Girls and Computing - an Overview

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There has been a certain amount of debate in computing and educational circles about gender differences in the take-up of computer courses at all levels. This concern many not be surprising once some of the figures involved have been examined:

Candidates accepted through Universities Central Council for Admissions, for Computing Courses(1)					
Year	Male	%	Female	%	Total
1979	1,269	74	438	26	1,707
1980	1,481	74	515	26	1,996
1981	1,586	75	520	25	2,106
1982	1,489	78	412	22	1,901
1983	1,544	80	381	20	1,935
1984	1,728	83	342	17	2,070
1985	1,585	87	243	13	1,828
1986	1,639	86	261	14	1,900
1987	1,897	87	294	13	2,191
1988	2,115	86	343	14	2,458
1989	2,096	85	364	15	2,460

A closer look at the above figures shows that not only has the number of female students declined *as a percentage* over the period in question, but that the *actual number* of female students has also declined, despite a general increase in the overall number of applicants and in the number of places available.

Note that these figures do not include applications for Polytechnic degree entry, although I understand that the figures for such courses are a little better. (One exception here seems to be Brighton Polytechnic which has changed the B.Sc. in Computer Studies to a B.A. Computer Studies, and has female enrolment running at approximately 30%)

These general trends serve at least to indicate that there may be some influence which has been at work in the United Kingdom over the past ten years or so, which has caused this effect. What, exactly, the factors involved are is a matter for debate, but I would contend that one of these factors is the rapid development of the microcomputer, and its proliferation into all areas of life.

Prior to this, those schools which offered any practical access to computers had been few and far between, and the use of the computer was strictly controlled and overseen by a member of staff. Computer Studies as a subject tended to be more purely theoretical than is currently the case. In addition, many schools were unable to offer any computing at all, so that those girls applying for

computing courses may well have known very little about computing per se. The chance that they would have had a significantly different experience of computing from their male counterparts was minimal. Then, as now, institutions of Higher Education, especially Universities, preferred to accept applicants without previous computing experience, as they have fewer pre-conceived ideas about the subject and are less likely to have bad habits to un-learn.

Part of British Government policy with regard to education has been geared to the introduction of the newly available microcomputer technology into education at all levels, as quickly as possible, through a variety of schemes (e.g. the Microelectronics Education Programme).

This can clearly be seen in the new National Curriculum, with its emphasis on the cross-curricular use of computing and other technologies.

This means that many more pupils have had, and will continue to have, some contact with computers. My contention is that it is this experience which is, for girls, so negative as to produce the effect outlined above.

Girls and Computing - The Current Situation

Despite the current emphasis on the need for technological literacy as a key to career and personal development, at least nine (2), and possibly as many as thirteen (3), times as many boys have access to a computer at home as do girls. This home situation is unavoidably reflected back into the school in a variety of ways, and many educational institutions do little or nothing to counteract this imbalance.

This may be due to the ways in which the computer has, or has not, been integrated into the school curriculum.

The use of computers in education has historically fallen into three main areas:

1. As an object of study
2. As recreation
3. As a general-purpose tool

In each case there are gender-related problems which need to be overcome if girls are to gain the full benefits available from this technology.

The Computer as an object of study

School and college computers are often linked with the Mathematics Department. This immediately gives the impression that computing is a scientific/mathematical subject, not for those unsure of their mathematical abilities. This therefore imposes some of the problems pertinent to questions of gender and mathematics (4), about which a great deal of research has been, and continues to be, carried out.

In addition the majority of syllabi available require some elements of programming, often (erroneously) supposed to require a certain level of mathematical ability. Historically the BASIC (Beginners All-purpose Symbolic Instruction Code) programming language has been used for this purpose. However, because of the lack of a defined standard for handling some aspects of input and output, notably file handling, many versions of the language make it difficult to develop commercial-type programming applications, and also to provide examples of such in text-books. This has had the result of throwing the emphasis more on the mathematical functionality of the language. The successor to BASIC, which is now being introduced is Pascal (named after the mathematician Blaise Pascal - not a good start), which is perceived to have an even more mathematical bias. Again, many of the example programs and programming exercises used emphasise this mathematical bias, thus exacerbating the problem for the non-mathematician. It can be difficult for a student to write a good program if he or she is not confident with the underlying concepts involved.

Another problem is that, because resources are scarce, some pre-selection for computing courses may be imposed. One of the most common selection criteria is that of having some mathematical ability, despite research having shown that the possession of such ability is, for the majority of computing courses, totally irrelevant (5). This may be because of the idea that much of the work carried out involves working in a variety of number-bases (binary, octal and hexadecimal), but more important is the need for a logical and orderly approach to problems, both of which skills girls are expected to have.

It is equally important to have some linguistic talent for learning and using programming languages, again an area where girls are expected to be strong. It is not generally appreciated that other skills at which girls are expected to excel are those which are highly valued in many commercial Data Processing installations, such as a methodical approach, persistence and a general ability to work well in teams.

The Computer as Recreation

Again this is an area where boys benefit more than, or even at the expense of, girls. Not only are boys likely to have better access to computers at home than are girls, but many of the programs available for home use are basically girl-hostile. By this I mean that there is a great preponderance of war-type animated games, which girls will have been socialized into seeing as inappropriate for them. There is also an increasing tendency for the games available to portray women purely as sex-objects to be abused: "Leather Goddesses of Phobos" for example, is one of the less extreme of these. It is difficult to imagine any girl wanting to play these games.

Any visit to a store selling computer games will illustrate this problem. The few non-aggressive, non-exploitative games available are usually adaptations of board games such as "Scrabble" or "Trivial Pursuit". This situation is probably a direct result of the law of supply and demand in relation to the figures for home use of computers mentioned above. It also has a side-effect in that the stores are always apparently full of males, both as staff and as customers; this can be very intimidating for any female. In addition the attitude of the staff often seems to be that a female cannot possibly have an interest in computing, nor can they know anything about the subject, and that they are consequently wasting time and space by their presence.

The computer as a general-purpose tool

Once again girls are at a disadvantage. Lack of access to computers in other areas means that girls may be slower at grasping the essentials of computer operation than many boys. This in itself may act as a disincentive. There is also a general lack of teachers who possess the necessary skills and training for using the computer effectively in the classroom. This is evident at all levels from infant to post- compulsory education, despite a variety of schemes, notably the R.S.A. Modular Information Technology Scheme for Teachers and Trainers, aimed at correcting this situation.

This lack of experience and ability is reflected not only in the ways in which the computer is being used e.g. control of access, but also in the selection of suitable software. Pupils of both sexes perceive the computer as being of more use to boys than to girls (6), so the use of this high-status resource tends to be dominated by boys.

An interesting (and worrying) side-light was thrown on this situation during a discussion on this area. One teacher told of a situation he had observed, involving a boy and a girl working together on a computer. The girl had been using the machine before, and was familiar with the procedures involved to achieve the desired end (some Word Processing). She sat at the keyboard and worked under instruction from the boy. The problem was that what she was being told to do by her male colleague was actually incorrect, but she still carried out his instructions! What most surprised the observer was that, in the normal course of events he would have expected the girl to ignore or challenge the boy's instructions if she believed them to be wrong. If this is a general problem then it

is very worrying indeed that girls should so lack confidence in dealing with the computer that they will do what a boy tells them, even if when working alone, they would know it to be wrong.

In situations where the computer is used as a tool within part of a pre-defined syllabus, for example, G.C.S.E. Information Technology, there seems to be less competition, although this may be because the syllabus is slanted towards the use of the computer in an office environment - a traditional employment area for girls.

Strategies for Change

Because of the problems encountered by girls when dealing with computers, it is necessary for some strategies to be developed for use in all educational institutions, which will assist in redressing the current imbalance.

These strategies may not, however, be easy to implement. Not only will they encounter opposition from teachers and other staff who do not perceive the need for them, but they may also meet opposition from parents and from pupils.

Part, if not most, of the opposition will have its roots in the socialization process, which starts at birth. Gender identity is initially shaped through interaction within the family. From birth the sexes are treated differently. Girls and boys are give different toys, different standards and rules apply to their behaviour and they are assumed to have different interests (7) This process starts atbirth and continues through life, though with greatest effect during the formative years of puberty and adolescence.

> *It is at this period of transition from childhood to adulthood that these notions relating to masculine and feminine roles become clarified and reinforced. (8)*

Given this, the teacher may find making changes an uphill task. Not only will boys be hostile to the idea of losing their classroom dominance,

> *Many researchers have found that teachers, both male and female, tend to spend more time talking to boys than to girls in class. In our society males are considered more important and interesting than females... both staff and pupils bring this assumption of male precedence with them into the classroom, and it results in boys demanding and teachers conceding them a disproportionate amount of attention (9)*

but girls may be made to feel insecure and hostile by receiving a higher level of attention than that to which they are accustomed. In addition teachers will have to re-assess their own classroom behaviour, not an easy task even when the teacher fully recognises the need for this.

In any case, not all the strategies outlined below may be feasible in any one situation, for a variety of reasons. However, once strategies have been designed and implemented, once teachers realise not only that there is a problem, but also that something can be done about it, progress may be made.

Control of Resources

Access to resources in a classroom may, in itself, prove difficult for girls:

> *Girls are taught to be aware of the ways in which their actions affect others, and as a result become cautious about their actions (10)*

and they may defer to others (boys) whom they perceive as having more "right" to the equipment, or more need of it than they have. This may especially be the case when the resources have to be shared amongst a large number. Saying that all pupils have equal access to equipment is not the same as ensuring that this is what actually takes place.

It has been observed that boys tend to "hog" equipment, and they have been seen to physically push girls aside to gain access to it. (11)

Teachers, pupils and parents may feel that this does not matter particularly, that boys get most of the attention and access to equipment. This is not necessarily a case of intentional discrimination but rather:

> *implicit acceptance of inherited and unexamined social and educational assumptions that girls were destined for different, mainly subsidiary, marriage-based roles in society and needed therefore less sophisticated equipment and education. (12)*

There are a variety of ways in which improvements to this situation may be made:

1. Improved Resources

Ideally, there should be one computer per pupil whenever computers are to be used. If there are enough computers to go round, the element of competition will be removed. This is, of course, idealistic, and may in many cases be impossible to achieve with the resources and funding presently available. If it can be achieved, then this may be done in two ways, either by increasing the number of computers (or terminals) available -- which is a fairly expensive option -, or by reducing the class size for those sessions where computers are to be used which is often difficult to arrange, and potentially equally expensive. Despite these difficulties it is one of the recommendations of Project 2000 that every pupil have her/his own computer available for use at any time, and a variety of educational institutions are, in a variety of ways, attempting to adopt this approach.

2. Single-sex classes for Computer-related work

Obviously this is not a problem in single-sex educational establishments, but may be of help in co-educational establishments. With the disadvantages girls suffer in the use of computers they need a safe and supportive environment in which to work and to learn, and one way of achieving this might be to eliminate boys from the class.

3. Girls-only Access Sessions

This could either take the form of a Computer Club for girls only (or with some time allocated just for girls) or simply by providing some measure of Open Access during some part of the day. Mixed sex sessions tend to become male-dominated, and this exclusion might provoke hostility among boys (15), so teachers must ensure that access is truly equal. Girls-only access once a week, or once a fortnight would not be sufficient. At the very least such provision must equal that provided for boys, which is effectively every mixed-sex session. In any case, whatever form this takes, computer clubs and forms of Open Access should be supervised and monitored by a competent teacher.

4. Improved Teacher Training/Heightened awareness among Teachers

The feminist movement has long considered that one of the reasons for the poor performance of girls and women academically, especially at post-compulsory levels, is that many teachers are not aware of the problems facing female students. Feminists have been calling for changes in teacher training to take account of this:

> *A major potential area of change lies in the training of teachers to be much more aware both of the processes of gender-typing and gender categorization going on in schools, and also in showing new recruits to teaching ways in which they may deliberately try to overcome some of the worst effects of gender typing on their pupils (13)*

though how this could be fitted into some teacher training syllabi remains a mystery – and who will train the trainers?

The reasons feminists give could apply throughout the curriculum, but may have special relevance in terms of the use of computers, and in scientific areas.

In mixed-sex classes, boys dominate the group dynamics, with girls relegated to the fringes of both the classroom and the activity both physically and metaphorically, and

> *a firm line of discipline is needed so that girls do not become the focus of ridicule in mixed classes when they meet with problems. (14)*

Contrasting behaviour between boys and girls may affect teacher's perceptions of their abilities and influence teacher's expectations which may have a severe impact upon later educational achievements as

> *an individual who holds a given expectation about another can communicate that expectation to the other in such a manner as to increase the probability that the expectation will be validated. (15)*

It is necessary, therefore, that teachers be made aware of these problems, especially in an area that is so strongly male-dominated.

One way of keeping this to the forefront of teachers' minds would be to monitor gender differences in terms of both take-up and performance.

In addition, teachers should beware the use of teaching material which contains gender stereotypes. Where such material must be used than the stereotyping should not be passed unchallenged. This problem seems to be particularly prevalent in scientific and technical text books where photographs and art-work often show females as subordinate to males, or to be non-existent in a particular area of employment.

5. Within the Curriculum

Another area where changes might take place is the use of computers within the curriculum, and within educational institutions generally. At present the majority of computer use takes place within specialist computing and business-type classes. The following strategies might provide for some involvement in other areas of the curriculum.

a. Setting up Specialist Computer Departments

This is, in fact, becoming more common, and has, to some extent, the effect of disassociating the computer from mathematics. It may be that the teachers involved in such a department are still, basically, mathematicians, but this situation might well change with time. An alternative strategy could be to avoid creating a computer department as such, but to attach computer specialists (this would need training) to every department, either by making direct appointments or by training an existing member of the department. These specialists would then have a brief to formulate school and departmental policies with regard to computing, and be responsible for introducing computing into the curriculum in as many areas as possible.

There is a wide variety of computer software available to educational institutions, for use in all areas of the curriculum. A computer specialist would be able to select the most appropriate software for use within a particular department. This does of course assume that adequate facilities are available.

This approach would also facilitate the cross-curricular use of computers as required by the National Curriculum, as computers would then come to be seen as a resource for the whole institution, rather than being dominated by any one department. This would also eliminate the problem of the controlling department refusing access to equipment to other departments unless pressed to do so.

b. De-mystifying computers

There does seem to be a tendency for computer specialists to cling to the idea that computers are esoteric machines which need a special kind of understanding and very careful handling if they are to be operated to the best effect, but this is not really the case. Modern computers are considerably

more robust than previous models and will stand up to quite heavy use without damage. For proof of this one only has to look at the numbers of BBC. Model B computers still in use in primary schools on a regular basis, often treated in the most casual way by the pupils, for whom concepts of delicacy of handling and technical difficulty are quite alien.

c. Improved choice of options at 14+

Another area of concern is that option schemes, especially in secondary schools, are so arranged that computing courses are arranged in opposition to "traditional" girls' subjects.

> *The school curriculum often deprives girls and boys of their freedom of choice by assuming that they will not want to study certain subjects, and by arranging the timetable on the basis of those assumptions. (16)*

This is not a new observation:

> *the prevailing picture is of traditional assumptions being worked out through the curricular patterns of secondary schools, and of support for and acceptance of these patterns by the majority of teachers, parents and pupils (17).*

Perhaps it would help progress if we note that these assumptions about subject choice may be damaging to boys as well as to girls!

Obviously some constraints have to be imposed upon subject options and choices made, but it might be possible to make adjustments to rectify this situation. One possibility might be to offer, in addition to Computer Studies, Information Technology as an introduction to computers in general. This has been the case in some Hampshire schools, but restraints on time caused by the implementation of the National Curriculum may make this impossible in the future.

However, the development of TVEI promises to enforce changes in this area, at least for some pupils, (even if this is popularly supposed to be a scheme for the less able), with the emphasis on Information Technology and technology skills for all.

6. Other Initiatives

One possibility is the development of links with local (and national) industries. Introducing pupils to the ways in which computers are used in the business world, the sheer variety of the uses to which computers are put, may open up perspectives for both boys and girls into areas which they had not previously considered, or been aware of.

Another suggestion is for educational institutions to offer and develop conversion courses in computing and I.T. for people with and arts or social science background, in much the same way that many Universities are offering conversion courses in Computing (either at Diploma or Masters level) for graduates with degrees in other disciplines.

Much can be learnt here from other disciplines where females have traditionally been in the minority, and which are now attempting to increase the representation of females. Notable among these in the United Kingdom is engineering, where a variety of initiatives at all levels of education and training have been taking place (18).

7. Improved Careers Advice

Careers advice should, ideally, be up to date, non-sexist, and provided at an earlier stage than seems to be the case at present. Options selected at, say, fourteen years of age will restrict the choice of careers and further educational opportunities available. It is therefore important that pupils are advised about the implications of their choices before they are committed to them. It might be possible to include Computing and/or Information Technology as 'utility' options for those who are unsure of their future careers and who wish to maintain a broadly-based range of options, although

this again depends upon the National Curriculum and the exigencies of timetable organisation.

Unfortunately it seems that much of the careers advice available, with regard to computing in particular, concentrates on the technical aspects of computing, rather than on the linguistic and inter-personal skills which are required for such careers as programming and Systems Analysis, yet these are the skills in which girls are considered to be

There is also a need for careers advisers to inspect material for suitability of illustrations because of the likelihood of it reinforcing gender stereotypes, in the past even the National Computing Centre has been guilty of this.

Miscellaneous Points

None of these strategies will be successful without a general change of attitude, and a raised awareness of what computing is really all about among pupils, teachers and parents.

Whatever strategies are used and developed within educational institutions they stand little chance of success without the support and encouragement of all concerned. The difficulty is, of course, in achieving this. As far as one can tell, parents come in two varieties; those who turn up to school events, and those who do not.

Access to parents who do turn up is relatively easy, and if they turn up then they may be persuadable; access to those who do not turn up is an entirely different problem. The use of desk-top publishing packages in the production of such things as newsletters and magazines - making sure that the production method is mentioned - may help, but this problem has been perplexing Head Teachers and Principals for many years, and might well prove to be insoluble. One shred of comfort which may be drawn from this is that they those who do not attend are unlikely to interfere in school or college decisions.

Finally, those in a position to appoint (or to fund training for members of staff with responsibility for computing matters) might consider some policy of positive discrimination with regard to female applicants (if there are any). The situation with regard to girls and computing seems to be reaching the stage of a self-fulfilling prophesy. Girls have no role-models to counteract the impression that girls and women cannot succeed in computing, therefore they believe that computing is for boys and men only and avoid taking computing options. This, in turn provides no role-models for future generations.

Conclusions

Many of the strategies suggested may equally be applied to areas other than computing, such as the "hard" sciences, but many of them are intended to be of specific relevance to computing. However, it should be emphasised that the situation is unlikely to change over-night, and any strategy might need to be employed for some time before any positive results can be observed.

Also, many of the observations outlined above do not apply only in the United Kingdom. Many of the problems are common in the majority of western democratic societies (19). What is needed is a radical re-think of the way in which computers are used and portrayed in education.

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