University Computing, 1987, 9, 207-210.

Where have all the girls gone?

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Abstract For some years now the number of girls reading computer science at university has been steadily decreasing: In 1980, 423 girls entered universities in the UK to read computer science. By 1985, this figure had dropped to 159 and at a time when the demand for graduates with computing skills was at a premium. Women represent the largest untapped resource of potential skill in this area, but they are being left behind in the technology revolution. This paper examines some of the reasons that lie behind this state of affairs and suggests some measures that can be taken to alter it.

Introduction

Recent Government initiatives to increase the number of places for computer science students in British universities at a time of economic stringency is evidence of the current and predicted shortage of computer scientists in industry and commerce. The demand for computer science graduates is such that many of them are in a position to pick and choose between job offers from the most prestigious software houses and industry. There has been much press coverage recently ·of ·Governments reports, stressing the increasing need for such graduates so that students applying for computer science degree courses now are assured of excellent employment prospects when they graduate. The Butcher Report[1] highlights the IT skills shortages and stresses the fact that IT companies cannot afford to ignore the intellectual resources offered by women during this time of growing skill shortages and declining school and university populations.

Given all this encouraging news, one would expect male and female students alike to be rushing forward to take advantage of these marvellous career opportunities. The boys certainly are, but not so the girls. The percentage of computer science students at universities in the UK who are female is currently less than 15%. In this paper we present an analysis of this disturbing situation and suggest some possible remedies.

Worrying trends

At the authors' own university, Southampton, the number of female applicants to computing degree courses has been steadily declining over the last few years. Awareness of the problem was heightened in September 1985, when the unenviable record was achieved of no girls in the first-year intake for either the single honours Computer Science or the Mathematics with Computer Science degrees. In a department where 25% of the academic teaching staff are female, and which in the past has recruited relatively high numbers of female students, this is a matter for some concern.

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Southampton University is not a special case; the statistics reflect the national trend. UCCA records show that of the total number of students accepting places on computer science degree courses, the percentage of women fell from 25% in 1978 to 15% in 1984. The statistics for 1985 were collected on a different basis and are not directly comparable but the trend is still markedly downwards and the figures appear to be of the order of 10%.

It could be argued that computing science is regarded by many as either a 'hard' science or an offshoot of mathematics and as such would naturally fail to attract girls. Indeed, at many universities and polytechnics a standard requirement for entry to a computer science degree course is A-level Mathematics and certainly at Southampton the majority of applicants are taking Mathematics and Science subjects at A-level.

This, however, only serves to increase concern, since UCCA records show that of the total number of students accepting places on mathematics degree courses, the percentage of women rose from 31% in 1978 to 33% in 1984. For physics, during the same period, the percentage of women students rose from 12% to 14% and for chemistry from 21% to 30%. Clearly, whilst the drive to attract more girls to the traditional mathematics and science subjects is having· some effect, girls are being increasingly discouraged from reading computer science.

These figures are for home students only. It is an interesting comparison to look at the UCCA statistics for the number of women overseas students as a percentage of the total number of overseas students taking computer science degrees in the UK. Whilst the percentage is much higher overall, the trend is still thesame. It has dropped from 38% in 1978 .to 26% in 1984. So this phenomenon is not restricted to British students alone.

The figures provided by the DES for O and A level entries do not show the same trend. For every year from 1978 to 1983, approximately 30% of the O-level and 22% of the A-level candidates in Computer Science/Studies were girls. Worryingly this latter figure fell to 18% in 1985, which serves to underline the downward trend of applications to university courses.

These figures give us no reason for complacency. They are unreasonably low and hide other less acceptable-

facts. For example, the Equal Opportunities Commission report 'Information Technology in Schools'[2] produced by the London Borough of Croydon, found that twice as many girls as boys dropped out of computer science courses before taking the examination.

Clearly, if girls are not motivated in school to take computer science options (or even worse are actually discouraged) then they will be unlikely to choose a career in computing. Before we consider what positive action can be taken to improve the situation, it is important to examine the possible reasons why so few girls show any interest in computing and computers.

The causes: some observations

There is no doubt that sex stereotyping exists pre-school and outside school. Evidence to justify this has been found in many of the surveys relating to girls and science.[3] The GIST survey[4] found that boys and girls who endorsed sex stereotypes were least keen to learn about the science associated with the opposite sex. The fact that girls are negatively influenced by cultural factors is also observed by Haggis.[5] On the whole girls are found to be more passive and conforming and also unwilling to make mistakes in front of boys. This latter observation is one of great importance, we believe, and is also apparent amongst university under-graduates. In general, girls are reluctant to sit down and experiment at a terminal, especially for the first time. Boys in comparison are keen to show their mastery over the new technology and are less afraid of the consequences if they take some incorrect action. The observation that boys are more likely to dominate lessons and clubs in schools is made in a number of studies including Else[6] and Haggis.[5] The demanding male student is more likely to command and get attention. Girls are generally more likely to learn by example rather than by experiment, reading from a set of instructions or following the instructions from a teacher. In mixed laboratory classes it is common for the boys to take a more aggressive approach than girlsto the selection of seating and equipment, which leads to the girls missing out when there are limited resources or different qualities of equipment.[4]

As the authors of the London Borough of Croydon Report[2] point out, children are more likely to develop their interest in information technology at home than they are at school. However, parental aspirations are also sex-stereotyped. There is a tendency for the home micro to be bought for the boy of the family. A survey carried out by the MEP Primary Project[7] showed that twice as many boys as girls have access to a microcomputer at home. Another survey has revealed that in all households owning microcomputers, boys are 13 times more likely than girls to be using them. Moreover, only 4% of micros are used by the mother in the home.[8] The feeling that computers are only for boys is reinforced if girls cannot find software that is of interest.

There is evidence as described by McLeod and Hughes[9] that children aged 6 to 10 have uniformly positive attitudes towards computers. However strong evidence of sex-stereotyping was found amongst children of both sexes when asked whether they saw computers as the province of boys or girls. It seems that by the age of 7 many children were already associating computers with boys and predicting that they will perform better with them. There is little doubt that media and software producers help to make computing appear a male domain.[3,5] Advertisements for computers are noticeably sex-stereotyped. Software firms produce largely aggressive and macho games from which women are often totally absent or cast in a passive helpless role. Space fantasy images are more appealing to boys.

It is an interesting observation that the figures for computer science students at universities begin to drop sharply in 1980 - the year the microcomputer began to make its presence felt and computing facilities became more available to British school children. The younger girls' assumption that computing is not for them[6] is one which will be difficult to unpick later, at a time when career choice is being considered.

One of the main findings of the Croydon Report was that the content of computing courses is often seen as irrelevant to the careers that girls are encouraged to choose and so they are less likely to be guided by teachers to take such courses. In addition to this, timetable constraints often result in the option subjects traditionally popular with girls (languages, home economics, etc.) being timetabled against computer options. The demand for school leavers and graduates with a high level of IT skills far outweighs supply. However, there is a popular belief that arts O-levels, A-levels and degrees will do just as well as an entry point to a career in computing. Careers teachers who advise girls in this way are widening the gender gap and allowing the girls to fall even further behind their male counterparts in terms of familiarity with computer technology and the lucrative careers that follow from this.

One final point to be made here is the lack of adequately trained IT teachers. In the primary schools the majority of teachers are women and yet the majority of primary teachers attending microcomputer courses are men[2] and it is usually an enthusiastic male teacher who organizes and promotes the use of computers in the school. Many women primary school teachers are intimidated by the new technology and this can affect the attitudes of the children in their classes. In secondary schools, the lack of IT specialists·means that teaching in this field is often half-hearted or non-existent. The competition to get on to the courses run by the one or two teachers in the school who know and are enthusiastic about their subject,

may be fierce and, for all the reasons mentioned above, girls will not push for these places. And so the circle goes on.

What can schools do?

The most important point here is that teachers should be made aware that the problem exists and be directed in how to deal with it. Implicit in this is the need for much more in-service training at all levels. By this we mean, training more IT specialists, increasing the number of women who feel confident and competent with modem technology in the classroom and including in these courses an appreciation of the issues raised in this paper. Providing the money for these courses and allowing teachers to go on them is of course a political issue, but it is well-recognized that the country needs more women in science and engineering and this is one way of achieving this object.

The Croydon Report[2] emphasizes the need for courseware to be designed in such a way that it is interesting to girls. This means choosing examples carefully to avoid subjects that are very male oriented. With imagination and a little forethought this is not too difficult a task. Even with this kind of courseware, it will still be necessary for teachers to be sympathetic to the fact that girls are frequently reluctant to learn about computers and the teachers may need to discriminate positively towards the girls to overcome this. Indeed, some schools have found that girls respond better to computing as a subject when they are taught in single sex groups. Schools are also experimenting by setting up single sex computer clubs which seem to be successful in engaging the interest of girls in computers since the element of male competition is removed.

It is easier to make computers an ordinary classroom resource in primary schools than in secondary schools. New languages like *Logo* and *Prolog* encourage the use of computers in an imaginative way. The turtle graphics of *Logo* is appealing to both boys and girls and research has shown that this motivates children into greater use of computing facilities. However, it is very important that this is extended to secondary schools. Unfortunately, due to lack of resources there is a tendency in secondary schools to centralize computing facilities, which detracts from their casual use in everyday teaching across the curriculum.

Schools can actively encourage girls to consider a career in computing by wherever possible making it easy for them to choose IT/computing options. At the very least, this will enable them to gain familiarity with the technology, which they will increasingly need whatever career they eventually choose. Careers teachers should be made more aware of the opportunities for girls in computing and related industries and should provide positive career counselling in this direction.

What can universities do?

Although decisions about choice of subjects have already been make long before UCCA forms are filled in, there are ways in which the universities can help to promote computing as a suitable subject for girls to study. Entry requirements to computer science degree courses should be as flexible as possible to include girls without purely scientific backgrounds. However, for many university computing courses, it would be unfair to the girls to allow them entry without the necessary mathematics qualification. It is possible to have completely open entry requirements for computing course that are more business studies oriented. Thames Polytechnic have operated this policy for some time and whilst the number of girls on their courses is not increasing, it is above the national average.[10]

Computer science, in common with other subjects studied at universities, changes its nature as the course develops over the three-year period of study. Typically the first year includes courses on programming and supportive mathematics and electronics, whilst the third year includes applications courses, a project and possible courses of a more reflective nature. Although expertise in programming is necessary for many courses, it is not the only ability required by a good computer science undergraduate. Qualities of good communications and organization are also important and frequently women have these qualities more than men. However, there is a commonly held opinion in school, children, parents, teachers and careers advisors that all you need to do a computer science degree is to want to program. To counteract this, universities should publicize the nature of their computer science degree course by holding open days for schools aimed not only at sixth formers, but also children before they choose their options. At such open days the many varied career opportunities can be displayed. All of this should consciously be aimed at the girls as well as the boys. Similarly, prospectuses should be carefully worded to illustrate the more rounded nature of a computer science degree.

Having attracted girls on to their courses, the utmost care should be taken to retain them. As the girls are likely to be in a minority, some may feel overwhelmed by the all-male atmosphere. University lecturers are not renowned for their teaching ability and computer science lecturers are no exception; indeed they are more likely to be under pressure to spend more time on research and less on teaching (despite the fact that the subject changes more rapidly than average causing frequent course revision). We would ask lecturers to discriminate positively towards

women in their lectures by, amongst other things, being more aware of the difference in learning attitudes between male and female students.

Efforts should be made to put girls in the same tutorial group and to ensure that their personal tutors are aware that they may need to be more than usually supportive. Ideally extra tutorial support should be available for girls, but in view of the current shortage of teaching resources this may not be possible. It may also be necessary to examine the conditions under which the students work at terminals. For example, are they expected to work late at night and walk back alone to halls of residence?

Summary

There is little doubt that this country cannot afford to waste the resource offered by women in computing. The Equal Opportunities Commission has had discussions with many new technology employers and the point has been made regularly that the companies would welcome more job applications from girls and women. Several companies have pointed out that they alone could have employed *all* the electronics graduates leaving British universities in the last 2 years, and that girls represent the largest untapped resource of potential skill at technician and technologist levels as well as at professional level. Such comments are particularly relevant in view of the demographic trends which indicate a significant down-turn over the next 10 years in the number of school leavers.[8]

In addition, to quote from the Butcher Report: [1] 'The very flexibility of IT, and the fact that IT systems make it possible to work from home as well as the office or factory, means that it is particularly well suited as a career for women at all levels.'

The future information society will require skills such as knowledge engineering, systems analysis, linguistics, logic, organization and communication.

Women have just as much to offer in these areas as men, if not more. It is up to us to provide the environment in which women will want to develop their interest in computing and will succeed in doing so.

Acknowledgements

The authors would like to thank all the people who have helped in compiling the reference material for this paper and in particular, Alison Edye of the University of Sydney, Australia, who worked with us to collate the background material and provided much practical insight to the problems during our discussions.

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