

Women in IT – What Are the Barriers?

**Network of Women in Further Education Conference
Showcase of Strategies for Women in Education on
Information Technology Conference Paper**

Department of Education Training and Youth Affairs

**Eileen Newmarch
Sandra Taylor-Steele
Andrew Cumpston**

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Acknowledgements

This paper is drawn from

- **findings from a report by Global Learning Services commissioned by DETYA which is still in progress.**

- ***Real Time; Computer Change and Schooling*, a DETYA publication, October 1999**

- **Internal research**

Graphs are sourced from DETYA's Higher Education Student Collection (1992-98, NCVER's AVETMISS (1994-98), New South Wales Board of Studies Data on 1998 NSW HSC tertiary IT&T applications and survey done as part of Real Time Report.

The view express here do not necessarily represent the views of the Commonwealth Department of Education, Training and Youth Affairs.

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" Women in IT - What Are The Barriers?"

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1. Introduction

Today I have been invited to talk about 'Women in Information Technology - What are the Barriers'. I will focus on the barriers women face participating in Information Technology and Telecommunications (IT&T) courses and subjects in school and post-secondary education.

As you are all well aware women are not taking their share of IT&T jobs. ABS estimates place women at 20% of IT&T professionals and the situation does not appear to be improving. Given that demand for people with IT&T skills has increased rapidly over the past decade as the IT&T industry grows and faces emerging skill shortages, the failure to attract women to the industry is of major concern. IT&T jobs represent a considerable chunk of advertised job vacancies.

Addressing barriers to participation in IT&T courses and occupations for under- represented groups, such as women, will improve skills supply as well as provide these groups with access to training and employment in a fast growing and potentially well-paid industry. As a result the Department of Education and Training and Youth Affairs undertook research to look at participation in IT&T education with a view to identifying the barriers that women, and members of other under-represented groups, face to participation and the level at which those barriers exist. My presentation today is based on the research commissioned by DETYA as it relates to women and in-house research.

The under-representation of women in the industry is unlikely to change in the near future - women are markedly under-represented in both Higher Education and Vocational Education and Training IT&T courses. Although the number of women studying tertiary IT&T courses has increased this has at best only kept pace with the overall expansion of the number of students studying IT&T (between 1994 and 1998 the . The proportion of students in tertiary IT&T courses who are women has not changed significantly over the last five years - at around 19% nationally.

I would like to highlight some keys issues that have come out of our research:

1. While the numbers of girls studying computing in school are increasing, and more girls are using the Internet and email for personal reasons, they still are not interested in post-secondary IT&T courses or IT&T as a career in very high numbers,
2. Sex-role stereotyping and culture are major barriers for women in Australia – not all countries experience the same under-representation,
3. The image of the industry - seen by girls as ‘blokey’ and ‘nerdy’ - is a major problem and is ‘putting girls off’.
4. The impact of how IT&T subjects are taught in schools is a major barrier – many students find IT&T ‘boring’,

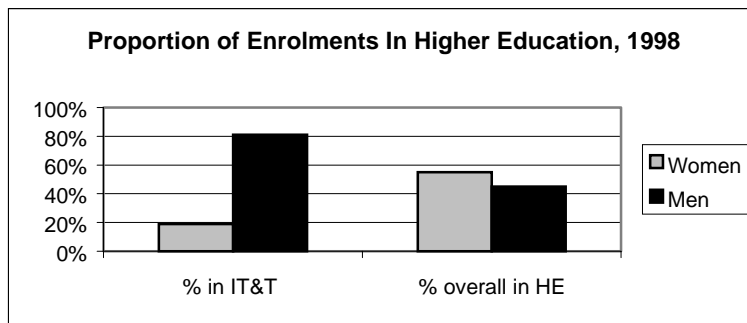
- Lack of information and an understanding of what a career in IT&T means and poor teacher knowledge of the industry - has a major influence on students understanding and perceptions of IT&T as a career. When you ask school students "what does a VET do, or an engineer?", they have no problem telling you, but when you ask them "what does someone working in the IT&T industry do?" students have great trouble answering that question.

It is clear that the school years are a key point at which these barriers need to be addressed, together with strategies in post-secondary education.

However, there are many examples of women who are successfully working in the industry and are enjoying their work. An interesting question to ask ourselves is why there not more of them?

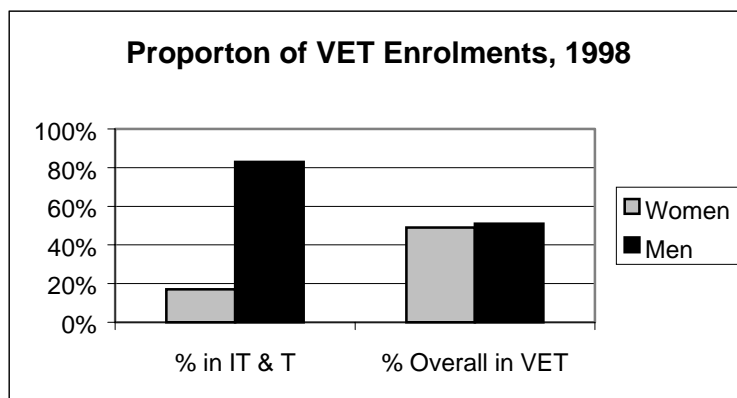
2. Overview of Data

It is well documented that females participate in higher education at slightly higher rates than men, but in IT&T that trend is dramatically reversed. In 1998 women made up about 55% of all higher education enrolments yet they constitute only 19% of IT&T commencements in Higher Education.



Source: Participation in IT&T in Education and Training-DETYA unpublished report 2000

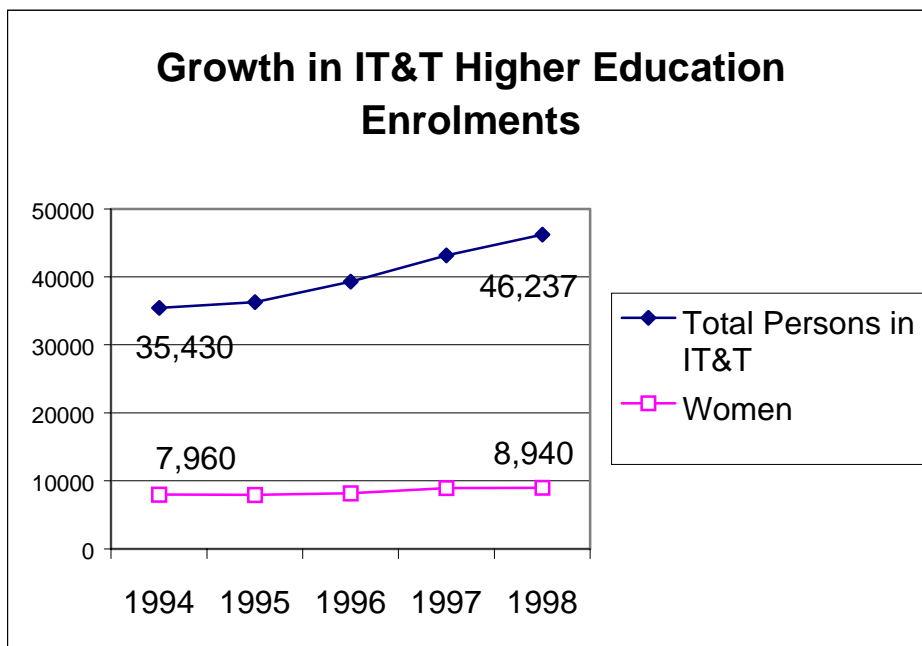
Female enrolments in the Vocational Education and Training sector show a similar trend. As with Higher Education, females constitute roughly half of the overall VET student body, yet again they only make a small proportion of IT&T enrolments, at just 17%.



There has been a slow increase in the number of female enrolments in Higher Education IT&T courses. Between 1994 and 1998 Higher Education commencements increased from around seven thousand per year to eight thousand (or by 12 per cent). However, in the same period the under

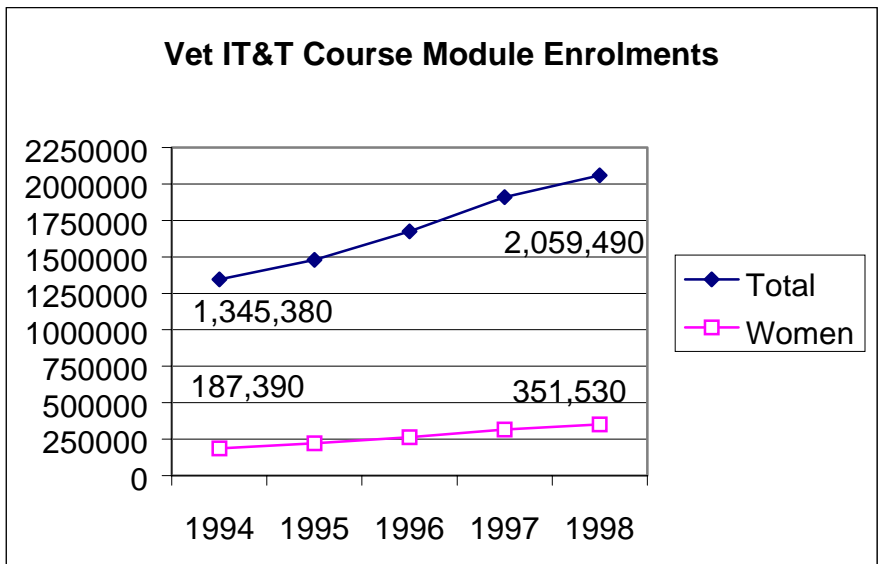
representation of women in IT & T Higher Education has actually worsened slightly. Overall enrolments in IT&T courses have been rapidly escalating at a far greater rate than the modest rate of improvement in female enrolments. Between 1994 and 1998 the total number of students enrolled in higher education IT&T courses grew by around 10,800 or 30 per cent. However females constituted only 10% of that increase.

The ultimate consequence is that the proportion of females in Higher Education IT&T courses has actually slightly deteriorated between 1994 and 1998, from 22% to 19%. There is however, some variation between universities in the proportion of women in IT&T courses, ranging from around 12% to 33% in 1997. Clearly whatever the factors behind the large gender imbalance in IT & T study, they are not improving.



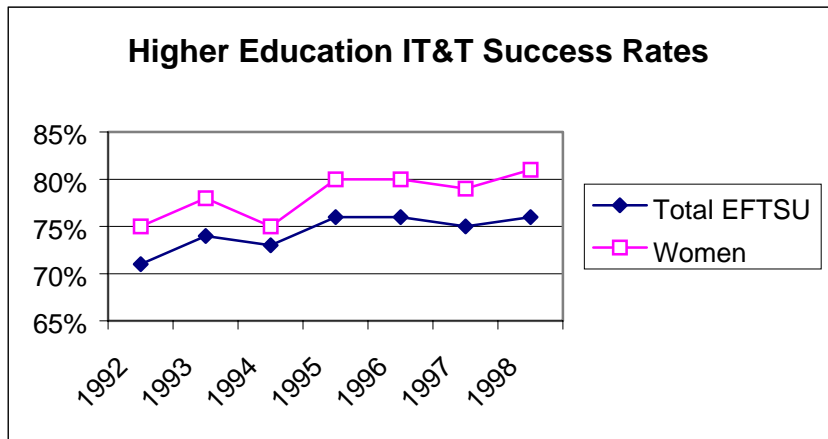
In the VET sector the trends are slightly different but the overall picture of female under-representation is the same. Total enrolments in VET IT&T courses have increased significantly since 1994 and so have female enrolments. In contrast to higher education, the proportion of women in VET IT&T courses has actually increased over the past 5 years. However the base level of female enrolments was very low. In 1994 14% of all IT&T course module enrolments were women, in 1998 that figure had increased to 17%, but is still lower than the 19% for Higher Education.

The basic point remains the same in both education sectors, at best females only make up around 19% of all enrolments. Further there is no indication from present trends that without a conscious effort to increase their participation, the gender balance in either sector will be equalised any time in the immediate future.

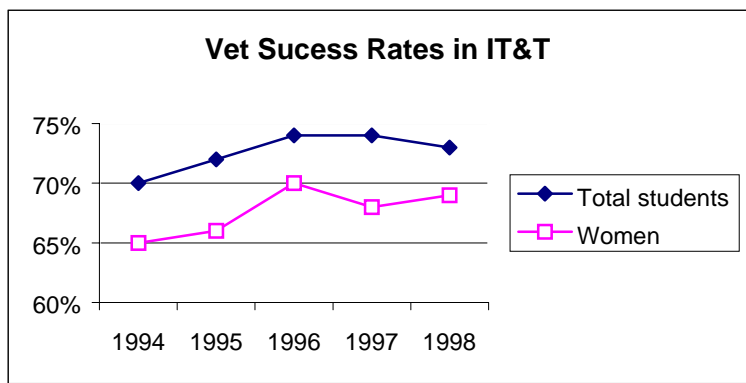


One issue we investigated was whether we were losing female students after they commenced tertiary studies in IT&T. We found that this was not a major factor contributing to their under-representation in the industry.

In Higher Education IT & T courses, females pass the units they enrol in at a higher rate than the student body in general.



In the VET sector women have a slightly lower pass rate than the student body as a whole.



While the difference in female's pass rates compared with all students is within 5%, which does not constitute a major disparity the reason why females in the VET sector are less successful than those in the Higher Education sector is unclear.

Further, it is frequently commented that females drop out at a high rate from IT & T courses. In Higher Education the disparity between females and the wider student body in first-year drop out rates is only about 3%. Clearly issues of success and retention rates are far less significant than the substantial gender imbalance in enrolment numbers.

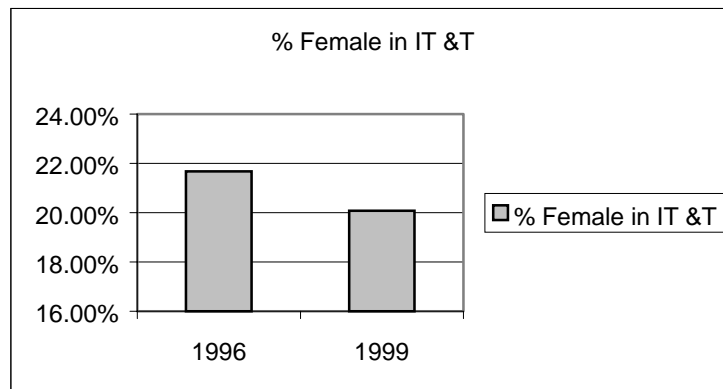
The issue for women once they get into tertiary IT&T courses is more related to the level of course they are completing, particularly in the VET sector. A study of *Women and Computers* in the New England Region of NSW in 1998, surveyed around 500 students in VET IT&T courses. The study found that although women were initially well represented in introductory IT courses, female students do not continue to study IT in proportionate numbers at higher qualification levels. In the study commissioned by DETYA it was found that about half the women in IT&T VET courses were in lower skill modules and in the 30 plus age group

The level of female representation in high school IT&T courses varies across States. It is difficult to compare States because there is no standard definition of IT&T subjects. Even so figures obtained from a DETYA study on Educational Performance suggest that the proportion of females in IT subjects, is much higher in Victoria than NSW.



Not surprisingly the educational imbalance in IT&T training is translating into imbalance in the workforce. The IT&T sector tends to cut across traditional employment sectors so trying to determine the exact proportion of IT professionals who are women is, at best, hazy but ABS estimates place female employment in the industry at about 20%. The proportion of women in the industry has not been improving, since 1996 this proportion has been stable, or even declined slightly.

Chart Women as a proportion of total employment in IT&T



3. Barriers

The under representation of women in IT &T appears to be a construct of certain cultures. In a number of countries computing can be a gender neutral profession. Both the United States and Britain have poor levels of female enrolment in IT&T coursesⁱ. The United States and Australia have similar patterns of under representation of women in IT, women make up just 18% of the US IT workforceⁱⁱ. However in certain Mediterranean and Asian countries females make a large proportion of enrolments in IT courses. Almost 50% of IT&T enrolments in Spain and Portugal are female while in Malaysia and Singapore almost 60% are femaleⁱⁱⁱ.

Sex-Role Stereotyping

The existing predominance of men in the industry has created a series of factors which discourage young women to pursue careers in IT&T. IT&T careers in Australia have always been stereotypically male pursuits. Men in IT&T unconsciously are more prepared to be mentors for male rather than female students. Parents are more likely to buy computers for boys than girls because they are more likely to believe that male children will have a future career in IT&T^{iv}. Around 32 per cent of boys own their own computer compared with 23 per cent of girls. Female teachers (especially those aged over 50) have lower levels of computer skills (both basic and advanced) than male teachers and are less confident in using the web and email^v.

When asked to nominate the most influential factors over their career choices Year 11 students nominated parents and role models^{vi}. There is a lack of appropriate female role models working in IT and if there is a household role model involved in IT they are far more likely to be male^{vii}.

The design of software has tended to be targeted to boys with educational and recreational software is still designed to suit boys, rather than girls. Computer games, which encourage children to become familiar with computers, are generally based around masculine themes like war, crime and male sports. Even programs that are designed to be gender neutral were more likely to be similar to those designed for boys than for girls^{viii}.

The Image of the Industry

There is a general misunderstanding in the community about what an IT professional does. When female IT professionals are asked what is the reason for the gender imbalance in IT they most frequently attribute it to misconception of what a career in IT is actually like. IT&T jobs have developed and changed dramatically over the last decade so it is particularly susceptible to cultural fallacy and false typecasting. The most common stereotype of a IT professional is a nerdy male dressed in a short sleeved shirt and tie who completely lacks social skills. Popular culture plays to the stereotype, hackers in television and film are usually quirky loners, for example the computer experts

in the X-files (all male) are technically adept but painfully geeky, comic relief from Mulder and Scully who have the real jobs, FBI investigators. Surveys of high school students confirm that impression, they believe that careers in IT are lonely and dull with little human interaction^{ix}. The way IT subjects is taught in universities and schools tend to confirm this notion.

Issue relating to access and experience

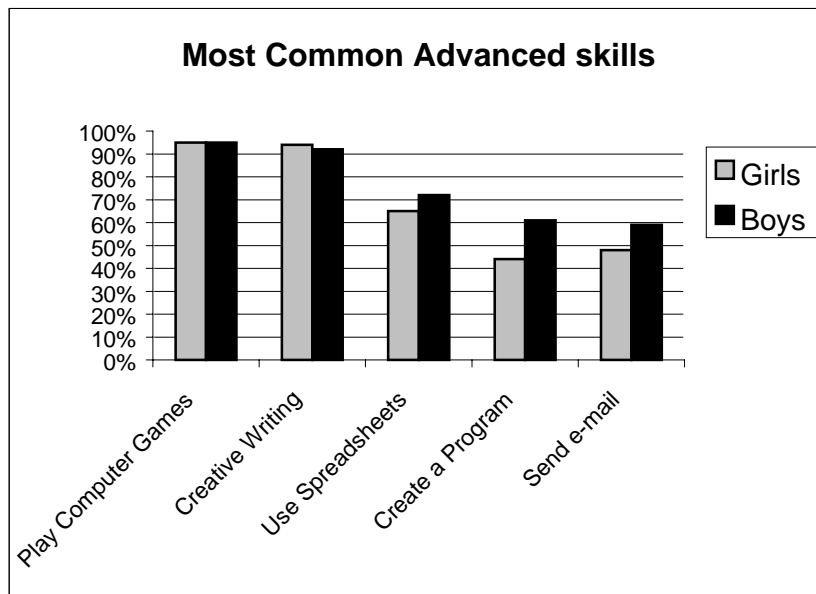
Although access to computers and competency has improved markedly for girls, they continue to be disadvantaged in their access and use of information technology in schools and in the home.

Earlier research found that boys are more likely to use computers at an earlier age in schools, boys tend to monopolise access to computers, computer rooms often become 'boys clubs' and girls are intimidated to enter what they perceive to be a male domain

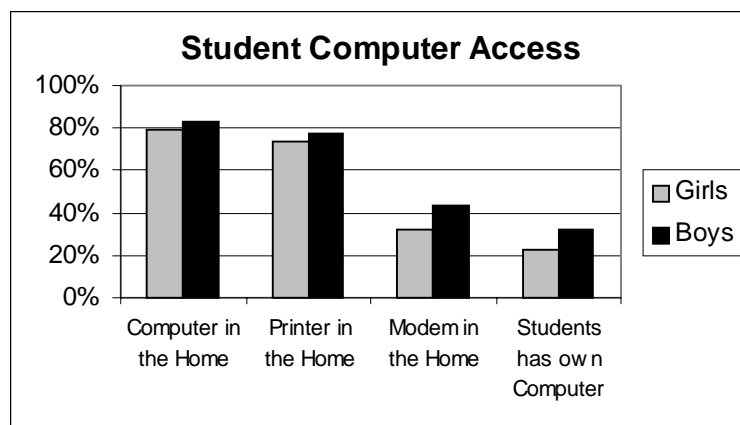
However, the recent study Real Time found that the majority of girls are using computers and that by the end of junior secondary school 71 per cent of girls have all 13 basic skills required to operate a computer (compared with 83 per cent of boys having the same level of skill).

Basic Computer Skills		
Core skill	Girls	Boys
	%	%
Use a mouse	99	98
Turn on a computer	99	98
Use a keyboard	99	98
Shut down and turn off	98	98
Exit/quit a programme	98	98
Save a document	95	95
Print a document	96	96
Start a programme	96	96
Open a saved document	94	95
Delete files	83	90
Data from CD-ROM or floppy	83	89
Create a new document	83	87
Move files	73	84

When it comes to more advanced levels of skills females are further behind with only 15 per cent of girls possessing all the more advanced skills compared with 29 per cent of boys.



The Real Time study also showed that while girls were only slightly less likely than boys to have a computer at home (79 per cent compared to 83 per cent) that boys were much more likely to have access to a modem and to own their own computer than girls were.



Furthermore, when it came to acquiring computer skills such as basic programming, boys were more likely than girls to obtain these skills at home. For those advanced skills where the proportion of boys acquiring the skills is appreciably higher than girls, boys were much more likely to acquire the skills at home with girls not learning more at school to compensate for this.

Once in the school environment girls are consequently less confident in their computing abilities and more easily discouraged from learning further computer skills^x.

Studies have shown boys are more prepared to take risks while learning to use computers, they utilise a broader range of programs and thus gain a more diverse range of experience with computers. Because boys spend a greater time attempting new tasks so they tend to attract greater teacher attention^{xi}.

Teaching and Curriculum

How IT&T is taught and used in schools has a major impact on girls attitudes towards IT&T. Although girls are now expressing a greater interest in using computers for their own purposes, such as internet surfing and school work, at around ages 15-16 girls appear to lose interest. Girls' computer knowledge and use is almost as high as boys in school but something is causing girls to drop out of IT&T in the later years of high school.

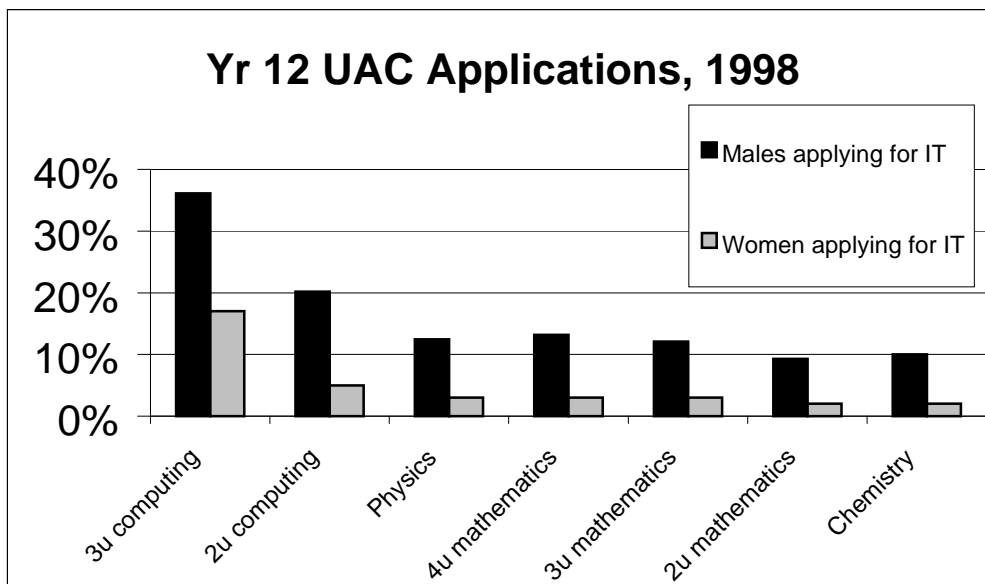
The way IT&T subjects in years 9 and 10 are taught in schools appears to be a major disincentive for girls to continue IT&T studies. These subjects are often poorly taught, usually by teachers who do not have computer science backgrounds. Most participants in focus groups had a negative attitude to IT courses which were widely described as too theoretical, rigidly structured and boring. While both boys and girls made these comments, the teaching methods adopted seemed to have a greater negative impact on the girls. Many traditional subjects could include some IT&T activities as part of their curriculum but teachers who are unfamiliar with IT&T are reluctant to do so. Interestingly, it should be noted that at UTS which has one of the highest Australian participation rates of women in undergraduate courses, over 90 per cent of female undergraduates went to an all girls school.

Particular teaching methods used may have a greater negative impact on girls. Girls consider working on individual projects to be less rewarding and satisfying than working on group projects, which involve relationships with other people. Amongst university staff there is anecdotal evidence to confirm this. The introduction of IT&T in schools is discouraging girls from higher study in IT^{xii}. Girls react far more positively to IT&T subjects if the curriculum includes group work and co-operative assignments rather than individual assignments. Further much of computer studies in schools focuses around the use of particular software packages, which many young women associate with secretarial work.

Some evidence exists to suggest teachers appear to react differently to boys and girls while teaching information technology subjects. Boys receive more positive feedback from teachers for their work. Teachers are more inclined to encourage boys to solve problems for themselves, but with girls teachers do the problem for them. This reinforces girl's lack of confidence and their image of computing as not being a suitable option for them.

Subject choice has a large influence on choosing to apply for IT courses. The subjects that most commonly lead to Higher Education IT&T study are the higher computer and mathematical subjects. These are the subjects which much larger numbers of males do compared with females, girls are more likely to enrol in English and Linguistic subjects. . In NSW in 1998, girls made up only 20 per cent of those who took 3 unit computing, 35 per cent of those who took 2 unit computing, 34 per cent of those who took 4 unit mathematics and 43 per cent of those who took 3 unit mathematics.

Most IT courses only have high mathematical prerequisites or assumed knowledge, but because programming is language based, ability in Linguistics can be equally useful^{xiii}. The choice of prerequisite subjects by higher educational institutions ignores that a solid background in both maths and English skills is important in developing computer skills.



Significantly, amongst student studying high school subject that tend to lead onto higher education IT study, for example computing and mathematics, females are still less likely than males to continue their IT studies into university. For example in NSW 27% of all HSC students studying 3rd unit computing in 1998 applied for entry into IT courses as their 1st UAC preference but only 17% of women studying 3rd unit computing did so. This pattern holds for all the courses which have high levels of enrolment in IT.

Clearly teaching and curriculum in schools and post-secondary education is not the only factor discouraging females entering information technology study.

The Myth and Reality of IT&T Careers

When asked what they desired in a career young women indicated they wanted things like human interaction, variety, communication, working with colleagues and job satisfaction, all qualities which stereotypically IT careers lack. When DETYA commission focus groups to investigate students attitudes towards IT we found that few girls expressed any interest in careers in IT, because of the image they held of careers in the industry. Most people in a position to advise students; teachers, parents and careers advisors are on-the-whole ill qualified to be able to tell students what a career in IT is really like.

The reality of IT careers is actually quite different to the perception. Amongst the major employers of IT professionals while there is a requirement for computer skills such as programming and systems analysis, there is a far greater emphasis is being placed upon broad business, teamwork and communication skills^{xiv}. Women already working in IT find that they spend little time actually at their computer and much more time working in teams, directing, managing and interacting with clients. If girls had a more accurate perception of what is involved in a IT career then they would probably be far more likely to consider studying it after school. The irony is that what female school children express as the desired attributes of their future career, human interaction, teamwork, etc is actually what the reality of most IT careers are like.

Teachers, careers advisors and parents are usually ill-equipped to advise students on what careers in IT really involve because their knowledge of IT employment is usually no better than their students.

4. Addressing the problem

Over the last decade educational institutions and the Government have implemented a range of strategies to increase the participation of women in IT&T. However it is clear that more work needs to be undertaken to increase the number of women in the industry.

Importance of a focus on the school years

The major barriers to students contemplating an IT&T career are set in late primary/lower secondary schools. When considering strategies to overcome these barriers a focus on the school years is extremely important, together with strategies that include parents and communities who influence attitudes of students. Strategies at the post-secondary level are also required to assist students enrol and successfully complete study and make the transition into IT&T careers.

Making the shift in perception

An issue I have raised is that getting girls to use computers is not sufficient. Strategies need to be developed that encourage girls to make the transition from using computers, studying some IT subjects at school and using the web for personal reasons, to considering IT&T as a career. This may require some reframing of the way we think about using computers and how we teach IT subjects in the classroom.

A number of factors that are ‘putting girls off’ have been identified. The research we commissioned concluded that a number of strategies to address the barriers were necessary, including:

Whole-of-School approach to teacher training and curriculum

Teachers (including IT teachers) at all levels need training in the use of Information technology to enhance classroom learning for girls and curriculum needs to be carefully reviewed to ensure IT&T is integrated.

Training and curriculum design should be reviewed to ensure that school - and post-secondary - subjects and courses build on girls interests in IT, and are responsive to their learning styles. To form the basis of these approaches girls need access to up-to-date computers in the school and ideally at home, included unstructured time ‘to experiment’.

Strategies to improve the image girls have of the industry

There is a need to improve the image of the industry as perceived by girls, while also improving careers information and education about the industry. This can be achieved through a range of methods, including the use of mentors, support networks and role models for women, communication campaigns, industry visits, attachments and summer internships.

What ever the range of approaches developed it is important that the strategy targets students from lower secondary upwards, together with teachers (not just IT teachers), school principals, careers advisers and parents to ensure that they have a contemporary understanding of the industry and relevant information. Such a strategy must also seek to respond to the dated stereotypes of the industry that are strongly evident.

In addressing the barriers for women in IT&T, industry - together with schools, universities and VET providers - must play a key role in helping students, teachers and key stakeholders acquire adequate and accurate knowledge about IT careers and how IT is used in industry. Attitudinal shifts towards careers in the industry can not be achieved by strategies focused on the education sector alone, because of the key influences of parents, families and peers on career aspirations. The relevance of

community-orientated strategies, such as community IT&T centres and networks, which may be effective in rural areas, should also be considered. Strategies should also reach girls through their usual sources of communication and entertainment.

Recent reports in Britain and America^{xv} have considered options for improving the image of the industry. These include a high profile national campaign lead by business - on-going for 5 years - and the use of the media to portray a contemporary image.

The commissioned study discussed the importance of a multi-faceted approach, as short-term, ad hoc measures are unlikely to be effective. To bring about the necessary cultural change a co-ordinated approach is important, in which links between individual strategies are carefully forged and where strategies developed incorporate the significant influence of parents, peers and the community.

5. Government Responses

The focus of the presentation so far has been to discuss our research, however I would also like to mention a number of Government initiatives that aim to increase the number of people available to enter IT&T careers, including women.

OnLine Australia is a Commonwealth Government initiative to raise awareness of the ways online technologies are changing and enhancing Australians' lives. The initiative comprises a national program of events and activities throughout last year.

WOW the women's website, *IT Girls*, a new website encouraging Year 9 – 12 schoolgirls into IT careers, *Ignite*, an IT Career Website and Women's On-Line week are all supported by Online Australia. www.onlineaustralia.net.au

The recently launched IT&T *Ignite* careers website is a collaborative initiative between Commonwealth, State and Territory Governments and the Industry IT&T Skills Task Force. (www.ignite.net.au) The site can help people kick start or develop a career in IT&T. It highlights the range of job and career opportunities with links to: jobs, education and training, graduate programs and career advice, including a section dedicated to promoting female IT&T careers.

The Commonwealth Government recently announced funding of up to up to \$5 million to help establish an Information Technology and Telecommunications (IT&T) Skills Institute.

The establishment of the Institute was first proposed at the IT&T Skills Summit last September. It is a major step towards meeting the demand for highly skilled people.

The Institute will work closely with the IT&T industry's Training Advisory Board, public and private sector education providers, State and Territory governments and other relevant organisations to ensure there are enough people with the right skills, at the right time, to fill the jobs being created in the IT&T sector. The Institute will also work to increasing community awareness of IT&T career opportunities to young people, especially women. It is expected that the Institute will commence operations in the second half of 2000. One of the Institute's key roles will be career promotion, including promoting female participation in IT&T courses and jobs.

In April 1999 the Ministerial Council for Employment, Education, Training and Youth Affairs (MCEETYA) endorsed Australia's *Common and Agreed National Goals for Schooling in the Twenty-First Century*. MCEETYA established the National Education Performance Monitoring Taskforce to

progress the national reporting of comparable educational outcomes, including information technology. The Taskforce has established a sub-group in conjunction with the EdNA Reference Committee (ERC) Schools Advisory Group to work on performance indicators in information technology.

DETYA has allocated \$77.7 million over three years to the Quality Teacher Program. The programme targets teachers who have been in the workforce for over 10 years or who are returning to work. It includes a principal focus on professional development in information technology as well as the other key learning areas of literacy, numeracy, mathematics and science. There is also a focus on pre-service education to facilitate IT teaching in schools.

DETYA has allocated \$420,000 over 3 years to the Quality Outcomes Programme for a project to examine models of teacher professional development for the integration of ICT into classroom practice. The first phase of the project is a detailed examination of existing models of pre-service education and in-service professional development, both in Australia and overseas. The second phase will focus on establishing collaborative mechanisms to share information about good practice models through a national network across all key learning areas.

A bookmark is to be distributed with the 2000 edition of the Job Guide which draws attention to occupations which have "good employment prospects in the new millennium", including Computing Professionals and Secondary Teachers in IT.

A further research project has been commissioned by the Department which looks at students' skills and competencies in ICT as they begin post-school education. The project is due for completion in June 2000.

6. Conclusion

Women's participation in post-secondary education in IT&T remains at a low level and has not changed significantly over the last five years. Although once in tertiary IT&T courses women have a success rate comparable to all students. However, women are in general taking lower level IT&T courses, particularly in the VET sector.

I have highlighted some key issues that have come out of our research in my presentation today, these include:

1. While the number of girls studying computing in school is increasing, and more girls are using the Internet and email for personal reasons, they still aren't interested in post-secondary IT&T courses or IT&T as a career in very high numbers.
2. Sex-role stereotyping and culture continue to act as significant barriers for women;
3. The image of the industry is a major problem and is 'putting girls off';
4. How IT&T subjects are taught in schools has a significant impact on girls and;
5. There is a lack of information and understanding of what a career in IT&T means;

As discussed in my introduction the school years are a key point at which these barriers need to be addressed.

Addressing these barriers involves a co-ordinated focus to improve women's participation in IT&T. It is important that strategies target schools, students, and their families, with a focus on their early secondary school years, together with post-secondary students.

ⁱ Camp, Tracy, 1997 The Incredible Shrinking Pipeline, *Communications of the ACM*, **40**, **10**: 103-110.

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- ⁱⁱ Betts, M., 1993, She Shall Overcome *Computerworld*, 27,5: 67-70
- ⁱⁱⁱ Cobbin, D, 1995, *Women's participation in Non-traditional Fields of Study at the Undergraduate Level of Higher Education 1989-1993*. DEET:
- ^{iv} *ibid*: 68
- ^v DETYA, 1999, *Real Time; Computer Change and Schooling*, a DETYA publication: executive summary, xxix
- ^{vi} Price, V. 1998, *Information Technology, Windows of Opportunity for Women*, ITITAB: 29
- ^{vii} Cobbin, D, 1995, *Women's participation in Non-traditional Fields of Study at the Undergraduate Level of Higher Education 1989-1993*. DEET: 69
- ^{viii} Huff, Charles & Cooper, Joel, 1987, Sex Bias in educational software: The effect of designer's stereotypes on the software they design. *Journal of Applied Social Psychology* , 17, 6: 519-532.
- ^{ix} Greenhill, Anita. von Hellens, Liisa. Nielsen, Sue & Pringle, R., 1997, Collaborative Practice and Computer Games: towards a new perspective on the participation of women in IT education, in *Proceedings of the Fourth Australasian Women in Computing Workshop*, University of Melbourne, Melbourne.
- ^x DETYA, 1999, *Real Time; Computer Change and Schooling*, a DETYA publication
- ^{xi} Cobbin, D, 1995, *Women's participation in Non-traditional Fields of Study at the Undergraduate Level of Higher Education 1989-1993*. DEET: 68-69
- ^{xii} *ibid*: 71
- ^{xiii} *ibid*: 70-71
- ^{xiv} *ibid*: 73-74
- ^{xv} ITCESG 1999, Office of Technology Policy 1999