Where Girls Take the Role of Boys in CS − Attitudes of CS Students in a Female-Dominated Environment

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Abstract: A survey has been carried out in the Computer Science (CS) department at the University of Baghdad to investigate the attitudes of CS students in a female dominant environment, showing the differences between male and female students in different academic years. We also compare the attitudes of the freshman students of two different cultures (University of Baghdad, Iraq, and the University of Potsdam).

1 Introduction

Low interest among females to study and specialize in Computer Science (CS) seems a worldwide issue, in particular in western countries [GC02, Fr94, RS06, Be03], and their dropout rate is much higher than for male students [RS06, Be03]. For the importance of women's role in CS and the reasons of their low interest in it see [Kl12, Be05]. Some countries do not have this issue, for example Iraq, possibly because of the admission procedure which is controlled by the Ministry of Higher Education and Scientific Research that uses mainly the "Baccalauréat" examination score (final exam in secondary school), or because women do not perceive CS as a male-dominated field. The University of Baghdad is one of the five universities in Baghdad city and the largest among 25 universities in Iraq. It has 24 colleges and accepts every year about 10,000 students [UB12, MH12]. The CS department at the University of Baghdad was established in 1983 when 30 students were accepted, 29 graduated in 1987 (21 were female). This high percentage of women studying and graduating from a CS department remains constant for the following years (Figure 1).
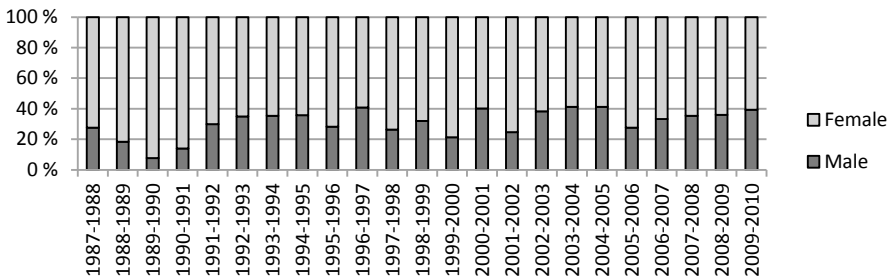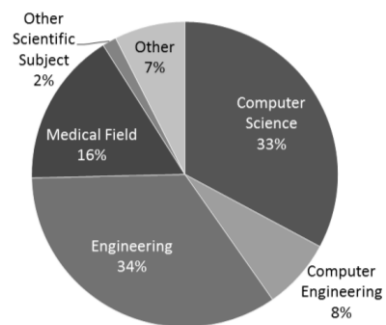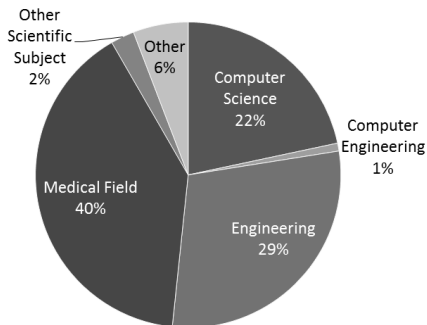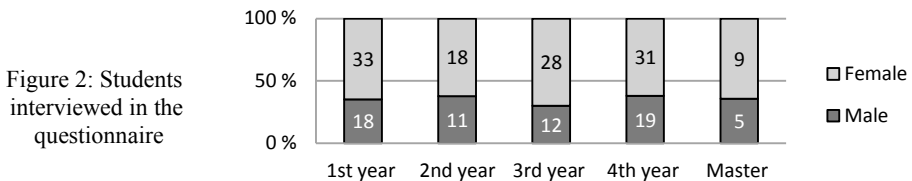

Figure 1: Students graduating in the CS department at the University of Baghdad [CS12]

Women in CS also graduate as top of their classes (between 1991 and 2010 68 % were women). At the CS department 65 % of the faculty members are female (63 % Asst. Professors, 91 % lecturers and 56 % Asst. lecturers [CS12]). Moreover there are 34 assistant technician members, of whom 91 % are female, who work to guide students in the labs of the CS department.

2 Methodology

Participants were a volunteer sample of students of the CS department at the University of Baghdad. 184 students covering every academic year participated in the questionnaire, 119 female students (65 %) and 65 male students (35 %) (see Figure 2). With the agreement of a lecturer in a class, a specific time (about half an hour or more) was taken from the lecture time to allow students to answer the questionnaire. The questionnaire includes multiple choice questions as well as open questions.[1]

Figure 2: Students interviewed in the questionnaire

Figure 3a: Females' interests

Figure 3b: Males' interests

3 Results and Discussion based on a Comparison between Male and Female Students

3.1 Passionate Commitment to Academic Studies

Most of the students fail to accomplish their dreams to study what they like and are passionate about, because of the central acceptance procedures. Only 22 % of the female students and only 33 % of the male students really wanted to study CS (Figures 3a and 3b). Although most students of both genders were not passionate about specializing in CS, only 25 % of the female students and 12 % of the male students regret it.

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[1] Questionnaire online: *http://informatikdidaktik.de/Forschung/Schriften/Al-SaffarHDI2012-Q.pdf* (12/2012)

3.2 Computing Lessons in School and Programming Languages

Computing lessons with IT-related contents are offered in some of the Iraqi schools during the secondary education stage. More female students (61 %) than male students (45 %) attended computing lessons. Teachers' influence on studying CS was 50 % affirmation for males and 45 % for females. The percentage of female students familiar with a programming language before university study was 61 % versus 49 % for male. PASCAL is the best known programming language before college.

3.3 Computer Usage and Interaction

Because of sanctions by the United Nations after the Gulf War 1991–2003, most Iraqi families did not have the possibility to buy a computer. This made a lot of students dependent on the computers available at the university departments. Now the situation is much better, but still not every student has his/her own PC before coming to the college. For freshman students this year, the survey shows that 22 % of male students and 24 % of female students do not have their own PC. 39 % of male students and 28 % of female students also do not have Internet access at home. Those freshman students owning a PC had their first PC at a median age of 15 ½ years for men, versus 17 years for women, but female students had an earlier interaction with computers. For a question that asks the students about what fascinates them most about computers, male students' highest percentage was for programming, with 20 % versus 12 % for females. Females' highest percentage was Internet browsing and chatting with 24 % versus 18 % for males. A higher percentage of men than of women use drawing and image editing programs.

3.4 CS Studies and Apprehensions

The main apprehension concerning studies for both genders is becoming unemployed in the future. This was 50 % of all apprehensions of males, and 32 % for females. The high percentage of male students may come because men see themselves responsible for providing income to their families, while women are sometimes more dependent on men, although they would like to work and participate. The second largest apprehension for female students with a percentage of 31 % was that studies might be too difficult for them, versus only 10 % for males. Surprisingly, although women are the majority of the CS students and graduate more often at the top level of class they strongly underestimate their abilities – a cross-cultural phenomenon analysed in many circumstances [HF00].

3.5 Women, Men and CS

According to the survey, 68 % of the male students and 58 % of the female students think that men do better in CS. But the reasons for this attitude are different in the point of view of each gender. Female students tend to complain about their freedom situation in going out to access knowledge and experience outside university, like working in the evening and late at night in local software market fields or in Internet cafes as male students do, mainly because of the family opinion wishing to protect their daughters. Fe-

male students also see men as working more as a team than women, and using the computer more often, knowing a lot of stuff about it, with a higher ability to understand scientific subjects. Male students tend to assume that men are cleverer and better logical thinkers than women, recognizing the fact that women do not have the freedom that men have. But also male students affirm with a higher percentage that men do better in CS, but without giving a reason.

Regarding the question of how a student sees himself in the future, the highest percentage for first year female students was 24 %, seeing themselves in the future as "professional computer users" versus only 4 % of their fellow students in the 4th year. This indicates a change in understanding about what CS is. Teaching CS or about computers and their uses was the most popular profession among the 4th year students of both genders. This percentage grows from year to year from 19 % to 42 % for the females and stays over the years at around 20 % to 24 % for the males.

4 Comparison between Freshman Students of the University of Baghdad and the University of Potsdam

Programming language knowledge, school background, university acceptance procedure, work expectations, and percentage of both genders in CS studies differ considerably between Iraq and Germany. So a restricted student attitude comparison has been made, based on mutual questions that were posed to a group of 45 freshman students at Potsdam University (winter term 2008/2009: 20 % female, 76 % male and 4 % unknown gender) with a group of 51 freshman students at the University of Baghdad (65 % female, 35 % male, see Table 1).

Although the gender percentage in both populations is different, there are some similarities in the students' answers, but there are differences as well. CS freshman students at the University of Baghdad have very high apprehensions about not being employed in the future, and are much more afraid of the study being not appropriate for them due to the acceptance procedure that assigned them to a college and a field. But what is noticeable is that CS freshman students at Potsdam have higher apprehensions that the studies might be too difficult for them and are afraid that they might have the wrong conception of the studies, although they came to study of their own free will, have higher ability to think logically and are good in mathematics. Owning a PC nowadays is a must for all studies, not just for CS, but a much higher percentage of Potsdam freshman students think it qualifies them to study CS. Students in both universities agree that there is no need to read a lot of books on CS.

	Category	Potsdam	Baghdad
Reason for choosing computer science as an academic subject / continuing in it			
1	Guarantee to get a job later	44.4%	35.3%
2	Diversity of occupational possibilities	42.2%	43.1%
What qualifies a student to study computer science			
3	Like working in a team	48.9%	49.0%
4	Ability to think logically	60.0%	39.2%

5	Owning a PC	55. 6%	29.4%
6	Being good in mathematics	51.1%	17.7%
Perspective and expectation a student has for computer science study			
7	Learning to understand many complicated issues	73.3%	49.0%
8	Spending much time using a computer	33.3%	25.5%
9	Reading many books	15.6%	13.7%
10	Learning many programming languages	53.3%	64.7%
Apprehensions concerning choice of study			
11	Computer Science not appropriate "for me"	4.4%	17.7%
12	Being unemployed in future.	2.2%	51.0%
13	Having wrong conception of the studies	35.6%	15.7%
14	Studies might be too difficult	57.8%	39.2%

Table 1: Some attitudes of freshman students of the computer science departments at the University of Baghdad and the University of Potsdam

5 Conclusions

The study was initiated for investigating students' attitudes in studying CS without real commitment and with women dominating the environment, due to the special admission procedure to colleges/institutes in Iraq. 77 % of female students did not want to study CS, but at the same time only 25 % regret doing so (second year female students regret most) and they even usually graduate on top of the class. Students who regret studying CS usually have no intention to drop out, because it is difficult to change a study field and it comes with the consequence of losing a year or more of students' life and usually does not lead to studying what the student really wants after all. Also family opinion usually encourages the student to continue the study he/she has started with.

Different factors may contribute to the women's attraction towards studying CS, such as the point of view of both genders towards working in the field of CS (about 90 % of both gender said that CS is for both of them). This may come from the fact there is no pre-conceived opinion in society toward classifying CS as a boy thing and there are no misconceptions about working styles of people successful in the field, although 68 % of men and 58 % of women acknowledge that men do better in CS. There may be misconceptions about the field in particular for first year female students but the study shows a progress and understanding of what CS is about when compared to their fellow students in the 4th year. Another factor may come from schools being single gender institutions in Iraq, which encourage girls to be more confident towards pursuing in science or technical studies with no boys sitting around them in class trying to affect the computing study environment negatively as described in [GC02]. Also the high female students' percentage in the CS department might give them positive attitudes of being the majority in the class. Academic and technical staff with a high female percentage provide a positive environment for women to study and progress, considering female lecturers as role models who encourage them to pursue their further study and possibly apply for post graduate studies.

The restricted comparison between freshman students of the University of Baghdad and their counterparts at the University of Potsdam shows that although women represent

65 % of freshman CS students at the University of Baghdad, they regard computer science as less difficult than the men, representing 76 % of freshman students at the University of Potsdam. The CS freshman students at the University of Potsdam clearly state that computer science is appropriate for them, but at the same time are afraid of having the wrong conception of the studies, while the CS freshman students at the University of Baghdad have similar concerns on both apprehensions. This indicates that although the admission to the University of Potsdam is based on interest and most believe that CS is a suitable academic subject for them, they have higher concerns about the studies.

Acknowledgments

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