THE CYBER CEILING
A Report On Gender Imbalance In Information Technology

By

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1.0 INTRODUCTION

Information Technology has brought enormous well-documented benefits to a wide range of disciplines including medicine, engineering, technology, manufacturing, communications and the sciences .The advent of the affordable mass-produced personal computer created a revolution in the business world too – but it is a revolution that has scarcely been documented. The most significant changes have occurred in the microbusiness (less than 10 employees) turning a sector historically comprising of hereditary family businesses engaged in low-tech, low-skilled enterprises into a glamorous new high-tech, high profile sector.

The Computer Science Department at Swansea University recognised the need to interact with this new phenomenon and appointed an Industry Liaison Officer as a first step in strengthening links with the local business community. This appointment led logically to the creation of the IT Wales project. IT Wales started a business support club which now has a membership of over 1200 businesses. The IT Club has been active for five years and the research potential inherent in relevant data accumulated in its records has encouraged the Computer Science Department to launch a research programme examining aspects of the pivotal role played by the advent of information technology in the development of small and micro enterprises.

This first report in the series focuses on the issue of the status of women in the UK IT industry, with particular reference to the IT Wales Business Club, to women's up-take of Computer Science as a subject at Swansea University, and to the role played by IT in local women's enterprise.

1.1 HISTORY

IT Wales Business Club was set up in 1999 to act as a forum and a networking venue for local businesses. It was anticipated that these would be IT related businesses -- and business people who used IT in the workplace. The success of the club led to the creation of ICT Forum, a fortnight-long annual celebration of the IT industry and the people who shape it. This initiative pioneered by Swansea University's Computer Science Department has since been replicated by numerous colleges and business support groups in South Wales. Both IT Wales Business Club and ICT Forum attract generous public and private sector sponsorship and support.

1.2 TRADING STRUCTURE

The IT Wales Business Club is funded by the European Regional Development Fund and holds monthly meetings on IT related subjects. Membership and attendance at meetings is free to members living/working in the designated Objective One Area. The Club also publishes an online webzine with content related to IT topics. The membership consists now of over 1,295 businesses, spread across a wide range of commercial activity, of diverse size in terms of number of employees and of turnover.

1.3 OBJECTIVES

A. The first objective of this report is to examine whether and how IT Wales Business Club reflects the prevalent gender imbalance in the IT industry sector
B. The second objective of this study is to elicit evidence from female students at the Computer Science Department in Swansea University regarding the issue of women's take-up of IT.
C. The third objective is to appraise the role of Information Technology in women's enterprise locally.

1.4 METHOD

A. This objective will be met by analysing the database of the IT Wales Club to determine the status quo relating to women members.
B. The second objective will be met by means of research carried out by a (male) student in the department, supervised by Dr Monika Seisenberger also of the Computer Science Department and by means of a group discussion with female first and second-year students, seeking spontaneous responses structured on the same questionnaire as appears on the website viz http//gissues.tripod.com

C. The third objective is met by a survey of a small sample of local businesswomen who are not members of the IT Wales Business Club – in order to collect data for future marketing strategies for the club. Two detailed case studies and six shorter one-to-one interviews with businesswomen who are not members have been carried out to meet this objective.

This report is a practical report, based mainly on actual conversations. All conclusions drawn are from first-hand information and analysis of current records. Some pertinent and interesting websites have been raided but on the whole web-based information is too prolific, too accessible, and too facile and the results are pre-digested and likely to be glib. In any event, most of the website information is out of date and lacks the local bias that makes this study so pertinent.

2.0 IS GENDER IMBALANCE WIDESPREAD IN THE UK IT INDUSTRY?

Perhaps the most informative and comprehensive source for general background facts on the subject was yielded by Hansard from a 2002 debate led by the then Minister for E-Commerce and Competitiveness Mr. Douglas Alexander: "Information and communications technologies are perhaps the defining technologies of our generation, and to an increasing extent they pervade our lives and work.

"Current estimates suggest that servicing the nation's ever-increasing demand for ICT provides jobs for more than 1 million people in the United Kingdom, but when one examines the profile of the IT work force, one is immediately struck by how few women work in the industry. Women comprise nearly half of the overall work force and slightly more than half of the population, but they account for only one fifth of the work force in IT—sadly, that is a declining trend—and for less than 10 per cent. of high-value-added jobs such as software engineering.

"That is highly disadvantageous to women, because it means that they miss out on opportunities to earn the higher wages available in the IT sector. That is arguably another facet of the digital divide that, unless it is bridged, threatens to entrench inequalities between the sexes and within communities. It is also disadvantageous to business and to the wider economy.

"An IT industry dominated by men harnesses only half of the talent and creativity available. That is a cause for concern in an industry that, despite current economic conditions, will in the long term have a growing demand for skilled labour. The Institute for Employment Research has forecast that, through a combination of expansion and replacement demand, the IT, electronics and communications industries will need more than 1 million people to fill jobs between 1999 and 2010.

"………. recent research commissioned by the DTI, the Department for Education and Skills and the women's unit on women's participation in IT learning and employment, entitled "Women in ITEC Courses and Careers"….. covers women's participation in IT, electronics and communications. It reveals that compared to a number of other countries, including the USA, Canada and Ireland, the UK is not performing especially well in terms of the proportion of women working in IT and related high-tech industries: for example, in the US, women account for a fifth of the high-skill, technical roles in those industries, whereas the figure for the UK is only 9 per cent., with far more women taking lower skilled, non-professional occupations."

2.1 EMINENT WOMEN IN COMPUTING HISTORY

Yet, the history of computing reveals some distinguished contributions by British women. In a web page developed as part of the **ACM's Committee on Women in Computing (ACM-W)** Ambassador Project, entitled 'Women in the History of Computing' the following mentions are made:

Lady Ada Lovelace Thought by many to have written the first ever computer program, calculating Bernoulli numbers. Wrote an analysis of Babbage's Analytical engine.

Admiral Grace Hopper Was a programmer on one of the first computers in the 2nd World War. Later she invented the computer compiler and this lead to the first 'high' level language 'COBOL'.

Adele Goldstine Wrote the manual for one of the first computers, being one of the first programmers in the world

Edith Clarke One of the first women electrical engineers. Designed and patented the first graphical calculator.

Erna Hoover Invented the computerised telephone switching mechanism

Rozsa Peter Founder of recursive function theory

2.2 QUEEN BEES AT WORK?

Whatever happened to the impetus given by these female pioneers? Has the dreaded 'Queen Bee Syndrome' been at work, undermining the achievements of aspiring women? The Times in an article entitled 'Office Queen Bees Hold Back Women's Careers' by Roger Dobson and Will Iredale published on 31.12.06 declares that 'Women bosses are significantly more likely than men to discriminate against female employees.'

The article was a report on research carried out by Rocio Garcia-Retamero, a psychologist at the Max Planck Institute in Berlin and lead author of the study. The findings, based on experiments carried out among more than 700 people suggest that the 'Queen Bee Syndrome' of female rivalry in the workplace may sometimes be as important as sexism in holding back women's careers. The study says : Female participants had a stronger tendency than male participants to view the female candidates as less qualified than the male candidate….they also thought that the female candidate would fare worse in the future in her job than the male candidate.

This view is endorsed by celebrated City financier Mrs Nicola Horlick. 'Some women look on other women as a threat and prefer to surround themselves with men. It is called the 'queen bee syndrome,' she said. 'I have seen women in managerial positions discriminating against other women, possibly because they like to be the only female manager or woman in the workplace.' The article goes on to quote Katherine Rake, director of the Fawcett Society which campaigns for sexual equality. Katherine Rake said that stereotyping was more important than female rivalry in holding back women's careers."

Whatever the cause the fact remains that women in the UK lag behind men in the field of Computer Science and IT

2.3 FURTHER EVIDENCE

Further evidence is provided in this extract from BBC online news: Even though women make half of the UK's overall workforce, the number employed in technology industries fell from 27% in 1997 to 21% in 2005,

according to the Office of National Statistics (ONS). Jackie Edwards, a lecturer from De Montfort University from Leicester, works for the Women's Access to Information Technology (WAIT) course at De Montfort University - a one-year course that gives women the technology skills they need to go on to do a degree or get a job.

"WAIT is for women who have no qualifications, who perhaps flunked out at school, who perhaps didn't achieve what they should have done, but who have got some potential but don't really know how to start to get back onto the career ladder."

It is free and attracts women between the ages of 19 and 65 from all walks of life, and graduates have gone on to a range of careers in IT. Part of her job, she says, is to visit local communities to try and persuade more women to get involved in technology and to consider joining the WAIT scheme. For Jackie, getting more women into technology is vital - currently only 22% of the IT workforce are women.

2.4 RETAINING WOMEN IN IT
Equally, the following report from BBC News Online on 8.9.05 is significant in its implications as well as its impact:
The UK's technology industry must do more to keep women within its folds if it wants long-term success, according to a report by Intellect, the hi-tech trade group. This research, by Intellect and the Department of Trade and Industry (DTI), said there was an "old boys club" in parts of the industry. Action was needed to ensure that all was being done to recruit, motivate and retain women in hi-tech work. It concluded there should be more equality and support in the workplace. The report said women left the industry because of long hours, few networking opportunities and a perceived male-domination of hi-tech industry culture.
Those who work part-time said they were not given the same responsibilities or opportunities as full-time colleagues. Many women questioned reported that they would be more inclined to stay if there was less pressure to work long hours in a full-time role.

2.5 VITAL FOR THE UK

"It is vital for the UK's productivity and competitiveness that the IT industry harnesses all of its skilled labour force potential," said Meg Munn, DTI Deputy Minister for Women and Equality. "To meet the continuing growth

in the use of IT, we need to encourage more people to consider IT related careers - and ensure that professional women in this sector are able to contribute fully at all stages in their career."

Office of National Statistics (ONS) figures show that the number of women employed in technology industries fell from 27% in 1997 to 21% in 2005. Microsoft chief, Bill Gates, also recently lamented the lack of women working in the fields of technology and computer engineering. Only 17% of students starting computer science degrees are women and the majority are from overseas.

The British Computer Society (BCS) also reported that 28% of UK organisations do not employ women technologists.

One organisation working to get women back into science, engineering and technology careers is the UK Resource Centre for Women in SET (Science, engineering and technology). The centre, which has an active presence locally in Wales, is a key part of the UK government's 10-year investment framework in science and innovation. It works with employers and SET experts to provide support, training, mentoring schemes, and information. One of the centre's aims is to see 40% of women sitting on industry and academic boards in senior positions in three years' time, or less. A charter for women in science, engineering and technology was also launched in June 2005 to help tackle gender inequalities in UK universities. The six-point charter, launched by the Athena Project and the Scientific Women's Academic Network (Swan), aims to stem the loss of women scientists."

2.6 STATUS QUO FROM UCAS

To sum up the status quo is as follows, contained in the following information derived from data on UCAS applications from 2000 to 2005:

In 2000, a total of 24,151 applications were received in the UK for places in Computer Science: 4,488 of these were women. In Wales, in the same year, the number of applicants was 819 of which 111 were women.

In 2005, a total of 13,650 applications were received by UCAS in the UK for places in Computer Science: 1,638 of these were women. In Wales in the same year, the number of applicants was 424, of which 36 were women.

The percentages of women applicants has been dropping steadily from 18% in 2000 to 12% in 2005

3. 0 THE SITUATION INTERNATIONALLY

It is appropriate at this point to briefly review some aspects of the situation in other countries. The difficulty of finding any information on gender imbalance from some countries, notably India, could point to the fact that the existence of gender imbalance in the field of Information Technology is too low to be noteworthy. On the other hand the change in demographic profile in China (BBC News Online Thursday, 6 January, 2005) caused by the 'one family, one child' policy and the preference for the retention of male foetuses inevitably leads to male domination in every aspect of life. The China Daily admitted the one child policy had been badly applied in some places. It did not give any details, though rights groups overseas accuse the authorities of forcing women to have abortions. One hundred and twenty boys are now registered as born for every 100 girl babies. The consequent distortion of gender composition is a recent phenomenon which makes it impossible to accurately assess gender imbalance issues in the IT sector in China.

3.1 USA

The situation in the USA does not appear to be much of an improvement on the UK. Gayle Laakmann, an employee of Microsoft in the US says in her article 'Women in Computer Science' (27.10.05):

'Being a woman in computer science, I can't deny that I've seen some sexism over the years. Not the blatant "you can't do this" sexism that was prevalent thirty years ago, but rather subtle assumptions from people within the industry

 'The Male / Female Ratio in Computer Science

'I believe Computer Science is currently around 15% female. That figure alone doesn't worry me (hey, times change, it'll grow, right?). The problem is that the number has actually *declined* since 1980. Yikes. Furthermore, I've been told by several people that parts of Asia (see below) actually have very close to a 50/50 ratio. Why does the US lag so much? Additionally, recall that fields such as medicine and law were at one point in time a male dominated field, but now have at least as many women as men - if not more.

So while things have gotten better in other fields or in other countries, it seems to have gotten worse within the US. So, yes, there is a problem... and time isn't just magically fixing it.'

Blog response by Sathish | RE: Women in Computer Science Sunday, January 29, 2006 2:23:43 pm. 'In Indian based off shoring companies - I notice a trend that - there is almost 50 -50 ratio in new joinees. But, as years progress; most women seem to be switching to Management positions in the organisation compared to men. (at least the trend in the Indian based off shoring companies). By end of my 8 years working, most of the women in my original fresher's batch have moved to management positions, but, there are more than 30-50 % of men who preferred to stay in technical line."

3.2 INDIA

India has become a major player in the international IT scene – it is therefore pertinent to examine the issue of (lack of) gender imbalance in greater detail.

Women's Programme Professor Karuna Chanana of Jawaharlal Nehru University looks at Indian women's disciplinary choices.
(This article is based on a full-length article published in 1999.)* 'The tendency for women to cluster in general disciplines which do not lead to specializations and professional occupations is also reflected at the institutional level. This is more applicable to specialisations within engineering and technology courses. Parikh and Sukhatme (1992) mention that there are fewer women students in the Institutes of Technology, the apex engineering institutes, and regional engineering colleges (1992). In addition, electronics is the most preferred specialisation followed by electrical and civil engineering, computer science, chemical and mechanical engineering follow in that order.

'Emerging Disciplines and Globalisation: The enlargement of educational choices in the mid-nineties in the post-liberalisation phase is related to market demand. It has spread a little more to engineering and law but also to management oriented and computer oriented courses. These are being started in a large number of private and hurriedly setup unrecognised institutes. Although separate statistics are not available for these courses, informal discussions with experts in the universities have revealed that the courses on computer applications and (software) engineering in the universities are registering a higher enrolment of women. But computer

courses are also of varying kinds. It will have to be seen whether women are joining highly specialized courses leading to upper end jobs or only train as data entry operators.'

3.2.1 FIRST HAND COMMENT

John Pettedson, an Indian IT employee at a multinational IT giant in the UK comments, "Women would definitely be more in IT both work and studies compared to men in India because computer science is a feminine discipline of engineering where men though much interested in computer science and information technology would prefer to study mechanical, civil, production, instrumentation etc. However the above is just my view and my view is with respect to the trend in the later Nineties when I was a student in Kerala State."

3.2.2 FROM THE PRIMARY SOURCE

John has provided the only gender based figures from India that I have been able to find. These were compiled especially for this paper by two local colleges in South India. The Department of Computer Science at the Nesamony Memorial Christian College in Kerala wrote, 'From 1988 onwards there are 648 students completed their undergraduate degree in Computer Science. Among this 375 (57.8%) were women candidates.'

The Department of Computer Applications at the same college has provided figures that show a consistent female uptake of over 50% every year over a 10 year period from 1997 to 2006. There is no reason to doubt that this situation is replicated all over the sub continent

3.2.3 INDIAN WOMEN THRONG US IT SECTOR
Journalist Sreejiraj Eluvangal in Mumbai (April 11, 2006) writes: "Indian women march into America's InfoTech campuses.

"Indian men have been walking the corridors of high technology in US for quite a few years now. It is now the turn of the Indian women. In a head-turning spectacle, Indian women have emerged as the largest non-US group in the list of recipients of the prestigious Anita Borg scholarships for female computer-science students in US universities, announced recently. They have managed to bag 10 of the 47scholarships on offer. While four of the 19 girl-students who won the $10,000 scholarship this year are Indian, even the

28 finalists who won consolations of $1,000 contain no less than six Indian names The Indian girls have left behind their Chinese counterparts who had to be content with a total of eight selections, all in the "finalists" list. The 19 winners (including four Indians) were selected from 90 universities across the US.

www.rediff.com/money/2006/apr/11us.htm - 31k

3.3 GERMANY

In direct contrast, but of considerable significance, are these off-the-cuff observations made in the course of a telephone conversation, by Pawel Wojcik, a senior manager in Maxdata, the giant pan European IT software developer and hardware manufacturer. "Although I have not consulted the statistics, I can see that the number of female employees in the IT sector is at a minimum --- and there seems to be no change in sight. The number of female job-experience applications is zero at the moment, at least for Maxdata in the German towns of Marl and Aachen. IT does not seem to be a field of interest for women."

(Readers interested in information for other European countries are referred to www.eustatistics.gov.uk)

4.0 OBJECTIVE ONE

4.1 GENDER IMBALANCE REVEALED BY THE IT WALES CLUB MEMBERSHIP DATA

Records of the IT Club have been kept for the 5 years of its existence, both manually and electronically, providing considerable detail and are a goldmine of information. Of the 1,296 members of the IT Wales Business Club, only 483 are women.

4.2 WHAT'S IN A NAME? GROUPING OF MEMBERS BY TITLE

When registering for membership, women had a choice of title on the form viz Dr/ Miss/ Ms/ Mrs. Each member made clear choices in each case. There is no doubt a profound psychological explanation driving the selection of title; for me the implications are simple -- women using the title of Dr were proud of their accomplishment in having a doctorate and happy to proclaim it to the world (many men with non-medical doctorates do not use the title,

with the exception of Europeans particularly Germans who would regard its omission as a slight.)

Using the title of Miss is quite an assertive choice, given that the ambiguous option of Ms is available. Only 78 members opted for Miss, while 239 chose Ms. The use of Miss serves to emphasise that the member is definitely single, definitely has no family ties to hold back her career and has no inhibitions about proclaiming her single state.

There is no choice about the title Mrs –in the UK (not in Germany and a few other European countries where middle-aged women are given the courtesy title of Mrs). Mrs is uncompromising. It signifies married status with all the accompanying constraints on personal freedom caused by domestic impedimenta and family obligations. A member with the title Mrs would find instant understanding if she missed meetings and had a low attendance record for IT Business Club events.

The title Ms was selected by 239 members. It is a neutral title, much in use by women in business and the workplace because it offers the minimum personal data --- the sort of data that might prejudice promotion or even selection for appointment to a post. By using Ms, women feel on a par with men --- Ms equates with the male Mr Certainly the use of the title Ms implies a modern, aware woman with a strong sense of privacy and a strong instinct for self preservation.

4.3 FUTHER DETAILS OF WOMEN MEMBERS

Group A:

- There are only 6 women with the title of Dr (There are 33 male members with this title)
- 3 of these women Doctors work in IT roles
- 4 of the women doctors work in microbusinesses
- 1 works in a company employing more than 10 staff
- 3 of these women work/live in cities, 3 in towns or villages

Group B:

- 78 of the women members bear the title 'Miss'
- 25 of these women work in companies identifiable as IT companies
- 46 of these women work in microbusinesses

- 34 work in companies employing more than 10 staff
- 43 women in this group work/live in cities;36 in towns or villages

Group C:

- 127 women members bear the title 'Mrs'
- 49 of these women work in identifiably IT related companies
- 91 women in this group work in microbusinesses
- 31 work in companies employing more than 10 staff
- 38 women in this group work/live in cities;79 in towns or villages

Group D :

- 239 women members use the title 'Ms'
- 29 of these women work in companies identifiable as IT companies
- 67 work in microbusinesses
- 35 work in companies employing more than 10 staff
- 53 women in this group live in cities; 186 in towns or villages

4.4 EVENTS ATTENDANCE DATA

Records of the events held by the IT Club have also been maintained for the 5 years of its existence, partly manually and partly electronically. These records reinforce the disparity between male and female members. This sample of 12 consecutive months from October 2004 to October 2005 lucidly illustrates the overall attendance pattern in gender terms. Only one meeting -- apart from the event on International Women's Day which was aimed at women ---- had an attendance of 50% (28.7.05)

EVENT   DATE   TOTAL ATTENDANCE   WOMEN ATTENDING

2004   (members and guests)

1. Online Marketplace (EBay etc)   7.10.04   43
   7 women
2. Integrated Business Systems   4.11.04   15
   2 women

3. In Business with Broadband (Swansea)	24.11.04	12
3 women		
4. Computers, Commerce and Crime	25.11.04	25
6 women		
5. In Business with Broadband (Neath)	26.11.04	21
7 women		

2005

6. Tackling Cyber crime	20.1.05	15
3 women		
7. Networks – The next Generation	27.1.05	33
6 women		
8. R&D Project Programme	10.2.05	71
15 women		
9. Women Shaping the Future of Wales	8.3.05	88
78 women		
10. Google Adwords	15.3.05	38
11 women		
11. EBay Workshop	14.4.05	45
14 women		
12. Wireless Technology	28.4.05	34
8 women		
13. Small Office Network	12.5.05	24
9 women		
14. Launch of webPro Wales	26.5.05	35
12 women		
15. Open Source Opportunities	16.6.05	23
4 women		
16. Wireless Networks	14.7.05	20
8 women		
17. Anti-piracy Technology	28.7.05	26
13 women		
18. Applying Science of Software Technology	6.9.05	34
7 women		
19. Using PR	13.10.05	22
7 women		

4.5 REMARKS

The subject matter of the event does not appear to have a significant influence on female attendance. Female attendance remains well below 50% throughout. It is possible that other factors come into play such as the timing of events, the day of the week, the venue and the length of the event. Clearly, a survey of all women members to determine the main causes of non-attendance is absolutely essential as a first step in redressing the gender imbalance within the club itself. It is strongly recommended that such a survey is carried out at the earliest as a pioneering move.

The topics are all of a high quality with significant didactic content. If the meetings could achieve 'continuous professional development' status, more women might be inspired to attend as a sound career move.

5.0 LOCAL DATA ON BUSINESSES

This is a count of enterprises that are active in Swansea, including multi-region enterprises registered outside Swansea. The data also includes estimates for the very small businesses that operate below the VAT threshold (unregistered enterprises)

Size Band Analysis of Enterprises Active in Swansea 2003

- Micro (0-9 employees) =11,100 microbusinesses
- Small (10-49) =555 small businesses
- Medium (50-249) =175 medium-sized business
- Large (250+) =450 large businesses

Total: = 12,285
Source: SDR 69/2004, Size Analysis of Welsh Businesses 2003, Welsh Assembly Government

5.2 MICROBUSINESS DATA FOR WALES (Start 1998)

These figures were kindly provided by the Welsh National Assembly Economic Development Committee. The data shows 153,345 VAT and non VAT registered businesses at the start of 1998, employing 724,000 people

- 95.1% are microbusinesses employing less than 10 employees. (UK =94.8%)
- 66% of businesses have no employees.

- 23.5% have 1-4 employees
- Micro-sized firms account for 39.9% of all employment in businesses in Wales. (UK=30.5%)
- In Wales the smallest firms are a relatively more important source of employment than in the UK as a whole.

5.3 REMARKS

It is clearly evident that the membership profile of the Business Club does not match the official business profile for Wales. With particular reference to the women members, only 208 of the 483 women work in microbusiness – less than 40% --- a figure totally at variance with the 95.1.% total of microbusiness in Wales. Again this points to a large market for future members as yet untapped, or indeed ignored, by the club.

6.0 OBJECTIVE B

The second objective is to examine the gender imbalance in the Computer Science Department both in terms of faculty and students. This is achieved through research carried out by George Petrides, a (male) third year student, supervised by Dr Monika Seisenberger also of the Computer Science Department and by a discussion with a focus group of first and second year female Computer Science students. Following are extracts from George's findings:

"The phenomenon of female under-representation in computing courses (and IT courses in general) has been a topic of discussion for at least the past three decades. Despite the attention and the importance this problem has received, with countless studies and researches dedicated to it, the percentage of women enrolling for a computer science degree keeps getting lower and lower. A quick look at UCAS applications [UCAS] over the past years confirms the validity of the fact.

6.1 INTERVIEWS BY GEORGE PETRIDES

Question 1: What attracted you to choose a computer science degree in the first place? (Was there any influence from your family/high school/friends?

Respondent 1: I did an A – level in Computing and enjoyed it very much and also discovered I seemed to have some quite good understanding of the main concepts. This then made me decide I would do a degree in Computer Science, so that I could take my knowledge further.

Respondent 2: My sister.

Question 2: Was the whole experience what you expected?

Res 1: Yes. Some course subjects were quite a lot more difficult than I had expected, but generally I thoroughly enjoyed the whole experience.

Res 2: Yes, the whole experience was as expected

Question 3: Male students are the overwhelming percentage of CS, with only 3-10% being female. How did you feel about being in class with so many boys?

Res 1: It didn't (and still doesn't) bother me in the slightest. I'm not quite sure why for some girls it is such an issue, as for me it was not a concern at all. When I help out on Open Days for the computer science dept, one of the main questions from parents and applicants is about the ratio of boys to girls. I'm not sure why people generally see this as a concern, and I don't think it should be an issue for girls at all. Those girls who do choose to take a CS degree should be proud to not let the fact they are in the minority be a problem for them.

Res 2: I don't feel any different. I believe that both boys and girls have the same equal opportunity.

Question 4: In your opinion what is the reason that female students show no interest in joining computer science and IT courses in general?

Res 1: As I am a girl who did choose to do such a course, I am really not the best person to ask. The only reason I can think why this might be the case is because generally and traditionally girls do not have the same interest in more technical subjects as boys do. It is not very common to see female mechanics, engineers, builders etc just like it is not common to see female computer scientists, however the numbers in each of these very technical fields is growing, albeit slowly. I think girls are commonly drawn to more academic/theoretical subjects such as nursing, law, sociology, history etc partly because of tradition and stereotypes they have been surrounded by in their every day lives when they were in school. Traditionally women have been encouraged to do non-technical jobs, and men have always done the more technical and physical jobs. I think to a large extent this stereotype still exists in many areas of a student's life from junior school to high school/college, so generally it is just natural for students to follow the same trends as the generations before them.   Scientifically there might also be a reason why CS courses attract more males, since a male brain is considered to be more mathematical than a female's, and also better adapted to problem solving type applications. These types of skills are vital in all of the male-oriented fields/jobs I have mentioned above (including CS), so maybe this is why men are drawn to them more than women. Maybe you should include some research into this in your work.

Res 2: The lack of encourage while in school and the general expectations that female students should be doing non-science subjects.

Question 5: You obviously had very good marks in order to be accepted for a PHD. Do you think your views represent other female students who were doing a CS degree with you?
Res 1: My views about being a female CS? (please clarify if its my views about something else) None of the other female students in my year had any major issues with the fact that we were in the minority. It was just something we accepted, and we did not have any problems with it. It can actually be quite a good thing, as because there were only a small number of us we got to know each other very well, and also on the other side everybody (lecturers, other students etc) knew who we were which made making friends easier.
Res 2: Yes to be honest I do.

Question 6: What aspect of the course did you enjoy the most and which one did you dislike the most? (For example you enjoyed theoretical modules more and disliked programming problem solving modules).
Res 1: I liked all the programming related courses and all the technical/general courses, however I did not enjoy the more mathematical/theory subjects as this is my main weakness.
Res 2: I like all of the subjects equally but the subject that I enjoy the most is Computer Graphics.

Question 7: Do you regret your choice doing computer science? If you could go back would you choose a different degree?
Res 1: I do not regret doing Computer Science, and if I could go back I doubt I would change my mind and do something else. The only other thing I ever wanted to be was a vet, however when I did my A-levels I discovered I had a real interest in computing and decided to follow that route instead. Although I still wonder what it would be like if I had gone to vet school, I do think I have made the right choice and probably would not change it.
Res 2: I have no regrets doing a computer science degree and if I could go back, I would still have choose to do a computer science degree.

Question 8: Can anything be done in order to attract more female students to these courses or is the stereotype in the society too big to overcome?
Res 1: I think in time things will change and more females will do such courses, however I think maybe more encouragement is needed in schools and colleges before students have decided what they want to do. I think universities should encourage female students by using their current female students to try and attract more females at open days and at presentation

days etc (something which I have actively been involved in myself), and also I think that colleges and universities should definitely try and attract more female lecturers to their computer science departments, as I think this area is severely lacking. An all-male (or almost all) staff does not really provide potential female students with a good role model, nor does it reinforce the idea that maybe they could be successful in this type of career.

Res 2: I believe that more things can be done to attract more female students to these courses such as providing an introductory class (or workshops) to the computer science subjects and a support group (or a mentoring program) to help support and encourage more female students to take up a computer science degree.

Question 9: Are you planning on using your degree to get a job in the future that involves computer or would you do something different for living?
Res 1: I'm not really sure what I plan to do when I have finished my PhD. I think I would like to do something related to computer programming as this is my main passion, however I am also considering becoming a teacher/lecturer, or maybe I will do something completely different like join the police force. I feel that it is too far away for me to think too closely about what I might like to do for a career; however those are some of the possibilities I have considered recently.

Res 2: I planning to use my degree to get a job that involves computers.

Question 10: Are you planning on staying in the UK for employment?
Res 1: Yes. I have no desire to move away from Wales, so I would hope to find a job in this area.
Res 2: I am hoping to stay on in UK for employment.

6.2 FOCUS GROUP

Similar questions were put to a group of 12 female first and second year Computer Science students from Swansea University at a group discussion held on 23.2.07, chaired by Dr Seisenberger. Seven students were from the UK, the rest were foreigners.

The majority of the group had decided to take Computer Science because of a personal liking for the subject.

6.3 SOME REASONS WHY

Reasons offered for the very poor uptake of Computer Science as a subject varied:

- "It's the conditioning. From an early age we are told that science is for men."
- "I believe that the attitude changes when we start playing computer games and see that the themes are often violent and male-oriented. Girls lose interest in them and as a result it is the boys who have the unbroken focus on IT till they take it up as a subject in college."
- "It is a hard subject. There are so many other opportunities to select more interesting and easier subjects to study."
- "It doesn't bother me that there are so few female students in my class. I don't see that it makes any difference to student life."
- "I actually enjoy all-female tutorials"
- "Computer Science has a geeky image. It needs to be made more attractive. It needs a sexy image so everybody is attracted to taking up the subject."
- "You have to glamorise Computer Science. I love the subject but I am always being asked why I have picked IT –in a very derogatory tone."
- "I find myself apologising for taking the subject among family and socially. I have to defend my choice."
- "People should be made to understand that Computer Science leads to expertise in all traditional subjects."
- "After qualifying we would find very few female colleagues in the IT workplace."

- "I am not sure about a career in IT. Women have family responsibilities – parents, home, children -- it is so much more difficult to plan any career."

6.4 SUMMING UP

All except one respondent wanted a career in Computer Science. All understood that the gender imbalance in the study of Computer Science in the UK and in other European countries needed to be corrected and all had ideas on how this could be done (as seen above). The group was very surprised to hear that the gender imbalance did not occur in Indian Computer Science Departments and had to be assured that not only was this the case, but that female Indian IT students regarded Computer Science as an easy, light and feminine option as opposed to civil, mechanical or electrical engineering.

Most interesting was the image issue i.e. the perception of IT as a dull, nerdy subject to the extent that students were apologetic about their choice and had to defend it. Clearly this is a significant issue and needs attention.

6.5 ACTION PLAN

Dr Seisenberger offered her own personal statement that she wanted more female colleagues because there would be more networking and more cooperation making the workplace more interesting. Dr Seisenberger suggested an action plan to deal with the problem of attracting and retaining female staff and students viz:

- School teachers should be trained to encourage female students to take an increased interest in Computer Science.
- Higher retention of staff and students will result if the college provides a supportive community to female members
- Steps should be taken at the point of admission to assure students that Computer Science is as good a choice as any other traditional subject

7.0 OBJECTIVE C

7.01 CASE STUDY ONE: Women in ICT in a small business.

Details :

Name of company: Goose Island Ltd

Number of employees: 25

Premises:

 i. 10,000 sq ft warehouse and offices in the prestigious Kearns complex, Swansea
 ii. 4 up-market retail premises in Swansea, Cowbridge and Cardiff each over 1500 sq ft in size.

Nature of business:

 i. Importers of jewellery, accessories, paintings and furniture from China, India and Bali
 ii. Retailers of these products in South Wales
 iii. Wholesalers of these products serving 400 outlets in the UK and Europe

Use of IT:

- Accounts
- Office admin
- Stock control
- Distribution
- Web site updates
- Online shopping for public
- Online ordering system for trade customers
- Multi-currency transactions
- Payment systems

Chronology:

1993 -- The enterprise was started in 1993 by Karen Hutchins, an Allied Dunbar Financial Consultant, who was inspired by an extended trip to the Far East. Karen spotted the market potential of Balinese clothing and accessories and successfully tested the UK market, mainly using the party plan system of retailing the products that she selected personally in Bali,

Hong Kong and Thailand. Karen used IT from the very start and taught herself to use Quick Books, a program to manage her day-book (enter her accounts) and admin data on a simple PC and was thus able to reduce professional fees paid to her accountant.

1996 to date -- Karen opened her first retail shop, followed by three others in South Wales. The success of these and the personal pleasure derived from her regular buying trips to the Far East prompted Karen to branch into wholesale - an enterprise which now has over 400 business to business retail customers. Staff increased from two to the present levels of 25 employees. Karen's husband Peter retired from a successful international business as a steel stockholder to join Goose Island full-time.

2006 –Karen made a successful application through Business Connect for an Assembly Investment Grant and moved to new warehouse cum office premises at Kearns House in Llandarcy. A grant was also received from Swansea City Business Centre for marketing and IT soft and hardware.

7.02 DEVELOPMENT OF IT USE MIRRORS COMPANY GROWTH

In the words of Karen Hutchins: "I have been IT oriented from the inception of the company, operating most of the systems   myself. I trained my book-keeper to use my simple early systems. As our trading became more complex I bought up-to-date Sage accounts packages which are now operated by my staff – I no longer have time to do it.

"My use of Information Technology has grown to meet the changing needs of the company. In the first instance, we needed a system for stock control which led me to the purchase of our first version of EPOS. We later needed a more sophisticated version to deal with the wholesale section of the company.

"I have never regarded IT as a challenge or a hurdle. I simply use computers as a tool to run my company more efficiently and to speed up operations. The cost of new hard and software is justified by the increase in information flow, improved customer access, and accuracy and speed in transactions.

 "I find it difficult to understand why anybody, male or female should have emotional issues in dealing with a simple business purchase. For me a new IT system means no more than the acquisition of any other plant or machinery designed to increase efficiency.

"However these issues do arise with our male colleagues at work. We have six female staff members who work variously on EPOS, SAGE, Online sales etc. A further sixteen female employees work in the retail outlets using intelligent tills at multi tasking work stations using state-of-the-art equipment. I have never had a problem with these employees. They have always been completely at home with IT and have simply got on with the job after initial training.

7.03 REALITY CHECK

"The issues you mention about women in IT suffering from an experience gap or a confidence gap or experiencing peer pressure are simply not relevant –not for me and not for my female employees.

"However we do have these issues where our male colleagues are concerned. My co-director has never handled a keyboard in his working life – a phenomenon dating from the era of typewriters, when the keyboard was perceived as a secretarial task, for which secretaries were employed. He is slowly coming to terms with viewing the PC as an essential management tool. He certainly suffers from your 'experience gap' and your 'confidence gap'---- every female staff member is far more advanced in IT use than he is.

"Equally, our male warehouse manager can only carry out basic IT tasks while   our (male) distribution manager does have quite a lot of involvement in tracing parcels electronically. Neither is comfortable with IT outside their immediate ambit. But all three male colleagues do feel peer pressure to use IT equipment and to improve their IT skills. They feel left out of the mainstream of day-to-day operations and are perceived as operating below par."

"There is no question of anybody's career progression path being affected by the level of their IT skills," adds Karen. "IT is simply a quicker way to do the job and its use provides speedy responses to complex business issues. Everybody receives standard supplier training. "

7.04 REMARKS:

Goose Island's use of IT has been in response to a series of business imperatives rather than any intention of conforming to trends or 'modernising.' Over the years there has been an increase in the sophistication of their soft and hardware purchases to keep pace with the

changing needs of the growing company. Essentially the growth of IT use in Goose Island has been organic, steadily widening in scope and increasing in specific problem solving – but on an ad hoc basis with no strategic intent. Karen now sees the need for an IT strategy to optimise the use of IT in Goose Island and is taking steps to put a plan in place.

However it is clear that Goose Island, a company heavily dependent on IT for its day to day operations, employs 22 women and only three men. None of the male employees play any significant role in IT whereas the women do. It must be concluded that in this small business the only evidence of gender imbalance is weighted against male and not female staff.

Karen has confirmed that she has no policy of recruiting women in preference to men, but they do receive more job applications from women.

7.2 CASE STUDY TWO: USING ICT TO ENTER THE BUSINESS WORLD

Details :

Name of Company: SW Projects Ltd

Number of Employees: Three

Premises: Home office.

Nature of Business: A series of online purchase businesses set up by Sarah Williams, with the technical expertise of Ryan and Alun Hughes.

Chronology: 1984
I first came in to contact with computers at the Swansea Advertiser in 1984. I was not required to operate the computer but was aware of its role within the organisation.
The then editor comments : " The Advertiser Group was among the first small local businesses to embark on the use of PCs for accounts. We bought a little Tandy and an early accounts package and as might be expected, it was the two youngest staff members who clamoured for training. Both were female. The only male from 30 employees to show any interest was the MD, who mastered the computer quite easily. An Indian student on work experience with us seemed totally conversant with the system straight away.

Sarah worked in the sales department and was aware of the impact the introduction of IT had made in every department.

For example, because we could now churn out invoices speedily and accurately using a minimum of (wo) man power, we were able to sell low denomination advertisements cost-effectively, providing the sales team with a wider range of low priced products for their price lists. This had the knock-on effect of now being cheap enough for microbusinesses and start-ups to try out newspaper advertising, encouraging them to spread their marketing wings. Thus investing in the Tandy had a significant overall business impact – we widened our customer base and increased our turnover.

"The most dramatic changes made by the advent of ICT have certainly been in the design/print/media industry. Apart from the obvious improvements in admin and credit-control, ICT improved studio productivity and response times to unprecedented levels; it has drastically reduced the need for manual skilled labour; has wiped out many ancillary sectors (block making, typesetting,) that were once integral to the media supply chain; has reduced the number of processes in almost every aspect of studio work (e.g. process cameras and therefore darkrooms have almost disappeared completely); has completely changed the face of the newspaper industry making a huge number of job sectors (e.g. compositors) redundant , cutting costs savagely and giving the industry a new lease of life and a return to profitability."

1988

 My first experience of actually operating a computer was with a company called Man and Overton who were based in London, and were one of the main dealers for the London Hackney taxi. They sold repaired and provided finance to their customers. I joined their accounts department in 1988 and was trained to operate a specific computer programme that was directly linked to their parts department. The programme I operated dealt with all sales and stock relating to the parts department. I was trained by a young lady called Wendy, and I recall being absolutely terrified that if I hit the wrong key the computer would crash and burn or even explode. I was

extremely anxious and nervous initially. There were about ten members of staff within the accounts department eight were female and two male. The manager of the accounts department was also female.

As time went on I was trained to operate other accounts and book keeping computer programmes that dealt with other department's sales, within the company.

1989

My next encounter with computers was not office work related.

I was the lead singer with a band in London and we performed original music, we would write individually and also as a team. One of the members of the band had a home studio, we used a computer programme called Q Base to record and try out our song ideas. At that time the programme would only allow us to directly input digital information i.e. music from a musical keyboard. If we wanted to input vocals or guitar it involved external hardware that could synchronise the music with the live vocal or guitar input. I became very involved with operating this computer music programme during our writing sessions as I found the programme itself very user friendly. There were four members in the band I was the only female. The operation of this computer programme was mainly carried out by me and the member of the band who owned the home studio.

1990

I then worked for solicitors in London called Evil and Coleman I joined them in 1990.

As I recall the accounts department used computers to facilitate all of their operations and the secretaries had what they called word processors but the solicitors and other members of staff did not use computers to carry out their work.

It was when I left on maternity leave in 1993 that Evil and Coleman upgraded their office technology and became completely computer networked throughout the whole company.

I returned to work for a short time after the birth of my first child and this was my first real experience of a windows based computer system.

I recall crashing the computer quite a lot initially as I kept opening window after window I was not formally trained on this system but felt my way through and with some assistance from members of staff and trial and error became proficient at using this system.

Evil and Coleman had about thirty members of staff and approximately twenty seven of the staff were female.

1996

I took a couple of years out from work to bring up my first daughter then in 1996 returned to Wales and started working for the Swansea Job Centre. My first day at work involved being trained to input information on to their computer system in their order control department. This involved answering phone calls from employers wishing to place an advertisement for an employment vacancy at the Job Centre. The information given to us over the phone had to be put directly on to the system so that the advert could be processed and displayed as soon as possible.

I worked in several different departments within the Job Centre over a two year period. Every department had a different computer programme that I had to familiarise myself with and learn to operate proficiently.

There was a large turn over of staff at the Job Centre and I would estimate that we were approximately seventy to eighty members of staff.

The percentage of male to female was roughly 65% female 35% male.

The IT support team was all male.

1998

It was in 1998 that I purchased my first home computer, and entered the world of e mail, and the internet. I was also introduced to chat rooms through a close friend who had purchased her home computer about a year or so before me, and was very adept at using her computer.

It was at this point that the computer took on another identity for me. Previously to this I had operated computers because it was a requirement of my job. I really had no choice but to get with the programme. The music software was the only exception to this.

Having a computer at home that I believe had Windows 97 as its operating system opened up another world to me.

My friend assisted me and helped me make use of my computer and helped me familiarise myself with its operating system. I was fortunate to have her on hand and also my partner of the time who was incidentally male. They were both being trained on computers on a daily basis. My friend was at college and my partner was being trained through his job.

We installed many software programmes on to our computer that performed a variety of tasks. I began experimenting with them and began using the computer to generate publicity posters, letters, complimentary slips, logos etc, as it was around this time that I had re launched my singing career as a part time money making venture.

My partner was being trained in his job to build web sites using a computer language HTML he brought his work home with him and would explain technical terms and show me what was involved.

He built a site for me and I became involved on a small scale in the construction of this site.

I would surf the internet regularly for information on all manner of things and soon found that when we would encounter technical problems and we were unable to connect to the net for whatever reason I would feel a sense of loss and frustration. I was becoming more dependent on this new link to the world.

2002

My partner and I parted in 2002 he got custody of the computer I got custody of the children. (Gender imbalance or what?) I moved out and was without a home computer for about six months. This was a real handicap and I relied on friends with home computers if I needed to organise publicity posters etc.

2003

I then purchased my own computer and have used my computer every day ever since, for a variety of tasks.

Through various projects that I have been involved in over the last few years I have taught myself to use many software programmes including power point, excel, photo shop to name a few. Some I have had to learn for the purpose of projects I have been involved with and others because it was fun and I enjoyed exploring the software's attributes and capabilities.

2006/7

I have for the last seven months been working for a company called Systems Implementation Ltd.

We are in the process of launching new businesses on the internet. The company has five people involved in getting these businesses launched. Three of us are women, and two male. Both of the men have extensive IT skills both in operating software programmes and the back end of operational systems. Only one of the women has problems with IT she is sixty three years old and has not had a lot of experience with IT, her role in the company is not dependent in any way on her developing skills in this area. The other two females me being one of them have sufficient IT skills already and are gaining IT skills on a daily basis.

In the last six months I have learnt to use wedding planner software that is extremely user friendly. I am now in the process of learning to use an e commerce based software programme called Actinic. It allows the operator to upload images information and digital downloads to an on line shop. It is extremely user friendly and very empowering when you see your handiwork displayed live on the internet.

7.2.1 SUMMING UP
To summarise ---- my knowledge and skills in IT have been gained firstly through necessity i.e. the job required it, and secondly through a genuine interest, a sense of achievement and pure enjoyment.

The issues about women in IT suffering from an experience gap or a confidence gap or experiencing peer pressure are simply not relevant for me and not for the majority of my past or present female work colleagues or friends. Using a software program and being trained to use a specific programme is very straight forward in most cases, for male or female, as they are designed to be user friendly.

However in my experience, when you are looking at the development of software or knowledge of the backend of these software programmes or the back end of an operating system on a computer, it has been predominately men that seem to have expertise in this area of IT.

7.2.2 CONCLUSIONS
Women in senior positions in business use IT strictly as a tool to improve profits and efficiency and are not affected by the gender imbalance issue at all. In the IT industry itself there is some evidence that higher echelons such as software development are dominated by men. The academic sector of the IT world is clearly male-dominated as per the evidence above.

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7.3 APPRAISING WOMEN'S ROLE IN INFORMATION TECHNOLOGY IN LOCAL BUSINESS.

 Responses to a questionnaire for working women who are NOT members of the IT Wales Business Club

7.3.1 Name Mrs Sandra McAlister

Company name and address: H W Vaughan & Co
Nature of business ___Accountant and financial recovery
How many employed_____20

- Sandra is a member of the West Wales Chamber of Commerce and the Federation of Small Business
- She had never heard of the IT Wales Business Club?
- She would like to know what she will get from the club and at what cost.
- Sandra makes use of IT in her work for Clerical and Admin purposes; for Accounts and for Email and Web use
- She would like to learn more about e marketing and is always open to ideas on identifying and correcting any shortfall in her IT ability.

7.3.2 Name Miss Lea Halborg
Company name and address: Redhead Consultancy – 59 Bridge Street, Llanelli, SA14 8TW
Nature of business: Business & Community Consultancy Services
How many employed: 1 but work with associates on many projects.

- Lea is a member of the PROFIT CLUB/ BNI
- She has not heard of IT Wales Business Club and would be interested to try it out.
- Lea uses IT in her work for Clerical and Admin purposes , for Sales, Accounts, Information gathering and for Email and Web use
- She would like to learn more about Database creation
- Lea has identified shortfalls in her IT ability which she would like to correct

7.3.3 Name   Ms Diane Hughes
Company name and address   Inter City Finance Ltd   144 Walter Road, Swansea
Nature of business Financial & Mortgage Advisers
How many employed   3

- Diane does not belong to any business or trade club and has not heard of IT Wales Business Club
- She would be interested to try it out for one meeting

- Diane uses IT in her work for the following functions: Clerical and Admin ; Customer care;
  Accounts; Information gathering; Email and Web.
- The IT related topic she would like to learn more about is spreadsheet but she has identified many shortfalls in her IT ability that she would like to correct

7.3.4 Name   Miss Amy Hewitt
Company name and address : John Collins and Partners LLP
Nature of business Solicitors
How many employed   1*32*
- Amy's employer is a member of WWCC, Swansea Business Club, and many more
- Amy has heard of IT Wales and may be interested in trying it out, depending on the level of interest from fee
  earning staff.
- Amy uses IT for all aspects of her work and would like to learn more about search engine optimisation and would like the ability to use paint shop programs to design leaflets etc.

7.3.5 Name: Miss Fiona Wilson
Company name and address: DVLA Swansea SA6 7JL
Nature of business: Public Sector
How many employed circa 6500 staff
- Fiona does not belong to any business or trade club and has never really thought about it
- Fiona has not heard of IT Wales Business Club but would be interested to try it out for one meeting
- Fiona uses IT in her work in the following areas : Clerical and Admin ;Accounts ;Email and Web

7.3.6 Name: Mrs Fiona Nixon
Company name and address: Heathfield Tax Consultancy Ltd, 33 Heathfield, Swansea SA1 6HD
Nature of business: Tax Consultancy
How many employed : 1

Fiona does not belong to any business or trade club because she has no time, doesn't know anyone and because her business is too small to mix with other members

- Fiona has not heard of IT Wales Business Club and would be interested to try it out for one meeting.
- Fiona uses IT in her work for the following purposes :Clerical and Admin ;Customer care ;Accounts ;Information gathering Email and Web
- Fiona would like to learn more about EXCEL, but has identified many shortfalls in her IT ability that she would like to correct.

8.0 CONCLUDING REMARKS AND RECOMMENDATIONS

The issues that have arisen from this study

- The IT Wales Business Club has a low percentage of microbusiness members
- The IT Wales Business Club has a low number of women members.
- The IT Wales Business Club has a low number of women attending the events

The question is whether there is any need to change the status quo. Overall attendance is good and membership is growing steadily. Does it really matter that the percentage of women members is so low?

The government considers it a priority that more women need to be drawn into the IT mainstream -- with excellent reason as seen in the Hansard Report above. This view is shared by all senior players in the IT field as seen in this study.

Clearly IT Wales must prioritise the issue of increasing the number of women members and improving the numbers of women attending each meeting in order to assist in improving the national figures. These issues need to be addressed at grass roots level or the UK will find itself tagging even further behind the rest of the world.

8.01 RECOMMENDATIONS:

- A survey to be carried out to determine why existing female members do not attend IT Wales Business Club events
- A survey to be carried out to determine why more business/working women are not joining the IT Club. The small survey in this study shows that the women who have not heard of the club are willing to give it a try.
- A survey to determine why the proportion of microbusiness members is anomalously low. No other business support club shows evidence of such a phenomenon – all reflect the business profile of their area.
- The results of these surveys to be used to formulate a SMART strategy for action
- Similarly the female students' comments should be used as a platform for a strategic approach to attracting and retaining more female applicants to degree courses in Computer Science. More research across a larger sample would be useful but will not necessarily yield any further ideas.
- Dr Seisenberger's action plan should be implemented. It needs to be adopted, tested and improved upon on an ongoing basis.

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