

# Gender and Computers in Secondary Mathematics

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## Introduction

About 10 years ago there was a lot of research interest in gender differences regarding response to computers in the classroom, and regarding attitudes to technology and levels of parental support. Since then, I have seen little to follow up the earlier work, but at the same time computers are now being used more widely.

My interest in this area arose from work done by a mixed sex group of pupils aged 16 years in a mixed ability setting. The class were preparing a survey as part of their mathematics coursework. As part of their preparation, the class were given a demonstration of Pinpoint, and students were offered the opportunity to use the package in small groups working together. At the end of the session there were two groups of students who were interested in using the software. One group was all male and the other was all female. There were clear differences of attitude and confidence when the students used the computer.

Pinpoint is a piece of software for Archimedes computers. It enables the user to design a questionnaire, and input results from each completed form to create a database. The information can be analysed and presented on screen or as a printout.

The first obvious differences were apparent when the students created on screen the form for their survey. Whilst the boys happily adapted to using the mouse and explored ways to resolve problems and mistakes, the girls were reticent about using the mouse and were reluctant to experiment with a new tool from an icon. Because the girls focused on the particular tool I had shown them, they had difficulty producing a questionnaire that looked neat. As a teacher I

was keen to encourage the girls positively; after I had spent two more sessions with them they appeared more confident about setting up their questionnaire. By this time the boys could load the programme and their own files at the beginning of the lesson and were able to adapt the presentation of their form.

Eventually, having understood how the questionnaire was set up both groups were able to produce survey forms to collect their information. The girls were much more particular about the appearance of their form and were very self critical.

Questions in Pinpoint have to be defined to have one of three types of answer: numeric, multiple choice, or yes/no.

To enter data, a questionnaire form is completed on the computer for each respondent.

When the user analyses the data, Pinpoint presents, at each stage, choices appropriate to the type of data being analysed, before the diagram is displayed on screen.

Each group had about ten questions on their questionnaire, including Yes/No, multiple-choice and numeric questions. They were able to enter their own data, and then there were many ways it could be represented pictorially.

The boys had their data stored first, so they were shown how to draw bar charts and pie charts and how to group the data. The many choices available at each stage were demonstrated. They were

shown how the analysing tool could stack the sheets according to the criteria stated by the user. I suggested that they could explore different kinds of diagram by changing the bar width and using three dimensional representation. I emphasised that they should think carefully about what they wanted to show. The boys spent two or three hours on this altogether, making decisions about what to include.

When the girls were ready to analyse their data I explained the processes in the same way as I had for the boys. The girls were then asked to explore their data, but after about fifteen minutes they were neither using the keyboard nor discussing the work. They had no information on the screen and a boy from another group was exploring the use of the icons. The girls appeared frightened to press the buttons in case something went wrong. They were timid and hesitant about using the programme. I intervened and went through some of the explanation again, focusing on specific points, and emphasising they would not lose their data by exploring representations and cancelling them.

The girls frequently attempted ideas that were specifically related to the task, whereas the boys explored all the tools. The boys were inventive in the diagrams they created and were not as well focused on the task as the girls.

At this time other groups of students were using other software packages for mathematics coursework. They were also single sexed groups and again there were differences. The girls spent a lot of time discussing what they were doing and how to go on, whilst the boys worked less co-operatively, and did not keep on task like the girls.

Although it appeared that the boys were using the computer to advantage, when they compared printouts of their results, the attitudes of the two groups were very different. The boys assumed their printouts were correct whereas the girls compared their results and discovered some discrepancies, which they were able to resolve. The analytical skill of the girls demonstrated mathematical understanding. The completed coursework also reflected these differences. While the boys had some interesting diagrams with little interpretation, the girls had straightforward diagrams with excellent interpretation.

Before I discuss further the implications of these classroom observations, I want in the next

section to review and summarise some of the related research from the 1980's. Then in the final section, I shall describe how I went on to test some of my own ideas relating to gender.

#### **Review of related research**

Research from the 1980's indicates some major issues affecting attitudes of males and females working with computers, including:

- (i) the availability of computers at home;
- (ii) the tendency of girls to be less competitive and more interested in maintaining social relationships than boys;
- (iii) the lack of self confidence demonstrated by girls;
- (iv) the way the computer is being used;
- (v) stereotyping by teachers, the media and parents.

#### **Home ownership**

As long ago as 1983, teachers were writing about the different computer experience of boys and girls at home and at school. Later research showed that a computer was more likely to be bought for a boy than a girl, and that a male adult in the household was most likely to use it with the child (Harvey & Wilson 1985, *Girls and IT* 1985).

#### **Gender attributes**

There seems to be a commonly held view that internal attributes of females affect their self confidence (Ring 1991) and that girls respond to praise. They achieve this by conforming to good behaviour and/or through good performance in a rote learning situation (Hart 1985, Greaves 1988). Girls respond to what Hart calls 'accuracy skills'. Girls prefer to work collaboratively, whilst boys seek to work competitively. Greater male aggression is one of the best established and most pervasive of the sex differences. (Maccoby & Jacklin 1974)

Hoyles & Sutherland (1989) also observed single sex groups and mixed groups working on particular tasks.

"Gender differences were observable with a girl more likely consciously to share with her partner her representation of the problem and her ideas for problem solving." (Page 171)

"Boys used few verbal supports of their partner's contributions. They appeared to be trying hard to convince each other, which led to a competitive style of speech." (Page 175)

#### **Confidence in using computers**

There is clear evidence that boys tend to be more positive about computers than girls. Research by Hoyles (1988) compared pairings of boy-boy, girl-girl and girl-boy on a Logo task. This demonstrated that the girls performed better in a mixed pair group than in a girl-girl pairing, and the girl-boy pairing was not significantly different from the boys.

In the classroom girls tend to have lower expectations than boys and respond positively to comments. They seem to respond best when the work is collaborative or the software can be used collaboratively, and more particularly if the work is not conspicuously mathematical or science-based, even if concepts from these areas are integral to the work (Hawkins 1985).

#### **Different uses**

Uses of computers include games, word processing, using a piece of software, data processing, programming and problem solving.

Attitudes to computers depend on the use. Males tend to spend more time than females on games and programming, whilst females spend more time on word processing and data processing (Lockheed, 1985). Programming is seen as a mathematical activity requiring an element of competition for success, which does not sit happily alongside female values. Computer games involve competition and tend to be male oriented, so they are used predominantly by boys. Only when the computer is being used as a tool do girls become more interested and involved than boys. Other research reported that girls tended to persist with familiar ideas, and remain task oriented, whereas boys were innovative and experimental. Boys explored more with commands and icons and created complex games, whilst girls aimed at perfection.

#### **Stereotyping**

Fennema (1985) found that stereotyping by pupils ("computers are to be mainly used by boys") was more likely to occur from those with a working class background and unlikely to occur from a middle class background.

There is no doubt that for some subjects, the

response of students in a mixed sex group depends on the approach of the teacher; either boys or girls may feel disadvantaged as a consequence. Computers tend to be discussed from a male point of view. The Times Educational Supplement (1993) reported that girls were often given the message that a career in IT was unattainable for them. Certainly the number of new female graduates being employed in IT is only 14% and this is when the academic qualification may have included other disciplines than IT.

#### **Synthesis**

Putting together the classroom observations and the background knowledge gained from the review of literature I set out to test some of the ideas relating to gender. In a survey of 59 Year 10 students, I collected evidence on:

- home ownership of computers;
- the main users of the computer in the household;
- the frequency of use;
- the type of use;
- the confidence of the pupil in using the keyboard, mouse and joystick;
- the pupils view of the use of computers.

The following is a summary of my findings.

- There was no significant difference between the sexes in home ownership of a computer. This differs from results reported in the 1980s.
- Males were most likely to use the computer alone at home. About half the boys used a computer every day and well over half used one more than once a week. This was very different from the girls of whom half rarely used the computer. Girls are not using computers at home and one needs to ask why this is the case.
- The students were asked to rate, on a scale of 1 to 5, their confidence when using a keyboard, mouse and joy-stick. There were no significant differences between sexes in confidence using the keyboard, but boys were significantly more confident than girls when using a mouse or a joy-stick. This difference in confidence supports the literature (Hoyles, Fennema 1980).



- All the students used the computer for games, whereas about half the boys and about a quarter of the girls used it for Word Processing. It was noticeable that only the boys used it for Programming.

- Students were asked to rank uses of a computer in order of importance. The girls identified word processing as most important while the boys identified games. Again this supports existing literature (Lockheed, 1985) that girls see a computer as a tool while boys see it in a competitive light for games.

- When I tried to find out whether pupils regarded computers as being for males or for females, many students wrote that the statements they were being asked to use were sexist!

A problem with this survey was that it did not identify the capabilities of the computer at home; this could explain why the girls recognised the value of word processing but did not acknowledge that they used it on their machines. Similarly not all computers have a mouse and/or joy-stick. The ranking of uses of the computer seemed to work, but I should not have tried, at the same time, to collect information about whether computers were for males or females.

Other factors that I now consider to be important are age, ability and social class.

#### The future

There is a continuing need to give confidence to girls using computers, and to be positive in discrimination towards girls. Certainly all children who have computers at home should be encouraged to use them for problem solving and word processing, although for boys these activities may be generated from a game. In this way, girls would benefit from hands on use and boys might develop other skills.

Where possible, classroom software should not be gender biased. There must be a recognition of what appeals to girls. It has been suggested (TES 1993) that female writers of software should be encouraged; when they write software they think first of the user and the computer has to adapt, whereas male writers think of the user adapting to the machine.

Another way of encouraging girls is to ensure that school computer facilities (after school or lunch time clubs) are sometimes reserved for girls only. It is important that women are seen by pupils to be regularly involved in high level computer use. Effective computer use will require investment of both money and time by the school. As a practising teacher in mathematics, I believe that these are ideals to which it is important I work towards in the future.

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