayered [9, 11, 20, 21]. Güler & Camp [11] defined 14 such factors, which can be fall into the following categories: computing experience, self-confidence, attitude and support. Women acquire less hands-on experience with computers than most men [21]. Usually, the first experience boys and girls have with computers is through computer games. In most cases, computer games are designed for boys' interests and not girls [10]. Moreover, at school, boys tend to monopolize the teacher's time, leaving the girls to try and figure things out on their own, something that is really frustrating for young girls [24]. As a result, girls lose interest in Computing early on. Women have also less confidence in their abilities and individual accomplishments than men, and report feeling 'out of place' in the male-dominated, hacker culture. Loss of self-confidence impacts women more than men and is a major cause for women leaving Computing at all levels [11, 22]. Positive attitudes can greatly influence the school success of a student as well as their recruitment and retention in Computing. Attitudes towards computers and their uses differ along gender lines where a greater percentage of boys than girls hold positive attitudes towards Computing while more girls have negative attitudes [2, 11, 25].

Women also do not also usually receive the same level of support from their social environment as men to enter and remain in the Computing field [8]. It is true that, most of the images of Computing

coming from parents, teachers, and the media are mostly-negative for women, forming a computing stereotype, where, men more than women, are represented using computers for hours and lacking in other social interests, implying that Computing is for men only. The 'nerd' image, accompanying students in Computing (obsessed with computers, spending a great deal of time in front of a computer and lacking social skills) is more negative for women than for men [4, 22].

Despite the fact that the recruitment of females in Computing is an important issue, it is not the only problem. The retention of the females in Computing seems to be an equally important issue. There are studies suggesting that, once women enter the Computing field they are able to perform as well as men [3, 18, 19]. Women can contribute in advancing the Computing discipline, not only by designing advanced technological products, services and solutions [11] utilizing their diverse experiences [27] but also by adding scientific knowledge in the field. Besides, many remarkable women have made their mark in the history of Computing through their great achievements [13].

Teachers at all levels of education can play a crucial role to the recruitment and the retention of women in the Computing discipline. Schoolteachers are those who can attract and recruit women to the field while University Professors can play a crucial role in students' retention in the field of their expertise. In fact, students, both males and females, during their undergraduate and graduate studies, interact and cooperate with their professors. Studies credit faculty interactions with improving students' development as thinkers and scholars, confidence in their own abilities, integration into the university communities, and interest into graduate education [15, 16, 23]. Baker and Griffin [1] suggest that faculty-students interactions are critical from everything, from building students' capacity as scholars, fostering degree aspiration and retention, and promoting the success of students in underrepresented backgrounds, as females in Computing. Female students in a computer-related field seem to need more support to overcome the obstacles they face through their studies [26].

All faculty members are capable of aiding a female student with her academic concerns, which may range from raising a grade in particular class to choosing an appropriate graduate program. Although both male and female faculty members provide sources for being potential mentors, it seems that female professors provide the most appropriate form of mentoring for female students [26]. It seems to make sense that a certain level of comfort may be achieved between a female student and an accomplished female professor. Both the mentor and the mentee are free to "let their guard down" and speak freely of their concerns, aspirations, and fears [6]. Women role models demonstrate the presence, the participation, and the continuing prospects of women in the Computing fields. The undoubted positive role of a female role model in the retention of females in Computing, highlights the need to investigate the presence of female faculty, who could act as mentors/role models, in those departments.

Thus, it seems that it is worth to investigate the gender faculty-member representation during the last decade in Greece, in Computing. Such study has not yet been reported. Thus, the main focus of this study is the investigation of the female faculty representation in Computing and in every department of University and Engineering School in Greece during the decade 2003-2013.

The article is organized as follows: The context of the study presents details about the data presented in this paper, the 'Results' section gives a full description of the research findings, while discussion of the results and conclusions are drawn.

## **2 THE CONTEXT OF THE STUDY**

### **2.1 The data**

The data presented in this study have been taken from the Hellenic Statistical Authority (EL.STAT). The data concerning faculty's representation was classified for every year of the decade - by the authors - into Computing field, taking into account the International Standard Classification of Education (ISCED) developed by UNESCO. Computing field refers to Computer Science & Computer Engineering departments (especially 14 Computing University departments and 8 Electrical & Computer Engineering Schools in Greece).

The aforementioned data concerned the numbers of faculty of both genders in the mentioned field of Computing and in every department of University and Engineering School in Greece. The data regarding faculty cover the period from the start of 2003/04 to the start of 2012/13.

## 2.2 Data analysis and methodology

As regards faculty representation, EL.STAT presents the total number of faculty and the number of women each year per department, in terms of different categories of faculty, namely: professors, associate professors, assistant professors and lecturers. Thus, for each year of the decade, the numbers of faculty of the Greek Computing departments as well as every department were calculated. Then, the total number of faculty and the percentages of female faculty each year/category of faculty were calculated and organized in Tables which are presented in the 'Results' section of this paper. In terms of methodology, this study can be characterized as a quantitative research and a case study [7].

## 3 RESULTS

The gender representation of faculty members in the Greek Tertiary education from 2003/04 to 2012/13 is presented here, in terms of faculty members: (a) in all Greek universities and engineering schools (Overall) and (b) in the Computing discipline.

The total number (N) –male and female– and the percentage of female (F) faculty members the decade 2003 – 2012, as well as the number and the percentage of female (F%) Professors, Associate Professors, Assistant Professors and Lectures during this period of time are demonstrated in Tables 1 and 2 in respect to all Greek: (a) Universities and Engineering Schools (Overall; in Table 1), (b) Computing Departments (in Table 2)

### 3.1 Overall

As one can see from Table 1, the number of the total teaching staff in all universities and engineering schools in Greece, increased from 2003/04 to 2009/2010 and slightly decreased thereafter (see Table 1; column 2). The percentage of females remained almost stable through the decade, varied from 27.18% to 29.97% (see Table 1; column 3). On average, every year of the decade there were 8,881 faculty members in all Greek University departments and Engineering schools while the percentage of female faculty were, on average, 29.01% (SD=0.9).

**Table 1 Faculty members in Greek Tertiary Education: in total and by rank**

Start of Academic Year	Gender representation of faculty members in Greek Tertiary education - 2003/2012: Overall									
	Total Faculty		Professors		Associate Professors		Assistant Professors		Lectures	
	N	F %	N	F %	N	F %	N	F %	N	F %
2003/2004	7,354	<b>27.18</b>	2,103	<b>13.60</b>	1,697	27.22	1,998	34.68	1,556	39.33
2004/2005	8,053	27.65	2,202	14.85	1,965	27.48	2,161	<b>31.2</b>	1,725	39.48
2005/2006	8,237	28.19	2,241	16.47	1,981	<b>26.70</b>	2,223	31.85	1,792	39.96
2006/2007	9,268	29.01	2,457	17.62	2,200	28.00	2,546	32.33	2,065	39.56
2007/2008	9,326	29.29	2,619	18.86	2,153	28.19	2,701	32.51	1,853	<b>40.64</b>
2008/2009	9,248	29.30	2,581	19.29	2,160	27.92	2,706	32.59	1,801	40.37
2009/2010	9,515	<b>29.97</b>	2,816	19.46	2,149	<b>31.08</b>	2,886	33.68	1,664	39.90
2010/2011	9,409	29.48	2,836	19.11	2,125	28.89	2,908	34.87	1,540	39.22
2011/2012	9,306	29.63	2,879	<b>20.22</b>	2,036	29.32	2,909	35.27	1,482	37.25
2012/2013	9,098	29.80	2,779	19.86	2,037	30.00	2,847	<b>35.62</b>	1,435	<b>37.21</b>
<b>Average</b>	<b>8,881</b>	<b>29.01</b>	<b>2,551</b>	<b>18.15</b>	<b>2,050</b>	<b>28.52</b>	<b>2,589</b>	<b>33.57</b>	<b>1,691</b>	<b>39.38</b>

As far as the professors are concerned, as it is shown in Table 1, their number, increased through the decade, with a minor decrease in 2008/09 (see Table 1; column 4). The percentage of female professors increased from 2003/04 to 2009/2010 and remained around 20% the next years (see Table 1; column 5). That percentage varied from 13.60% to 20.22%. On average, every year, there were 2,551 professors (28.72% of the total number of faculty members in Greece), while 18.15% (SD=2.14) of them were females.

Regarding associate professors, their number, increased from 2003/04 to 2006/07, and decreased thereafter (see Table 1; column 6). The percentage of female associate professors, overall, varied from 26.70% to 31.08% (see Table 1; column 7). On average, every year, there were 2,050 associate professors (23.08% of the total number of faculty members) in all Greek universities, while the percentage of female associate professors were, on average, 28.52% (SD=1.28).

Considering assistant professors, their number, increased from 2003/04 to 2011/12 and slightly decreased the next year (see Table 1; column 8). The percentage of female assistant professors increased during the decade, (see Table 1; column 9) and varied from 31.2% to 35.62%. Surprisingly, in 2003/04, where the total number of assistant professors were 1.998 (the lowest in the decade), female appeared a high percentage, climbing to 34.68%. On average, every year, there were 2.589 assistant professors (29.15% of the total number of faculty members) and, 33.57% (SD=1.49) of them were females.

As far as the lecturers are concerned, their number increased from 2003/04 to 2006/07 and decreased thereafter (see Table 1; column 10). The percentage of female lecturers, overall, varied from 37.21% to 40.64% (see Table 1; column 11). On average, every year, there were 1,691 lecturers (constituted 19.04% of the total number of faculty members overall) while 39.38% (SD=1.12) of them were females.

To sum up, on average, every year of the decade, the assistant professors (2,589) were more than professors (2,551), more than associate professors (2,050) and more than lectures (1,691). Female assistant professors (869) were more than female lectures (673), more than female associate professors (584) and more than female professors (463). Despite this fact, among the four ranks, females were better represented in lecturers followed by assistant professors, associate professors and professors (39.38%, compared to 33.57%, 28.52% and 18.15% respectively). It is also worth noting that, every year of the decade, the percentage of female lectures, overall, was higher, than the respective of professors, associate professors and assistant professors. It seems that, females were better represented at lower ranks.

### 3.2 Computing

As one can see from Table 2, the number of the faculty members in Computing departments considerably increased from 2003/04 to 2009/2010 and remained stable, with a slight decrease, thereafter (see Table 2; column 2). The percentage of female faculty members varied from 9.66% to 11.72% with minor ups and downs through the decade (see Table 2; column 3). On average, every year of the decade, there were 553 faculty members, while the percentage of females were, on average, 11.11% (SD=0.68).

**Table 2 Faculty members in Computing departments: in total and by rank**

Start of Academic Year	Gender representation of faculty members in Greek Tertiary education - 2003/2012: Computing									
	Total Faculty		Professors		Associate Professors		Assistant Professors		Lectures	
	N	F %	N	F %	N	F %	N	F %	N	F %
2003/2004	461	10.41	184	<b>2.72</b>	118	15.25	99	14.14	60	18.33
2004/2005	466	10.52	181	3.87	118	<b>16.10</b>	101	11.88	66	16.67
2005/2006	497	<b>9.66</b>	190	4.21	128	14.06	105	10.48	74	14.86
2006/2007	523	10.52	212	5.19	117	12.82	110	<b>18.18</b>	84	<b>10.71</b>
2007/2008	570	11.23	231	<b>7.79</b>	108	12.96	138	<b>11.59</b>	93	17.20
2008/2009	567	11.46	226	7.52	104	14.42	149	12.08	90	16.67
2009/2010	615	11.71	252	7.54	113	8.85	164	15.24	86	<b>20.93</b>
2010/2011	612	11.60	253	7.51	108	<b>8.33</b>	177	15.82	74	20.27
2011/2012	613	11.58	258	7.36	108	11.11	181	15.47	66	18.18
2012/2013	605	<b>11.72</b>	253	7.51	107	11.22	177	15.25	68	19.12
<b>Average</b>	<b>553</b>	<b>11.11</b>	<b>224</b>	<b>6.34</b>	<b>113</b>	<b>12.54</b>	<b>140</b>	<b>14.20</b>	<b>76</b>	<b>17.21</b>

Regarding professors, their number increased during the studied decade from 2004/05 to 2011/2012 (see Table 2; column 4). The percentage of female professors varied from 2.72% to 7.79% (see Table 2; column 5). It is noticeable that even though the total number of professors increased, the percentage of female stayed still or slightly decreased. On average, every year, there were 224 professors while 6.34% (SD=1.82) of them, were females. Professors in Computing departments constituted, on average, every year, 40.50% of the total number of Computing faculty members, and 8.78% of the number of professors 'Overall' (2,551).

Considering associate professors, their number stayed almost still through the decade with minor ups and downs. The percentage of female associate professors varied from 8.33% to 16.10% (see Table 2; column 7). On average, there were, every year, 113 associate professors and 12.54% (SD=2.47) of them, were females. Associate professors in Computing departments constitute, on average, 20.43% of the total number of faculty members in these departments, and 5.51% of the number of associate professors 'overall' (2,050).

The number of assistant professors increased from 2003/04 to 2012/13 and slightly decreased the next year (see Table 2; column 8). The percentage of female assistant professors varied from 11.59% to 18.18%. That percentage continuously decreased from 2003/04 to 2005/06, had some ups and downs the next 3 years and remained around 15% the last 4 years of the decade (see Table 2; column 9). On average, every year, there were 140 assistant professors while 14.20% (SD=2.29) of them were female. Assistant professors in Computing departments constitute 25.32% of the total number of faculty members in these departments and 5.41% of the number of assistant professors 'Overall' (2,589).

Regarding lecturers their number increased from 2003/04 to 2007/08 and decreased the next 4 years (see Table 2; column 10). The percentage of female lecturers varied from 10.71% to 20.93% (see column 11). That percentage did not appear a steady trend (ascending or descending). On average, every year, there were 76 lecturers in Computing departments, while 17.21% (SD=2.78) of them were females. Lecturers in Computing departments constituted 13.74% of the total number of faculty members in these departments, and 4.67% of the number of lecturers 'Overall' (1,691).

To sum up, on average, every year of the decade, professors (224) are more than assistant professors (140), more than associate professors (113) and more than lecturers (76) in Greek Computing departments. On the other hand, on average, female assistant professors (19) were more than female professors (14) female associate professors (14) and female lecturers (13). However, the percentage of female professors in Computing departments is lower than the percentage of female associate professors and of the percentage of assistant professors both every year of the decade and on average. The percentages of female lectures in Computing departments were higher, every year of the decade, than the respective percentages of professors and associate professors and every year, apart from one, than the respective percentages of assistant professors. It seems that among the four ranks, female were better represented in lectures followed by assistant professors, associate professors and professors (17.21% compared to 14.20%, 12.54% and 6.34% respectively). Finally, it is worth noting that, during the whole decade there were 2 departments that had no female faculty.

## 4 DISCUSSION AND CONCLUSIONS

The results arising from the analysis of the data provide useful insights as far as the participation of females in the Computing Greek Tertiary Computing Education in terms of faculty members, namely: professors, associate professors, assistant professors and lecturers.

In fact, every single year of the decade, female faculty members were less prevalent than male: (a) in every department of University and Engineering school in Greece, and (b) in Computing departments. The under-representation of female faculty members in Computing is accompanied with alarming low percentages that did not exceed any year: (a) 8% for professors, (b) 17% for associate professors, (c) 19% for assistant professors, and (d) 21% for lecturers.

What is more, the analysis of the data shows that, for the studied decade: (a) female faculty members 'Overall' in Greece were less prevalent than males at every rank (professors, associate professors, assistant professors and lecturers), (b) female faculty members 'Overall' were better represented at the rank of lecturer, followed by the rank of assistant professor, associate professor and professor, (c) female faculty members in Computing departments were less prevalent than male at every rank, (d) female faculty members in Computing departments were better represented at the rank of lecturer, followed by the rank of assistant professor, associate professor and professor, (e) female faculty in

every department of Universities & Engineering Schools were better represented compared to female faculty members in Computing departments at every rank, (f) the percentages of female faculty members, at every rank, 'Overall' and in Computing departments appeared an ascending trend, through the decade, and (g) there were Computing departments where there were no female faculty members. Finally, the results indicate that faculty members in Computing constituted a small part of faculty members 'Overall'. From the total number of Greek faculty members, just 6,23% were in Computing departments

#### **4.1 Implications of the study for Computing faculty members and researchers**

Computing faculty members, can utilize the results of this study in order to realize and be aware of the issue addressed: that is the lack of female faculty members in Computing departments. In addition, female faculty members in Computing departments, in collaboration with researchers, should take actions in order to broaden the participation of female in the field, highlighting their work and their contribution, revealing the need for diversity in the Computing field, pointing out the need for the presence of females in every field of Computing, as well as in Academia. To this end, the results of this study may be the starting point for Computing faculty members and researchers to rethink what has been done wrong the last years and find out the reasons for that disadvantageous positions in order to widen the participation of female in Computing Tertiary education.

#### **4.2 Limitations of the study and future research directions**

This study focuses on the investigation of gender representation of faculty members in Computing Tertiary education during the decade 2003-2012 in Greece. This study concerns a certain period of time as well as a particular population and a country with a certain educational system, as far the tertiary education is concerned. Any generalization of these results should be undertaken with caution and be limited to countries and populations that have similar characteristics to those of the participants in this study. Any research finding that are differentiated from other studies should be handled with the same prudence.

This study yields interesting research prospects. The results highlight the deficient participation of women in the field of Computing, as far as the faculty members in the Greek Computing departments are concerned. The inadequate presence of women in Academia with the consequent lack of gender diversity in the field, as well as the lack of female Computing mentors and role models in tertiary education, an area where university students form their career choices seems to be issues that has to be seriously concerned. Thus, the next item in the authors' research agenda is the investigation of the causes of that under-representation in the field unmasking the reasons why female computing university students do not pursue an academic career and what are the obstacles that female faculty members in Computing departments faced on their way to the recognition, their progression and their retention in the field of Computing Academia. Useful information can be obtained from the study of the representation of female faculty members in other STEM disciplines and the comparison with the Computing discipline.

It is hoped that this paper provided useful insights into the representation of both genders in Computing discipline as far as the faculty members in tertiary education is concerned. The results presented can also trigger further research about the reasons of the underrepresentation of females in the academic fields of Computing education highlighting the causes of the disadvantageous situation for females and trying to end the vicious cycle formed in the field.

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