HOW WISE WAS W.I.S.E.?
THE RESPONSE OF GIRLS AND WOMEN TO TECHNOLOGICAL STUDIES.

Margaret B. Sutherland

University of Leeds
Great-Britain

Technological progress is admirable: but it may have unhappy effects on the careers and employment of women. In industry women workers are likely to be disadvantaged by such progress because they are largely occupied in relatively unskilled work which can most readily be taken over by technological devices: even in a 'white collar' occupation like banking women in many European countries are employed at the lower levels where, precisely, technological improvements may make their work redundant.(1) Further, women are less likely than men to engage in the scientific and technical studies which would prepare them to work in occupations where such a foundation is increasingly important. Thus it could be argued that one of the effects of progress in technology is to worsen the chances of women in the employment market.

This is a problem which has been widely recognised. For years now there have been proclamations in various countries of the need to further women's progress in employment and especially to encourage the greater participation of girls and women in the study of the physical sciences and technology. European Ministers of Education have frequently referred to such needs for improvement. The report (2) on activities of the Commission of the European Communities for 1983 and 1984 notes the work of the European Centre for the Development of Vocational Training in stimulating national programmes to provide training which will increase the range of occupational choices for girls and women. In the Commission's report (3) on Social Developments for the year 1984 there are references to such developments in a number of countries: e.g. in Greece, programmes "devised to initiate women in jobs traditionally reserved for men", in the Netherlands, an inclusion in policy plans to "encourage girls to take training courses that have traditionally been a male reserve" and in the Federal Republic of Germany measures both "at Federal and at Land level ... to train girls for technico-industrial occupations." What we have to consider now is the extent to which such efforts

may be successful and to note those factors which are likely to inhibit the access of females to technological and vocational studies and to 'non-traditional' occupations for women.

Sex bias in choice of subjects, with male opting much more often than females for physical sciences, craft and technological studies at school, further education and higher education levels, is so widespread that it seems scarcely worth while to quote the statistics from various countries. At an international level the three GASAT (girls and Science and Technology) conferences which have taken place recently (Eindhoven, 1981, Oslo, 1983, London, 1985) have amply shown the concern common to many countries to induce more girls to engage in science and technology, the success of some efforts and the opposing factors in other cases. If we look at the UK situation, we note that in Scotland the examination figures (4) for 1984 are fairly typical: at Higher Grade Level (senior secondary school qualification) we find:

	Male candidates	Female candidates
Physics	9578	3309
Craft and Design	63	3
Technical Drawing	2769	104
Engineering	545	21
Navigation	14	0

In England, if we look especially at the situation in the Computer Studies examination at 0 level (Joint Matriculation Board, 1984) (5), we find 15636 male candidates and 7,153 females: at Advanced level, 1009 males and 236 females. In further education courses, figures for 1979-80 (6) showed the percentages of women students in various subjects and types of course as these:

	Full-time	Sand-wich	Block-release	Part-time	In all
Phys. sciences	12.8	10.3	5.6	9.5	10.5
Chemical sciences	21.1	24.0	0.0	23.0	22.5
General Engineering	2.7	7.7	0.0	1.8	2.1
Electrical Engineering	2.1	1.1	1.9	0.4	0.9
Maths and	26.3	21.8	14.3	23.0	23.6

	Full-time	Sand-wich	Block-release	Part-time	In all
Computing					
Civil and Constr.	1.4	1.7	0.3	2.0	1.7
Engineering	0.4	0.0	0.4	0.2	0.2
Craft trades					

From this last table we may immediately recognise - in addition to the low level of participation of females in block release courses especially (a responsibility of employers?) - one probable difficulty confronting the young female trainee in certain fields of study: she may well feel lonely, lacking the support of female fellow-students.

The Computer Studies Situation is one which has particularly attracted attention recently and a good deal of comment has been made on the possible reasons for the lesser participation of females here. One survey by a manufacturer (Acorn) noted that where families had a home computer it was in only 17% of cases that the mother made use of it: this would seem to be a case of a negative role model for daughters. Outside school also, it has been argued, computer games tend to be of the Star-wars type - or provide other agressively motivated situations - which may be more likely to appeal to boys than to girls. In school, some have suggested, in classroom work girls may be elbowed out of the way by boys more confident in their ability to cope with the computer. Yet there is also evidence that girls and women can be very successful in computer studies. A recent American survey (7) has indicated that girls in high school can perform rather better than boys in some aspects of computer programming. And tutors in at least one British university conversion course for mastership in Computer Studies have noted how successful women students can be, even those whose earlier studies were in the Arts field and did not include an advanced level of mathematics.

What we have then is awareness of a problem and of difficulties in attempting to solve it. An instance of another discrepancy between intentions and results can be found in the TVEI (Technical and Vocational Education Initiative) scheme in England where from the outset it has been stated that sex bias in provision of courses must be avoided. Yet in some schools it can be found that boys but not girls are invited or urged by teachers to attend talks explaining the characteristics of the courses offered

in the local Technical College as part of the TVEI provision: teachers take it for granted that girls will not be interested in a technical course and tutors in the College may share this attitude: likewise when the school timetable is being adjusted to allow for attendance in the local college it may prove to be rearranged on the supposition that it is only boys who will be in the college for certain periods and must therefore have supplementary school classes arranged. Similarly the YTS (Youth Training Scheme) may show bias in its working. The Further Education Unit has noted (8), e.g., that at an information technology centre the proportion of girls to boys attending under the YTS scheme was 1 to 5. Girls are less often than boys employed on YTS Mode B (industrial board) courses.

What attempts are being made to improve the participation of females in the scientific and technical areas? Internationally, we have noted the GASAT conferences. In the UK 1984 was WISE year - the year of Women into Science and Engineering - when various conferences were arranged, publicity about female participation in such areas was provided by talks from women who could serve as examples of successful workers in science and engineering. Yet it remains uncertain whether the year was a success, though some enthusiastic responses were evoked and good publicity achieved. Supporters question whether the situation has in fact changed or modified. Similarly at the specific level of the secondary school there has also been the GIST (Girls into Science and Technology) (9) project carried out by a team in Manchester (1979-84) which focused on a cohort of pupils in ten schools and studied by action research (in eight schools, using two schools as control groups) ways by which girls might be more greatly involved in science studies. Again the results seem inconclusive. Some slight increase in the numbers of girls to study physical sciences may have resulted, and increased sensitivity to the problem was produced. But the researchers indicate finally the overwhelming influence of other factors determining the girls' choices - the views of parents, primary schools, peer groups, employers.

From these and other studies we return repeatedly to the awareness that whatever short-term action may be taken there is the problem of attitudes closely intertwined with the problem of education to prepare for various employments in a technological age. Such attitudes need to be defined.

Insight into such attitudes may come from the study of direct attempts to tackle the problem at the post-school level. In Britain the Engineering Training Board initiated in 1976 a Girl Technician

Scholarship scheme which attempted to show all those concerned - parents, girls, employers - how successful girls could be in this field of work. Later the Board has provided special grants for employers who recruit girls as technicians and technician engineers. There have been created in different parts of England various refresher courses and other courses (mainly short-term) for training women in technical studies, though one doubts whether the provisions made here are comparable with those in West Germany (10), where special courses (sometimes 3 to 3,5 years in length) have been provided for females to train as technicians or courses of rather lesser duration have been provided for slightly older women -e.g. in Hanover provisions for women to train for non-traditional craft and skilled work; in North-Rhine Westphalia, similar courses for skilled work in occupations non-traditional for women; in Essen, courses to upgrade unskilled women workers to achieve qualification as skilled workers.

Such developments have the advantage of attacking the problem at a level where, it is argued, intervention may be more important than intervention in higher education. Certainly in higher education attempts have been and are being made to recruit more women students to study technology in universities and parallel institutions. Various Faculties of Applied Sciences in British universities have organised talks for Sixth Form Pupils in schools, or day conferences or longer visits to the universities, so that girls can see what engineering studies involve and be assured of a welcome if they decide to choose preparation for a career in this area. Possibly such efforts are the cause of the increase in the percentage of women students in Engineering and Technology in British universities (11): it is now 9.7% which - though not spectacularly great in comparison with the level in other countries - is a considerable improvement on the proportion found only a few years earlier. Yet it is argued - and this argument was voiced especially with regard to efforts made during WISE year to present to audiences of schoolgirls women who had made an outstanding success in non-traditional careers - recruiting at the higher levels may not materially alter the situation. Exceptional women can indeed flourish there and perhaps serve as outstanding examples; but it is not until there is steady recruitment of female employees in technically based subjects at the 16+ age level that a real change will have been effected.

What then do we learn from the attempts to encourage young women to enter into non-traditional studies and occupations? What factors and attitudes are important in reducing the effects of

well-meant endeavours to orient girls towards science and technology?

Firstly, there are the attitudes still found among school pupils by which some subjects are regarded as 'boys' subjects', appealing more to boys, and some regarded as 'girls' subjects'. Traditionally the boys'subjects have been maths, physical sciences and crafts/technical subjects. Happily there is evidence to show some changes in these attitudes: mathematics is now thought of as a subject which 'belongs' to both sexes (even if there remain differences between sexes in their competence in different types of maths work and in their confidence in tackling maths). Biology is becoming less typecast as a girls' subject: even chemistry is moving towards a bi-sexual rating. But it still remains true that physics, building studies, metalwork, carpentry, CDT (Craft Design Technology) are not likely to be rated as girls' subjects and home economics/home sciences/office skills are not likely to be thought of as boys' subjects (even if office skills now demand competence at least with word processors). Although the English school system still allows pupils to opt for subjects with such stereotypes in mind - and allows teachers to counsel pupils in accordance with such stereotypes (to suggest, for example, to a boy that typing is not a good choice for him)- there are pupils who do make 'cross-sex' choices and study of their attitudes can be illuminating. It would appear that when girls make such a choice they are more likely to give as their reason that the subject is interesting or challenging and possibly may have some future usefulness in their homes. Their cross-sex choices seem seldom to be made on the basis of career prospects or the wish to enter a non-traditional occupation. Boys, on the other hand, in making a cross-sex choice are often likely to do so with an eye to future career prospects: e.g., to opt for home economics with a view to a career in catering.

A factor which does seem to encourage girls to opt for a 'male' subject or for a male occupation is apparently the influence of a male relation - father or brother or uncle - who has shown the appeal of the subject and encouraged the girl's interest in it. (Given the sex-stereotyping of subjects and occupations it is only in exceptional cases that one would expect the mother to foster such interests). Teachers seem less likely to be influential in this respect: possibly because all too often the teachers accustomed to teaching one sex group are not ready to welcome or encourage 'interlopers' - they may find them somewhat disconcerting. But an interesting attempt has been made recently to introduce a new kind of 'model' for school girls. This can be found in a recent publication (12) of the Equal Opportunities Commission, Letters to

a Thirteen-Year-Old. Intended for the young girl of this age, moving towards choosing her options in the secondary school, these letters are from girl apprentices in non-traditional occupations - e.g. electronics, electrical engineering. In each a young woman apprentice describes briefly and candidly her entry into her occupation and her training in it as well as her reactions to this training. Photos and a line or two in the handwriting of the women apprentices add a personal and interesting quality to the booklet. It remains to be seen whether such models will be accepted and have the intended effects.

The factor of encouragement and modelling from men in the family circle has also been evident in results of researches dealing with young women in the 16+ age group. for instance, an NFER study (13) based on interviews with young women attending science or technical courses in Further Education institutions found the part played by family connections to be important in having determined an early interest in a science or technical subject and having strengthened the young woman's determination to follow the career associated with the subject. Thus women students on a building and construction course had decided for it "in their mid teens when, with the help of this relative, they had explored the possibility of careers in construction" (14). Likewise, a study carried out for the YWCA (15), interviewing young women who were apprentices in 'male' occupations, noted that for them also family examples had frequently been influential in determining their present occupation. (One recognises here that family connections may also be helpful in actually finding a post for the 'divergent' young person.)

But although in such cases the influence of the male relative has been positive we cannot judge how many young women have been strongly counselled or warned by male relatives against thinking of an occupation which is traditionally for men. There is some evidence of schoolgirls reporting that at home fathers especially expect them to live up to the stereotyped 'feminine' image, which is incompatible with an occupation where workers get dirty. It would seem difficult to ensure that the factor of family encouragement will support girls' more divergent choices though just possibly school contacts with parents could gradually break down family prejudices against some occupations as 'unwomanly'. It is also an interesting point - since prejudices about women's appearance have been mentioned - whether educational attempts to encourage recruitment to science and technology by bringing in women speakers who are in a male occupation but dress in a charmingly feminine fashion (and who mention that they are also wives and mothers) are effective and legitimate: they do reinforce

some stereotypes, even in the attempt to break down others. And there is indeed the further aspect of this problem for the woman worker in a non-traditional occupation. Should the young woman engineer appear on a building site dressed in a pink trouser-suit? Or should she adopt the camouflage of the customary male attire for such occasions?

Let us further consider the factors and attitudes resulting from interaction with the working group. Where girls are in training for a non-traditional occupation, we find two types of reaction to their minority situation. Some report happily that all is going well. For example (16), two girls learning to be motor mechanics on the YTS scheme reported that as two girls among 38 boys on the course they had been "very well accepted by the boys". Yet this kind of expression of satisfaction does seem to indicate the underlying expectation that the boys might not have accepted them very well. There is, in such accounts, an underlying supposition that it is particularly good of the boys to receive girls apprentices kindly: the boys are seen as having a right to be there, the girls, perhaps, seen as being there on sufferance. In the other case, the explicit reaction of the girls may be less happy. Some, for example, among those interviewed in the YWCA sample, mentioned initial difficulties in being accepted as one of the apprentices' group even if, after varying periods of time, they managed to negotiate a satisfactory relationship. It was evident from these reports that the 'settling-in' period can be particularly difficult for these young women precisely because they may be in a minority of one. In such circumstances they may think that the problem is a matter of their own personality and abilities - not a more generalised expression of conventional prejudices of a relatively impersonal kind (prejudices dissipated as the individual comes to be known as herself). In such cases, the possibility of exchanging views and experiences by meeting with other female apprentices who are also working in isolated situations is found to be appreciated by the individual. The YWCA project has in fact led to setting up the GETWISE network by which such support can be provided to young women entering non-traditional occupations.

Some important attitudes must be noted as affecting the actual work performance of the young apprentices. Again, young women have been found to differ in the confidence with which they approach the practical side of their work. Some who have been accustomed to 'tinkering' with machinery from an early age approach the practical tasks with confidence equal to that of their male fellow-learners. Other young women have admitted to an initial lack of confidence in dealing with machinery. And research

in Britain and America on pupils' practical work in science labs in schools has pointed to similar differences in the amount of confidence with which boys and girls tend to approach tasks requiring them to cope with what may be fairly simple gadgets or instruments. Girls, it has been pointed out (17), are less likely to have played with mechanical toys or to have picked up in home surroundings facility in effecting minor household repairs: thus in the school laboratory they do often approach some instruments with the feeling of insecurity which results from lack of experience. There would seem clearly to be a need for schools to recognise this possible difference in background experience and deal with it by giving girls the necessary practice and guidance in handling instruments or machines. But it is also noted that at the apprentice stage, in the practical work situation, there may be a greater willingness of skilled or experienced workers to help and guide the female apprentice precisely because she is not expected to be as experienced as the male learners in fairly routine mechanical tasks. The young woman's reaction will depend partly on her actual level of confidence and skill: but in any case the avuncular attitude is not wholly without defects from the point of view of young women.

Motivation is also clearly an important part of the effective situation. Here a wide range of studies suggests that when females do enter on non-traditional areas of work they are highly motivated and learn well. The West German researches seem to agree with the NFER and YWCA studies on this point. The young women adapt successfully to their work situation and the working group.

We have seen therefore various factors and attitudes likely to affect the policy of recruiting more girls and young women for preparation for occupations based on scientific and technical studies. Some of these might well be changed by educational agencies, by changes in the behaviours of school authorities and teachers - though the family background remains important and often difficult to change. What remains to be studied also is the employment situation of such young women as do enter the non-traditional occupations: what is their fate when their training has been completed and even after the first few years at work? Some obviously succeed in making a success in their chosen occupation. But how many find themselves moving, once qualified, back to the type of job traditionally thought of as suitable for women? To personnel work in the factory? To employment as school technicians rather than in industrial concerns? (And there was recently the interesting case of the female who was refused employment in a submarine, however appropriate her qualifications

were.) To what extent does the success of the female apprentices employed during an experimental period lead employers to increase the proportion of female entrants? Do employers remain content with a 'token' gesture of continuing to admit a small minority? Some of the young women apprentices studied have complained that on occasion they feel themselves to be simply a 'show piece' used to demonstrate to visitors or researchers the employer's progressive outlook: they feel they scarcely have the chance to settle as 'ordinary' workers. In the YWCA research too, when questionnaires asking about the employment of girls as apprentices were sent out to employers in two areas of England, the response rate was poor: and many of the responses that were received said that no girls were employed. It is of course possible that many of the non- respondents were employing girl apprentices: but it seems on the whole improbable. And while one recognises that questionnaires (even very short and simple questionnaires) sent out by research workers can be irritating, it may also be the case that many non-responding employers did not feel that the subject of girls apprentices was worth considering. Certainly interview evidence indicated that for girls entering the non-traditional areas of work having a 'patron' who supported this entry was helpful. So clearly much does depend on the attitudes of employers and so far as can be judged, there are still many employers whose attitudes are not symphathetic to the recruitment of women to work requiring, especially, technical or technological competence.

Hence we come to yet another important attitude - the judgment made by young women of the possible availability of employment if they do venture into the new territory. Given the present difficulties in finding work in many West European countries, many young women may judge - and judge rationally - that their prospects are better if they stick to the traditional areas of employment for females. Careers teachers in schools in Britain, recognising in their contacts with employers the amount of prejudice still militating against female workers in certain industries and crafts, may feel that they must warn the young woman embarking on non-traditional occupation that she may encounter considerable difficulties on her way. (It is of course also true that in Britain the service occupations employ a larger proportion of the working population - more, for instance, than manufacturing. And there is also to be considered the crafts and technologies which are obsolescent: there would need to be very careful consideration before recruiting a new body of workers to such areas.)

Over all, we can see that there are still important factors which lessen the likelihood of major changes in the numbers of females opting for certain scientific, technical or technological studies and occupations. Schools can do something to show the attractions of these subjects and make them welcoming to both sexes. They can build up girls' confidence in their abilities to use new techniques and machines or gadgetry. Liberal employers can foresee the possible difficulties which female workers may encounter and can do something to reduce these. But the simple matter of finding employment at all still looms large. There is, in more than one country, evidence of trained young workers, females qualified in technical skills, finding themselves apparently unemployable. (Of course, there are also skilled young men in this situation: but - unless they seek refuge in domesticity - young women do seem to have greater problems.) The question thus remains whether the employment market is ready to cultivate equally the skills and working abilities of women as technology changes the work place and our way of life. The recent announcement of reduction in availability of the European Commission's Social Fund (19) and the setting of priorities for assistance to projects in different countries and regions should be ominous. The need to further the employment of women is still noted as a priority: but the major problem of unemployment might well reduce support for the special provisions which till now were encouraged to recruit women into new skills training. Does the technological society of Western Europe really want more technically qualified women workers?

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