WHERE HAVE ALL THE GIRLS GONE? WHAT ENTICES FEMALE STUDENTS TO APPLY FOR COMPUTER SCIENCE DEGREES

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ABSTRACT
The number of students taking Computer Science degrees has increased in recent years, but the number of female students within the cohort has been steadily decreasing (in terms of absolute numbers not merely the proportion). This trend is worrying for a number of reasons, but before we can entice more female students to apply we need to know why those who do apply have decided that it is the degree programme for them.

In this paper we present the findings of a qualitative study aimed at discovering just that. The findings are based upon interviews with female students from two traditional UK Universities.

Keywords
Gender, recruitment, expectations.

1. INTRODUCTION
National figures suggest that very few female students opt to study Computer Science (CS) or indeed any similar Computing related degree at undergraduate degree level. In the 1980s some 35% of applicants for CS degrees at UK universities were female, but now the figure is nearer to 10% and is still monotonically decreasing. There are a number of contenders for the cause, but as little research has been done since the mid 1990s there is no definitive answer to the question “why?”

The three main contenders are:
1. Introduction of the National Curriculum in schools.
2. Lack of female role models.
3. Decline in the number of students previously attending single-sex schools.

Anecdotal evidence suggests that any discouragement or lack of encouragement encountered by female students has occurred at a pre-university level. Indeed in many ways the initial battle can be considered won once the student reaches university level.

There have been several initiatives aimed at encouraging girls to consider Computing as a career choice. The pressure group WIC (Women Into Computing) has organised most of these [14].

Before attempting any new initiatives to entice more female applicants it is prudent to discover why our current students are with us. Any initiatives aimed at increasing the proportion of female students in the intake should not discourage those who are already convinced, and it would be all too easy to do this if we do not do our homework first.

2. THE CONTENDERS
Various reasons are cited anecdotally, without recourse to references, as the cause of the current worsening gender imbalance. Here we take a more detailed look at the three main contenders and some of the evidence that suggests that they may truly have had some impact.

2.1 National Curriculum
In the mid 1980s computers began to be introduced into schools. They were often locked away in a special room and pupils were allowed access if they were members of a “computer club” or similar; many schools did not have the funding to provide enough machines for mainstream teaching purposes other than possibly the new A-level in Computing. As the importance of the new technology rose so did the number of computers in schools. In fact in 1990, when the National Curriculum for England (and Wales, at that time) [8] was introduced, the then government deemed Information Technology and
computer use to be important enough to make the subject “core”. Up until this point girls had been happily playing with computers in school (admittedly in lesser numbers than the boys) but Deakin warned at the time that female disinterest could easily become an issue [7]. They have been avoiding Computer Science at university level in ever-increasing numbers since.

The timing fits; the perception that Computing is “all about word processing” fits with the content of the curriculum; and leading feminist researchers argue that it has to be a major culprit [7, 12].

2.2 Role Models
Women have been associated with, and taken an active role in, Computing ever since the first computing devices were invented. There have been many female role models in the past; Ada Lovelace, Grace Hopper, the original US “computers” replaced by ENIAC. Since the mid-1980s and the beginnings of the PC revolution things have changed dramatically. The role models are not only all male, but are noted for their business acumen and their “geekyness” [5]. Bill Gates, Scott McNealy, Larry Ellison and others are a very different kind of role model and they represent something that may not appeal to women.

2.3 Co-educational Schools
As Higher Education has expanded students have been drawn from increasingly diverse backgrounds, and there has been a dramatic increase in the numbers of students entering with non-traditional qualifications. What is less often considered is the type of school previously attended by our undergraduates. When looking at tables denoting the “top n schools by A-level grade” it is immediately apparent that many of the schools near the top of the table are single-sex. It is these schools that traditionally provided our entrants, but there are ever increasing numbers of students now entering from co-educational establishments. In fact the number of single-sex schools is also slowly being eroded as two smaller single-sex schools will now often merge to form a single larger co-educational establishment for reasons of financial expediency, or single-sex schools have become co-educational to enjoy the benefits of being awarded technology school status. This is depressing news for Computer Science if the majority of our remaining female undergraduates are from single-sex schools.

A similar state of affairs has been noted in Germany, but not, significantly, in Ireland. Ireland still retains a high proportion of single-sex schools.

3. The Study
The study is based in the Computing departments of two traditional UK Universities, the University of Kent at Canterbury and the University of Leeds. Previous work has shown that the academic profiles of the two departments are similar [1] and that students at the two institutions have similar attitudes towards their studies [2, 3].

The aim of this study is to develop a greater insight into why our female undergraduates chose a Computer Science degree and how their experiences match up to their initial expectations.

3.1 Methodology
The use of qualitative methodologies can be problematic within science-based disciplines, although they are unquestionably appropriate when collecting opinions, thoughts and feelings. Even within the Computer Science Education Research fraternity there are many who believe that the only valid research methods are quantitative; “we must apply the same basic principles of scientific research to our education studies that they do to their research projects” [6].

When researching gender related issues one cannot ignore feminist theory and the fact that the preferred methodology of proponents is quintessentially qualitative – although, surprisingly, many current feminist researchers distrust quantitative methodologies less than scientists do qualitative ones [9, 10, 11, 13]. We agree with the sentiment expressed by Stanley and Wise [13] when they argue that methods in themselves are not innately anything; it is the use to which research is put that is important.

3.2 Data Collection
Female students were asked to participate in semi-structured, tape-recorded, interviews with questions based loosely around the following themes:

- Academic and social background
- Why they chose Computer Science
- What is it like
- What did they expect it to be like
- Did they know the gender ratio before arriving at university – if so, how did they find out
- Is it a problem / issue
- Suggestions for enticing more female applicants
- Any other points which arise or that students feel strongly about

4. Findings
After interviewing the students the interviews were transcribed and the results categorised and analysed to highlight key features and determine any repeated themes.
4.1 Background
Seven of the fifteen students had previously attended a single-sex school. Since the type of school – grammar, high, comprehensive — varied between Education authorities we cannot read anything into that.

Some of the schools had studied IT and Computing A-levels, but several still had IT teachers who were not qualified in the subject.

- Our IT teacher was a qualified teacher, but she wasn't qualified in IT. She had a Latin degree.
- IT was taught by the maths and geography teachers. We knew more than what they did.
- It was really good in my school. The IT teacher knew what he was doing and he was really keen. He just made it interesting for us.

4.2 Why choose Computing?
Two of the students had previously started, but not completed, degrees in a totally different discipline and had changed to Computing after a closer inspection of what Computing degree courses entailed and job prospects upon completion.

One had started a German degree and found it unsatisfactory; her boyfriend was studying Computer Science, she investigated the subject, and it appealed.

The other had begun a European Drama degree and became disenchanted after 2 months. When she left she took a job in an IT company and became fascinated by some of the work that was done there.

The students who entered the degree programme directly after completing their A-levels presented a variety of reasons:

- Money was a factor. People say you can get a high paid job.
- I didn't enjoy my A-levels so I did Computing instead. It was something I hadn't done before.
- I didn't know what else to do.
- All I had to go on was my GCSE but I wanted a challenge.
- I went to a technology school. I was just fascinated, and I did well at school.

4.3 What did you expect it to be like?
Responses to this question were basically a variation on the theme of “I don’t know”:

- I expected it to be more interesting than what I was doing.
- I really didn’t know what to expect with programming.
- I didn’t know what to expect.
- I thought it would be like my A-level.
- Not sure what I expected, but I thought it would be more technical.
- I thought it would be more like using packages and stuff.

The obvious follow-up to this was to ask about advice from careers teachers and others at the school. Responses to this were worryingly unanimous:

- The careers teacher didn’t know anything about it.

4.4 What is it actually like?
This question partners “what were you expecting?” and solicited a range of answers from the extremely positive to the downright negative:

- I love it. It is good fun. There are so many aspects you can just choose the ones that appeal the most.
- I hate programming.
- It is more boring than I expected but I suppose I would still choose it.
- The logic thing takes patience. You have to adhere to a structure, but if you persevere you can make it do what you want.
- Oh that feeling when you actually make it compile and run!
- It’s a practical course. You can’t just tell people what to do, they have to just do it — give it a try.
- The first year was boring, but everyone knows different stuff when they arrive and we all need to know all of it, but now we can choose the bits we like and its good.
4.5 The gender ratio
Did they know that they were going to be one of only a handful of female students amongst well over 100 males before they arrived? If so, did knowing it actually prepare them for the experience? Is it a problem or simply a fact of life?

- I had an idea it would be mainly lads and not many girls.
- I came to an open day. My mum asked because there were 3 girls there and he said it was a good turnout.
- Girls become friends quicker because there are so few of you.
- The guys are alright. You can sit next to anyone.
- Quite a few people went to single-sex schools before. It must be quite hard for them to get used to.
- I was apprehensive at first but it doesn’t make any difference at all.

So the gender imbalance is not an important issue for the students, just for those of us who would prefer the numbers to increase rather than decrease.

Two further gender related points did emerge, however:

- At first I felt like giving up ‘cos everybody else knew so much and I knew nothing, but one guy came up and said “we must know enough else they wouldn’t let us on the course”
- If we ask for help they ask us how to do it afterwards. The boys don’t ask staff for help. We’ll just ask anyone in sight.

This suggests a difference in initial confidence levels and attitudes towards help seeking which have previously been investigated [2, 3], and will inform further work into staff perceptions of the academic effects [4].

4.6 Can we increase the appeal?
Any discouragement or lack of encouragement for applying to Computer Science degree programmes has obviously occurred at the pre-university level. Could the students cast their minds back to that time and perhaps suggest anything that they would have liked to see when they were making their choices?

- An information booklet saying there is more than just programming. It has so much variety and you don’t know that until you start.
- When you apply for maths or geography or whatever you know what it is about, but this is something new, it means you don’t have a clue.
- If there were more proper teachers and more girls could do A-level it would help.

5. Summary
The students volunteered a wealth of information, impressions and opinions and a representative selection has been presented here.

Trying to get the students to recall what they were expecting and to compare it to what they now have is crucial. Addressing the mismatch between expectation and experience (provided the experience is perceived as a positive one) is an obvious lynchpin within any drive to pique the interest of more students, although care must be taken not to disenfranchise the students who want to do something they know nothing about.

Much of the current body of knowledge about gender issues within Computer Science is anecdotal [4]. “Facts” are hypothesised, repeated and accepted with little or no evidence to support them; it is a subject upon which everyone has an opinion. With this paper we have provided some genuine “facts” upon which we can base our future research.

6. What Next?
This is the initial step in an information gathering process; merely interviewing female students is obviously biased. Subsequent interviews will include:

- Male students
- School careers teachers
- School pupils
- IT teachers (possibly)

Once all the information is gathered we should have the clearest picture yet of the actual situation and our intention is to utilise this by working, in conjunction with industry, on a means of exploiting the findings to encourage more female applicants. This is not an issue that is unique to University Computer Science departments; if we do not recruit female students we cannot send female graduates into industry. At least one major player in the IT industry is becoming increasingly alarmed at the small number of women applying for IT-related jobs.

Why is it so important to entice female students back into Computer science? Spender [12], arguing from a radical feminist viewpoint, suggests that we should use any means available in order to reverse the current trend. If women do not have any influence upon design and implementation decisions today then cyber space cannot be a female-friendly place tomorrow.

7. Acknowledgements
Many thanks to the students who voluntarily gave up their time to talk to us.
8. REFERENCES


[14] Wusteman J. Where are the women? Kent Society Bulletin 21