Gender Imbalances in Computer Science at the University of the Witwatersrand

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ABSTRACT
This paper presents figures which describe the current situation with respect to male and female entry, persistence and success rates in Computer Science at the University of the Witwatersrand (Wits). The figures indicate that the situation at Wits is similar to that observed at universities in other countries where only a small number of the students are women. The figures also show that persistence and success rates for men and women are comparable. The paper ends by discussing our ideas for the next stage of this research — an attitudinal survey directed at new first year science students at the University of the Witwatersrand.

INTRODUCTION
The relatively small number of women in Computer Science has been the subject of much concern in the international literature in the last few years[1-6]. In 1988, 32.5% of Bachelor's degrees and 26.9% of Master's degrees in the United States of America were awarded to women. The number of PhD's awarded was lower, at 10.9%[3]. As rank in academia increases, so the percentage of women decreases — only 7% of Computer Science academics in the United States are women[7] and a third of the Computer Science departments have no female academics[1]. The situation in Europe is worse — the percentage of women in Computer Science is dropping[4].

There are two possible explanations for the underrepresentation of women in Computer Science:
—   women do not enter Computer Science degrees
—   women do not complete Computer Science degrees either because they do not persist or because they do not succeed.

Research done in the United States[2] and Europe[8] supports the first explanation. However, research relating to the second explanation presents a more complex picture. Some research shows that female Computer Science students do as well as male Computer Science students[9][10] and other research shows that female students are less likely to persist[11][12] or to succeed[12][13].

A similar gender imbalance appears to hold in South Africa — the number of women in undergraduate Computer Science classes at the University of the Witwatersrand (Wits) has traditionally been small compared to the number of men. In addition, the Department of Computer Science at Wits entered 1993 with only one female academic member of staff and this at a part-time lecturer level.

We feel that the issue of gender imbalances in Computer Science, and specifically in Computer Science in the South African context, is one which warrants investigation. There is no reason why such imbalances should occur and we cannot afford to disregard a potential source of Computer Scientists, hence we should be trying to increase the number of women graduates and academics. The only way that the situation can be improved is by taking action and the first step in this action must be research into gender issues. There has been little research into Computer Science and gender in South Africa, the main emphasis in the literature on computers and education in South Africa seems to be on Computer Aided Instruction in schools[14-16].

We need first to assess the current situation in South Africa and second to understand the factors contributing to this situation. This paper addresses the first of these two issues, assessing the current situation, and in fact is restricted to the situation at the University of the Witwatersrand, although the results here may reflect the situation in other Computer Science departments in South Africa. This work involved studying the number of students (male and female) in our undergraduate programs at the University of the Witwatersrand over the last 7 years. Our focus was on comparing the entry rates, persistence rates and success rates of female students to those of male students.

THE CURRENT SITUATION IN COMPUTER SCIENCE AT WITS
The Science Faculty supplied us with student registration figures for the years 1986 to 1992 for the courses Computer Science I (CS I), Computer Science II (CS II), Computer Science III (CS III) and Computer Science Honours (CS Hons)* as well as the number that cancelled during the year and the number that passed and failed for each course. These numbers exclude the students that cancelled within the first few weeks of any course. We also obtained figures for the Master of Science in Computer Science (MSc) students that completed or did not complete during the period 1986 to 1992.

The percentage of women in the various courses has fluctuated over the years ranging from 6.25% (CS Hons 1986) to 50.98% (CS III 1986). Table 1 gives the percentage of men and women registered (as a percentage of the number of students registered) for each year of study across the period under consideration. As

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* An undergraduate degree in Computer Science at South African universities is three years long and contains three year-long courses in Computer Science. After this, students may proceed to an Honours degree in computer science which is a year-long concentration in Computer Science. After an Honours is completed, an MSc can be done in a minimum of one year and a PhD in a minimum of two years.

can be seen, the percentage of women ranges from 22.31% to 28.56%. It is interesting that the drop from third year to Honours is not substantial (approximately 4%).

In Table 2, the percentage of men passing (as a percentage of the total number of men registered) and the percentage of women passing (as a percentage of the total number of women registered) are compared. This table gives only the percentage passing — we were unable to get exact marks, so these tables do not compare how well men and women did. In both Tables 1 and 2, the percentages for CS I should be viewed with caution as the content of the course has changed during this time[17][18]. There is little difference between the pass rates of men and women students.

Table 3 gives the percentage of men and women gaining majors (as a percentage of the total number of students gaining majors) in Computer Science in the Faculty of Science. The percentages vary and there is no clear trend over the years.

The deregistration rates for male and female students (expressed as a percentage of the number of male and female students registered respectively) as shown in Table 4, are small and become smaller through the years of undergraduate study and

there are no substantial differences in the persistence rates of men and women in the undergraduate courses. However, a number of male part-time Honours students over the period of study (7 out of 101 or 6.9% of all male part-time Honours students) did not return to complete their second year of Honours although all women doing part-time studies completed their Honours. It should be noted that the sample is small.

The percentage of women who have registered for Honours (as a percentage of the total number of registrations for Honours) is 22.3%, and this drops to 14.8% for Masters, although the Masters figures should be treated with caution as they are small. Although few women have done a Masters, as can be seen in table 5, three out of four completed. However the completion rate for men is very low; only ten out of twenty-three (43.5%) passed. A possible explanation for this poor completion rate is conscription, where white male students register for a full-time Masters to postpone the South African Defense Force calling them up for military service, but do not intend or do not have the motivation to actually complete their degrees. Students who are still registered for Masters degrees are not included in the statistics given above but our current group of Masters students, nineteen in total, contains four women.

	CS I	CS II	CS III	CS HONS
TOTAL	1131	545	447	130
% male students	71.44	75.78	74.27	77.69
% female students	28.56	24.22	25.73	22.31

TABLE 1: Registrations 1986 — 1992.

	CS I		CS II		CS III		CS HONS	
	Base	%	Base	%	Base	%	Base	%
% male passes	808	75.12	413	86.68	332	90.96	101	90.10
% female passes	323	70.90	132	85.61	115	97.39	29	96.55

TABLE 2: Passes 1986 — 1992.

	1986	1987	1988	1989	1990	1991	1992
TOTAL	50	52	48	56	68	72	68
% male students	48.00	75.00	75.00	82.14	64.71	79.17	82.35
% female students	52.00	25.00	25.00	17.86	35.29	20.83	17.65

TABLE 3: Passes CS III.

	CS I		CS II		CS III		CS HONS	
	Base	%	Base	%	Base	%	Base	%
% male deregistrations	808	5.20	413	1.94	332	0.01	101	6.93
% female deregistrations	323	7.12	132	3.79	115	0.00	29	3.45

TABLE 4: Deregistrations 1986 — 1992.

	MALE	FEMALE
TOTAL	23	4
Passed MSc	10	3
Didn't complete MSc	13	1

TABLE 5: MSc 1986 — 1992

The figures above show that the percentage of female undergraduate students at the University of the Witwatersrand is similar to the percentages that occur in the United States and Britain. There do not seem to be gender differences in persistence for undergraduates and the pass rates for men and women are similar. There seem to be no substantial trends over the years. The same can be said for Honours students, except that it seems that male part-time students are less likely to finish their degrees. The percentage of women drops sharply to 14.8% for Masters degrees, although women have a much better completion rate than men.

HOW CAN THE SITUATION BE IMPROVED?
In the long term we need to be able to answer two questions:
— Why do women form such a low percentage of the Computer Science graduates in South Africa?
— What can be done to increase the number of female Computer Science graduates?
If we can answer these questions then we can go some way towards improving the situation and producing an increased number of women Computer Science graduates.

To improve the situation we must have a good understanding of the factors which contribute to the present situation. The issue has been the subject of much research internationally and the indications are that the imbalances are due to societal issues rather than to an innate inability to cope with the demands of the discipline[18]. More research in the local context is urgently required, both into general attitudes to and expectations about computers as well as women's attitudes and expectations. If the situation in South Africa mirrors that in the rest of the world then we can benefit from the research which has been done. If there are significant differences then we must try to address these.

The next phase of our research will involve gathering information about why so few women enter our Computer Science courses. We feel it is important to determine the factors which contribute to the decision to do or not do Computer Science at university. If we know and understand these factors then we can begin to address the problems. We intend to begin by means of a questionnaire directed at all students registering for first year in the Faculty of Science in 1993. The questionnaire will be made up of two parts, one to be completed by students who are registering for Computer Science and a part for those who are not. The results obtained by analysing the questionnaires should indicate the direction to be taken in further research.

CONCLUSION
At the University of the Witwatersrand the percentage of female undergraduate students over the last 7 years has been small in comparison to the percentage of male undergraduates. This percentage mirrors the figures that occur in the United States and Britain, although the underlying causes in the South African context are not necessarily the same as those found in other countries. A more important conclusion is that the persistence rates for undergraduates and the pass rates for men and women are similar. This seems to imply that the gender imbalances which are observed in our Computer Science classes are determined by factors outside of the course and subject. Research done internationally has shown that these factors are largely societal and environmental. It is thus extremely important that research is undertaken to determine the factors which have resulted in the small number of female undergraduate students in our classes.

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