

A Sorry Tale - A Study of Women's Participation in IT Higher Education in Australia

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This paper examines long term changes in the participation of women in professionally accredited computing degree programs. It reports on the results of three intensive Australia-wide studies of the situation in the mid 1980s, in 1992 and in the late 1990s. The early study painted a detailed and rather depressing picture of women's representation in IT education. It also identified barriers to improvement in the discipline itself, the teaching institutions, and for individuals. The intervening years have seen many attempts to address these barriers in respect of both the attraction to and retention of women in IT courses. The current paper summarises the Australia wide studies and then draws upon recent localised data in contrasting environments and larger scale literature to explore how little things have changed as a result of these intervention programs.

Keywords: Computing education, women's participation in IT

CR Categories: K.3 Computer and Information Science Education, K.7 The Computing Profession

1. INTRODUCTION

There has long been concern at the shortage of IT graduates in Australia (Bennett and Kummerfeld, 1978; Bennett and Kay 1981). Although there are many ways to address this, one important possibility is to ensure that women are well represented in the IT profession.

The Picture in 1986

In 1986, a CTEC funded study looked at women's representation in professionally accredited computing courses (Kay et al, 1986 and 1989). At that stage, it captured an Australia wide snapshot of courses which had a major role in educating programmers, analysts and other professionals with a high degree of computing skill. It surveyed all departments in CAEs and Universities offering such courses.

The study had three major objectives.

- Gaining a quantitative picture of the representation of women in professionally accredited Australian computing courses. In particular, it summarised the number of women starting such courses, the number finishing and the number awarded highest grades.

- Identifying issues that students and staff perceived as relevant for the representation and success of women in such courses.

- Exploring some approaches to supporting women starting such courses.

The study also collected both quantitative and qualitative data to assist with interpreting the statistical data. A smaller number of institutions was selected for student and staff interviews. The study also involved analyses of handbooks and other materials available to students entering the courses.

Major findings on women's representation in the courses in 1984 and 1985 were:

- women constituted about a quarter to a third of the enrolments in most courses;
- at the very early stages, up to the formal enrolment deadline date, women outnumbered men three-to-two among those who discontinued;
- women were slightly less likely than men to pass in the first units;
- there were slightly fewer women at the top of the class in the first units.

However, the study found that in the graduating class of 1985, there were proportionately more women than men at the top of the class.

Overall, the statistical findings indicated problems for women in the early stages of the courses and that some aspects of teaching method, curriculum and course emphasis and orientation seemed to need attention for better outcomes for women in these early stages.

Encouragingly, those women who remained, performed well.

Explanations for these findings were explored at three levels:

1. At the disciplinary level, the study observed the commonly projected image of computing to be

- heavily technology-centred and
- reliant upon mathematics,

where those had tended to be less accessible to women and the importance of them for the discipline was frequently overrated. By contrast, other aspects commonly underrated included:

- the importance of communication and
- interpersonal skills,

areas in which women traditionally are believed to have strength.

2. At the institutional level, major issues identified were:

- effects of assumptions of students' previous computing knowledge and experience;
- effects of women's typically weaker mathematics background;
- the coverage and sequence of material within the courses;
- effects of heavy workload and scarce resources.

3. At the level of the individual, the study identified stereotypes and the attitudes and behaviours that follow from them. Important findings were:

- Women's participation appeared largely determined either before their entry to tertiary institutions or in the first few months in their courses.
- Intervention would seem more likely to succeed if it were structured and closely related to the course of study and if it occurred either immediately before or very early in the first year. An example is the orientation program by Kay and Prosser

(1989). Similarly for some years, UTS has run a three day (computer-free) orientation camp before the start of the first semester for all newly enrolled undergraduate computing students. This appears to have enhanced retention rates amongst all students but especially females.

Indeed as most authors of retention program studies have pointed out, the approaches to rethinking curriculum and teaching approaches to make computing education more female friendly, in fact improve it for all students, especially those who might be from other slightly less obvious minority groups.

In all, the study established that women were under represented in IT degrees and there were substantial barriers to a change in this situation.

2. THE PICTURE IN 1992

Cobbin's (1995) study of women's participation in non-traditional fields of study included an analysis of women's enrolment in computer science, information systems and business data processing courses. She detailed women's enrolments in such courses in each Australian university in 1988-92, and provided the representation of women nationally in the sub-fields of study. This suggested some relative growth from 1989 to 1992 in women's commencement and completion of Business Data Processing courses, a relative deterioration in women's commencements and completions in Computer Science courses, and mixed effects in the "Other" and "General" IT&T areas. As an aside, most authors in this field have commented on the disparity of classification of "Computing" courses - a process which makes it difficult to give accurate comparative figures between studies.

3. THE PICTURE IN 1999

Various papers in women in computing and computing education conferences eg Clayton et al (1996) and Greenhill et al (1996, 1997) have outlined strategies attempted by many University computing departments based on addressing some of the issues raised in earlier studies. More recently, various websites (see references) designed specifically to entice women into the IT profession and give a more accurate picture of the wide variety of careers available have appeared. However, a quantitative and qualitative study looking at under represented groups including women in Australian IT&T carried out for DETYA in 1999 (Cameron et al, 2000) shows that depressingly little has changed in the higher education sector.

Quantitatively, with the exception of scarce resources, the same barriers as those listed in the 1985 study were raised again by staff, students, high school students, teachers and industry. Women now represent some 55% of all Australian university enrolments but some 19% of IT &T enrolments. Women in IT&T have an 81% pass rate compared with the overall success rate of 75%. Slightly over one third of women in IT&T discontinue during or at the end of the first year compared with slightly under one third overall.

However, from 1992-1998 the number of women discontinuing in First Year dropped from 37% to 32% indicating that some of the strategies for retention of women might be starting to take effect.

The work of Margolis, Fisher and Miller (2000) and Blum (2001) at Carnegie-Mellon shows that some of their retention strategies such as Big Sister/Little Sister also appear to be having a positive effect. Of course, US universities unlike most Australian Universities also have the ability to select undergraduate students on attributes other than just academic results. Moreover, Carnegie-Mellon appears to be a shining light in this regard and their retention experiences are not typical of those being reported in Northern American literature, eg Camp (2001).

3.1 Vocational and Educational Training Sector (mainly TAFE)

Although approximately half of overall VET enrolments in 1998, women were, at only 17% of VET IT&T course enrolments, very much under-represented in IT&T. Furthermore, they were concentrated in low level entry modules, eg spreadsheets rather than in the higher level Associate Diploma courses. Completion rates are not available but success rates tend to show women in IT&T with success rates of approximately 5% under the overall rate for IT&T at TAFE.

3.2 Overseas

The picture in other English speaking countries is, if anything, even more dismal than in Australia. Camp (1997, 2001) shows the number of females in US Computing courses is steadily decreasing, as is the number at each level from high school to PhD. Similarly in England, the number of females in Computing courses has halved over the last decade. In contrast, however, are Mediterranean countries such as Spain and Italy where the proportion of females in IT courses is around 50%. In countries where IT has strong Government backing, eg Hong Kong and Singapore, the numbers of females are closer to 60% (Edwards (1998)).

In Australia, and particularly in universities in Sydney, an extremely high proportion of local (as well as international) females in computing courses are of Asian, particularly Chinese or Indian, backgrounds. This may be due to existing role models for women in IT in these communities but more likely appears to reflect family views on the suitability of an IT career for women, strengthened in part by the emphasis being given IT by many governments in Asian countries. This conclusion is supported by the work of von Hellens and Nielsen (2001) at Griffith University in Brisbane. While one of their hypotheses in the WinIT study was that IT is gender constructed, this was not borne out by their research. The extensive work of Margolis et al (2000) at Carnegie-Mellon draws similar conclusions (though based on a smaller sample) on both the numbers of Asian women in Computing and the fact that IT does not appear to be gender constructed.

4. A CONTRASTING LOCAL STUDY

4.1 The University of Technology, Sydney

On a more local scale - in the mid 1980s at the University of Technology, Sydney (UTS) (then NSWIT), the percentage of women commencing the computing undergraduate course varied from 26% to 44%. On the whole, more men than women discontinued during the first year but the numbers of either discontinuing in or at the end of the first year were small. Graduations were around one third female, ie commensurate with the proportion of females entering. In contrast to many institutions at the time, where Computing was an elective major in say a Science degree, the degree at UTS was essentially all computing. This may explain the low first year discontinuation rate compared with some institutions where students could make the decision each year as to whether or not to continue with Computing subjects. At UTS, students had already made the decision to study Computing for four years and either remained in it or in rare cases changed to a different degree.

Despite various initiatives aimed at attracting and retaining more females over many years, the figures from 1992-2000 are little different. Initial enrolments and completions are still around one third female. However, in recent years the proportion of females is much higher (ranging from about 50% to 88%) in the more generalised degrees, the Bachelor of Information Technology, - a scholarship degree where entry is by both very high academic ability and interview, Computing/Law and Computing/International Studies. Studies show that students believe these courses offer a broader education with a substantial proportion of non technologically based subjects. Although these courses have comparatively small quotas, unfortunately their success in attracting females has detracted from the proportion of females (now around 27%) in the straight Computing Science degree, which is normally these students' second choice.

Computing is a popular major for students from the Business Faculty. The proportion of females from these cohorts varies but is normally at least 50% especially from international students who are predominantly Asian.

4.2 The University of Sydney

It is useful to compare the position at UTS with that at University of Sydney as the two institutions represent quite different styles of courses. Where UTS students opt for relatively specialised degree programs, the University of Sydney provides many opportunities for students to undertake broad generalist degree programs. Although there are some quite vocationally oriented programs such as the Electrical Engineering (Software Engineering) course, there are also large enrolments in IT in broader courses. This includes, for example, the Bachelor of Liberal Studies where students can major in computer science but would also study Arts subjects, including languages. Even the Bachelor of Computer Science and Technology allows students considerable freedom and encourages breadth of study. Another new degree in Arts - Informatics, also encourages breadth (and has 44% female enrolment).

The style of courses at the University of Sydney means that students may do varying amounts of IT study and varying flavours of it. So, for example, the foundation

programming unit in 2001 has 30% female enrolment, and within that cohort, this varies considerably across faculties. For example among students from the Science Faculty, women constitute 35% of enrolments, in Arts 36%, in Economics 43% and in Engineering just 14%. Perhaps more disappointing is that women make up only 19% of the Advanced class. These figures are consistent with the picture each year since the early 1980s.

Given student choice in their studies, it is relevant to consider the higher year enrolments. The 2001 enrolment in a core second year unit in computer science has about 20% women but in third year core units women make up around a quarter of the class. The picture is rather different in the Information Systems units where, for example core and second year units have 33-38% women and by third year the range is higher, with women making up almost half of some units.

5. PERENNIAL ISSUES

Studies over some decades, (Kay et al, 1986 and Cameron et al, 2000) show that schools continue to play a significant role in the decisions of students, particularly females to study Information Technology. Initially, computing in schools was often associated with mathematics, which was regarded by some females as a disincentive. There were few computers, they were user unfriendly and they tended to be the domain of technically minded males. Computers are now more widespread and somewhat more user friendly. However, in co-educational schools, they are still largely the domain of male students. It is significant that at UTS, the proportion of female first year computing students in recent years from comprehensive co-educational high schools has been as low as 5%. The females choosing computing are overwhelmingly from single sex schools with a few from co-educational selective schools.

Another long standing problem is that many school teachers have still not had the opportunity to become particularly computer literate. A considerable number of school students have access to computers at home and more time to learn about computing than their teachers, though the learning is often at a fairly superficial level. The students' impression is often that computing consists of spreadsheets, wordprocessing, making webpages and surfing the Internet. They are unaware of the vast body of underlying principles that make up the discipline. In turn, they, and unfortunately their careers advisors, and even the computing teachers have little concept of the wide range of careers available in Information Technology today. Margolis et al (2000) used a substantive grant to run workshops for school teachers of advanced computing drawn from across the USA. Apart from benefitting the teachers and all students in their schools, this does appear to have helped increase the proportion of females entering Computing at Carnegie-Mellon. It was carried out with the benefit of a substantial short term grant. Will the positive effects be long term once the program has finished?

The other significant factor in females rejecting computing as a potential career is that it still has a "nerdy" and often boring image. Despite the efforts of bodies such as the

Australian Computer Society (ACS), Australian Information Industries Association (AIIA), Females in Information Technology and Telecommunications (FITT), the National Office for the Information Economy (NOIE) and individual Universities and TAFEs and some IT companies, the general public still thinks of computing in terms of a person (normally a "geeky" male) communing with his computer. The fact that many computing careers consist of working in teams and problem solving with users across a vast range of applications with the added benefits of good pay and often travel is not yet widely understood, especially by school leavers making career choices (interviews in Cameron et al, 2000 and Margolis et al, 2000). Nor is there an understanding that a computing career is not just technical skills but requires a wider education. Many employers show a preference for university IT graduates over students from the VET sector for this reason.

Industry sponsored co-operative programs with scholarships which emphasise these features attract a high proportion of females. While companies are eager to employ these graduates, they are not always as forthcoming with financial support. Governments target undergraduate places in IT. They could contribute in a more practical manner, eg with women in IT scholarships, to ensure that 50% of the population has the opportunity to participate in and contribute to the knowledge revolution.

6. CONCLUSION

The proportion of females in all IT degrees in Australia fluctuates considerably from year to year but there are no apparent trends, except that unlike say the UK or the USA, the proportion in Australia, and certainly at the University of Sydney and UTS is not dropping. Unfortunately, except for the more niche degrees, which tend to have fairly small quotas, the proportion does not seem to be rising either. The overall proportion of females entering the degrees at these two institutions seems to have reached a state of equilibrium at around one third (lower elsewhere in Australia), despite all the explicit and implicit attempts from individual institutions and industry bodies to attract more. However, the overall proportion of women graduating is now consistent with the entrance proportion suggesting that retention strategies are having some effect, albeit with the women tending to be more concentrated in the 'softer' end of the IT spectrum.

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BIOGRAPHICAL NOTES

Jenny Edwards gained a BSc, MSc and PhD, all in the Basser Department of Computer Science at the University of Sydney. She was John Bennett's second PhD student. After working at Basser for some years, she joined what is now the Faculty of IT at the University of Technology, Sydney, where she is an Associate Professor and was Head of School of Computing Sciences from 1994-2000.

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