Research in Science Education, 1991, 21, 55 - 64

GENDER DIFFERENCES WHEN CHOOSING SCHOOL SUBJECTS: PARENTAL PUSH AND CAREER PULL. SOME TENTATIVE HYPOTHESES.

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ABSTRACT

The literature has made us all aware of large gender differences in students' attitudes to science, in enrolment statistics in upper high school and tertiary level science courses, and in different spheres of employment. What have not been looked at in detail are the factors which are influential when students begin to make choices in early high school, choices which may well set them on a particular pathway from which it is difficult to turn.

This preliminary study identifies factors which students in a Year 9 class believed were influential on the limited subject choices they had been able to make in Years 8 and 9, and the factors they believed would be most influential on choices to be made later in the school. In addition the students' views of science, of the separate sciences, and of their anticipated career patterns were sought.

Several interesting findings were made which, if validated in further work, could lead to strategies which would support other approaches designed to reduce gender imbalances related to science.

INTRODUCTION

While much is known about gender differences in students' attitudes to science, and in enrolment statistics at upper high school and tertiary levels (for example, de Laeter, Malone & Dekkers, 1989), very little research has focussed directly on the factors which are influential when a choice of school subjects is being made, especially in early high school, despite the fact that these choices probably create a 'flow-on' effect into the later years.

Pitt (1973) reviewed the literature on a range of factors which might be influential, and concluded that early choices are liable to be made following a cursory reflection on perceived small differences between options. However initial small differences tended to become magnified by the nature of the subjects chosen. For instance, while some students had slight initial preferences for syllabus-bound subjects, and others preferred syllabus-free subjects, this eventually led to distinct science and humanities cultures in the English 6th form.

Woods (1979) examined how choices were made by Year 9 students in an English school. He suggested that two major groups of factors influenced their decisions; firstly an affective component (liking/disliking), and secondly a utilitarian component (career/ability). He noted that girls tended to be more influenced than boys by the liking component, while boys had a stronger career orientation, and were less swayed

by likes and dislikes. Parental influence ranged from compulsion to nil, and showed a heavy utilitarian focus, especially amongst parents of top stream students. Teachers' involvement was low, and tended to be aimed at ensuring that the students entering their classes would be in some way 'acceptable' academically or otherwise.

In an Australian study, Sleet and Stern (1980) invited Year 11 students to select from a list of twelve options no more than three which they believed had influences their choice of particular science subjects. For those who had chosen one of the two courses which involved the study of chemistry and physics, the most important factors were both career orientated - 'choice of career', and 'keeping one's options open'. This was true for both the girls and the boys in these two courses. For those taking the biology course, 'interest' was listed as the single most important factor. Significantly, 'interest' was rated more highly by girls than by boys in every course, as was the relatively minor factor 'advice from the family'.

Since these reports, little research seems to have been focussed on these matters. But in view of the recognised importance of the eventual imbalance between girls and boys enrolling for certain subjects, including the different science subjects, this appears as a major omission. In a small way this study begins to fill this gap, by focussing on the factors affecting the choices made by 21 students (13 girls, 8 boys) at the beginning of Year 9, and their view of how these same factors will influence future choices.

METHOD

The study was conducted in June with one Year 9 mixed ability class in a metropolitan Catholic High School. While the initial intention was to select about 30 students randomly from across the four Year 9 classes, the school found this impossible to organise, and this lack of randomness served as a constraint on the design of the study. The students had chosen one language from Italian, French and Japanese at the beginning of Year 8, and in Year 9 had chosen firstly whether to continue their language study or take a course in Asian Studies, and secondly from a range of electives including a one year elective in Music, and semester electives in Applied Science, Drama, Extended Art/Design, Extended Mathematics, Typing, and Physical Education Skills Development.

For several reasons, the major one being the opportunity to personalise questioning, an open-ended interview schedule (Burns, 1990) was used to identify students' views about the factors which had affected their decisions in the immediate past (at the beginning of Years 8 and 9), and also those which they would expect to influence decisions at the end of the year (for Year 10).

The interview was designed with sufficient time allowed to follow up an individual's response when it was idiosyncratic, unclear, or perceived to contradict an answer given earlier in the interview. The following factors, which were culled from the literature, and from the researchers' own experience, served as focus points for each interview:

* the influence of mother, father, peer group, teacher(s)
* perceived difficulty of the subject
* the amount of homework expected
* the teacher's reputation
* interest in the subject
* career expectations

Because a major emphasis of the study was to identify factors which might lead to the selection or rejection of science subjects, a second set of questions addressed the following.

* interest in year 9 science lessons
* memories of the first semester's science course
* comments on the most/least interesting sections of the course
* suggestions about the ways science lessons might be improved.
* understanding of the probable content of senior biology, chemistry, geology and physics courses.
* how Year 9 science compared in difficulty and interest with English, mathematics and social studies.
* perceptions of the relevance of science to their future careers
* knowledge of, and attitudes towards, senior science courses
* feelings about the relative involvement of boys and girls in senior science courses.
* attitudes to the place of science in our community.

RESULTS

Influences of choice

Influence of parents

Parents were reported as being more influential on year 8 and 9 decisions by more girls than boys (10 girls (77%) and 3 boys (38%): this pattern accords with Sleet and Stern (1980). Parental influence ranged from rigid compulsion to 'talking over'. All the boys had talked with both their fathers and mothers, but only 4 girls had done so, with 6 receiving advice from only their mothers. Their expectations were that when making choices at Year 10 level, parents would be rather more involved (12 girls: 6 boys), but again, while most suggested both parents would be involved, 3 girls expected to consult with their mothers only. The general pattern seemed to involve parents in solving dilemmas, giving approval, and making helpful suggestions for the long term (for instance several students had been given advice to select Japanese because of its expected long term value), and only one case of virtual compulsion (to take Italian) was reported. Students seemed to seek, and value, parental advice more than that of teachers or friends.

Influence of peer group.

8 girls and 4 boys stated that peers had had some influence on Year 8 and 9 choices, but fewer (7 and 2) expected them to influence Year 10 choices. Rather they believed that career interests and personal relevance would be more important.

Influence of teachers.

Few students had consulted with teachers before making their choices (3 girls and 2 boys), and 6 girls and 1 boy expected they would do so for Year 10 choices. 7 girls and 3 boys considered that the teacher's reputation had been somewhat influential, but the expectation was that it would be less so for Year 10 choices (3 girls and 1 boy). One view seemed to be that a student may simply have to put up with bad teaching once a definite path had been chosen. Current teachers of a subject appeared to exert an indirect influence by affecting whether or not students like a particular subject.

Perceived difficulty of a subject/amount of homework.
7 girls and 3 boys believed that perceived subject difficulty had dissuaded them from enrolling in certain subjects in Years 8 and 9, and 6 girls and 4 boys thought it might in Year 10. However some believed that they might have to put up with a difficult subject to reach their goals. Japanese was seen to be difficult, but useful, and so presented something of a dilemma for students making choices. The anticipated homework load affected few students: they were generally inclined to accept its necessity as part of future school life.

Interest in the subject
Interest in the subject permeated many of the interviews and as an influential factor it seemed to rate below career and parental influence, but above friends, teachers, subject difficulty or the amount of homework. However the concept took on different meanings for different students, therefore providing an area which should be more deeply researched in the future.

Career considerations.
Almost all of the girls (12), and the majority of the boys (5) were able to state their career orientation (Table 1)
Career interests had a strong influence on subject choice even in Years 8 and 9 (8 girls and 6 boys), and it was expected to be much higher in Year 10 (12 girls and 7 boys).

Attitudes to science
Students had just completed their Year 9 first semester course in science, and had all been taught by the same teacher. 10 girls and 4 boys expressed a liking for what they had done, whereas the rest were negative. 7 girls had enjoyed the environment topic, but only 1 boy had, with one believing that "you sort of feel like you are hammered about the environment by everyone." 1 girl had enjoyed 'chemistry' and 3 'rocks', whereas 4 boys and 1 boy had enjoyed these same topics. 'Rocks' had been found "boring" by 4 girls and 5 boys. Overall the girls had been more interested in this particular science course.

TABLE 1.
EXPRESSED CAREER ORIENTATION OF YEAR 9 STUDENTS

Girls	Boys
fashion designer	lawyer
journalist	computing career
'perhaps a secretary'	electronic engineer
P.E. teacher or tourism	pilot
secretary	computing technician
career in tourism	
'something to do with art'	
veterinarian	
air hostess or teacher	
'something to do with animals'	
a business career	
gardener.	

Both girls and boys believed that the course would be more interesting with the addition of more practicals and activity. Girls also believed that more discussions and projects would make it more enjoyable.

Perceived relative difficulty and interest.

Students were asked to compare science with mathematics, English and social studies with respect to both difficulty and interest. Table 2 presents a summary of responses.

TABLE 2
PERCEIVED DIFFICULTY AND INTEREST OF SUBJECTS
BY YEAR 9 STUDENTS.

Difficulty/interest level	Girls	Boys
Difficulty Increasing	Maths/Science English Social Studies	English Maths/Science Social Studies
Interest Increasing	Social Studies/ English Maths Science	Maths English Science Social Studies

For girls science was seen as both more difficult and less interesting than English and social studies, even though, it will be remembered, some aspects of the first semester science course had been found quite interesting. Boys saw science only slightly more positively and, while they saw English as being more difficult, they were more interested in it. A similar low interest, steadily declining throughout school years was reported by Yager and Penick (1986) who somewhat flippantly suggested that if we want students to consistently report their enjoyment of science, we would stop teaching it in third grade.

A particular factor which several students associated with the perceived difficulty of science was the need to obtain the correct answer, whereas in English and social studies some marks at least could be obtained for giving an opinion. Yager and Penick (1986) also commented on the exactness of science and the fact that few students make the highest grades.

Students' knowledge of the branches of science.

Students were asked to say what is meant when the terms biology, chemistry, etc. are used. Boys seemed to have rather more knowledge about each area, though overall understanding was not high, and it was particularly low for physics (Table 3)

TABLE 3
PERCENTAGE OF YEAR 9 STUDENTS WITH AN UNDERSTANDING OF THE SCIENTIFIC DISCIPLINES.

	Chemistry	Physics	Biology	Geology
Girls (n=13)	9 69%	1 8%	11 85%	6 46%
Boys (n=8)	7 88%	2 25%	8 100%	4 50%

It has to be said that while some of these percentages are relatively high, attribution of some understanding was given relatively easily. For instance, 57% of the girls and 50% of the boys described biology as "something to do with dissecting animals", even though they had neither conducted nor seen a dissection in their science classes. It was interesting to note that plants were never mentioned.

Predicted Year 11 first choice

When asked which science subject would be their first choice in Year 11 (in this school students must select at least one science from biology, chemistry, physics and general science), major differences between girls and boys were again observed (Table 4). In order that these selections were somewhat informed, students were given a brief description of each area about which they were unclear before the question was asked.

TABLE 4.
YEAR 9 STUDENTS' ANTICIPATED FIRST CHOICE FOR A YEAR 11 SCIENCE COURSE.

	Chemistry	Physics	Biology	General Science
Girls (n=13)	2 15%	1 8%	7 54%	3 23%
Boys (n-8)	2 25%	4 50%	1 13%	1 13%

Evident in Table 4 are the anticipated gender differences. Of particular interest are the boys' responses to physics. As seen in Table 3 only 25% could initially say anything about what it is, but on being given the information, 50% said they would make it their first choice. The girls tended to favour biology as their first choice and believed it would be interesting, though their ideas about it were rather hazy.

Perceived difficulty and relevance of senior science.
11 girls (85%) and 4 boys (50%) believed that senior science courses would be difficult, some having been led to that view by other students. Students were not yet thinking of these courses in terms of gaining high marks in public assessments as probably tends to be the case later.

All the boys, but only 6 (46%) of the girls, believed that the study of senior science would be of some relevance to them. For most of the boys this was of career relevance, but relevance for the girls was to life in general, not to careers. More than half the girls thought senior science would have no relevance of any sort: the junior science course, together with a compulsory Year 10 health unit, would be quite sufficient.

Attitudes to boys and girls entering careers and studying science.
Virtually all the girls and boys believed that there should be equal opportunity as far as the choice of careers is concerned, and believed that males and females would be equally capable in any career. However, both girls and boys believed that the sexes would have different interests, particularly when it came to careers, and hence would choose different school subjects, including different science subjects. There was a strong attitude reflecting "women can, but don't want to" (Dillon, 1986).

Attitudes to science in the community.
While students were well aware of the negative side to science, they chose to emphasise the positive: the contribution science is making to the solution of environmental problems, and the outcomes of medical research, were cited often. The positive nature of their responses is in harmony with Schibeci's (1986) study.

DISCUSSION

The way in which individual students make their subject choices, and the factors which ultimately affect subject enrolment patterns, career interests, and eventual career patterns are highly complex. Much has already been written elsewhere about various aspects of gender imbalances, including those related to science, however little work has previously focussed on the factors which are taken into account when subject choices are being made. While this study is only a small one, and its results require replication and extension, possibly through use of a questionnaire based on its findings, it does shed some light on how students make their choices. From it a few tentative suggestions will be made about strategies to ensure that the process of making choices is made in a more information rich climate.

Before going further, it is important to identify the problem being addressed, and to set it within a broader perspective. It would seem to be totally inappropriate to mount an argument, or to suggest strategies, aimed solely at encouraging more girls into the areas of physical science and technology or, on the other hand, to encourage more boys to take up nursing or typing, or other currently female dominated careers. Students should be in a position to make their choices, from the early years of high school onward, in a climate which makes them fully aware of where those choices might lead, and of the implications involved when some subjects are dropped.

The interview data from this study shows the Year 8 and 9 choices had been taken seriously, but had often been made when the information available was limited, and

similar choices might have been made for different reasons (for instance, one girl had selected typing because of her intention to become a secretary, but a boy selected it to help with his computing).

A major feature was the difference in the ways in which the girls and boys saw their future, and the place of science in it. While more girls were able to state their career interests than boys, the differences in interests of the two groups were marked by major stereotyping. While the girls seemed to have gone beyond the very traditional stereotypes, and a business/commercial career was quite a popular one, few of the careers mentioned require scientific or technical qualifications. Even the girl who wished to become a vet had seen no relationship between this and a need to continue to study science. For the boys the career interests were more scientific/technical.

Not surprisingly, this gender difference was matched by the overall attitudes to science. It is of concern to note that the interest in science expressed by both girls and boys was below other commonly taken subjects, however the boys seemed to be kept on a physical science track by a strong utilitarian, job related, interest. 6 of the 8 (75%) boys anticipated that either chemistry or physics would be their first choice for Year 11 science, despite their knowledge of these subjects being relatively low: only 22% of girls selected one of these. This selection by boys matches data from other studies (for instance, Harvey & Stables, 1986; Dawson, Note 1) showing that many boys think biology (or biology and chemistry) is more interesting but select chemistry and physics because they are seen as more useful for careers: what Woods (1979) has named 'instrumental compliance' (see also Sleet & Stern, 1980). While it was not evident in the data from this study, it is very likely that, in contrast with the long term career orientation of boys, girls consider future home commitments as one component of long term plans. Compatibility of these plans with any future career is of importance (Birke et al. 1980). In this regard a career in science does not rate highly amongst the possibilities.

In a sense, making these subject choices, within the framework of both current interests and long term plans, becomes an attempt to solve an ill-structured problem, and, as Chi, Glaser and Fan (1988) point out, there is no single correct answer to such a problem. Instead the solution favoured depends on how the problem is presented and perceived. In the matter of subject choice, many factors can be influential, and individuals tend to weight them differently but the trends observed amongst this small group of students will, it appears, in due course lead to traditional enrolment patterns in senior school science, and in eventual career choices.

What are the possibilities for changing these patterns if a school wishes to actively intervene? Douglass (1985) has suggested that the decision to pursue science is probably made during childhood, and, if interests can be used to judge the situation, it is evident that even in middle to upper primary school, boys' and girls' views of science can be quite different (e.g. Dawson & Bennett, 1981). So is a high school in a position to do anything?

Evidence from high school intervention studies in several countries has demonstrated that some change is possible, primarily through strategies which utilised gender inclusive teaching methods, and attempt to change the image of science itself, and of science

based careers (see Kahle, 1985; Stage et al., 1987); this approach needs to be continued. But are there additional possibilities?

Two features of the current data bear on this matter. Firstly, while Year 8 and 9 choices had been taken seriously, there was evidence that for some students at least this was done in an information poor climate. Secondly, the girls in the study were more dependent on advice from others, especially their mothers, than were the boys. Similar results to this have been reported by both Kahle (1985) and Woods (1979).

Using this information, together with the knowledge that interests in science and in future career patterns tend to be developed relatively early in life, two additional tactics are proposed. Firstly, high school career programs should be introduced much earlier. Currently, in South Australia at least, programs are very variable. They are usually offered in Years 10 and 11, and may include work experience, careers evenings, use of computerised data bases and so on. In the new South Australian Certificate of Education pattern, a work related aspect is a compulsory component of all Stage 1 (Year 11) courses. However, in the context of this study, much of this seems to be too late. Early programs are needed, not primarily to focus on particular jobs, but to introduce all students to broad areas of possible employment, what each offers, and what requirements have to be met. This early information, given at lower secondary level, could be more influential than the usual Year 10 and 11 programs in making information available at a critical time.

A second tactic would be to attempt to ensure that the individuals with whom girls are likely to consult are themselves well informed. This would include school personnel and parents, especially mothers. Remick and Miller (1978) suggested that counsellors can easily become a negative factor in girls' choice of science subjects, due to lack of knowledge of career structures in technical areas. The influence of many mothers on girls is likely to be similar. School programs, which actively involve parents, especially mothers with their daughters, could emphasise the gender differences in educational and career patterns, and provide an information base for a range of careers, including technical ones, while ensuring that examples of women pursuing both career and family interests are made available.

Interestingly, while this paper was being finalised, a 'Career Expo for Young Women' was held in Adelaide. This was organised by the Department of Employment, Education and Training for Year 9 and 10 girls. Its aim was to "assist the girls in making vital career and subject choices necessary for the achievement of their personal ambitions", and based on the knowledge that 'womens' employment is primarily restricted to a narrow range of occupational groups" (DEET, 1991). This demonstrates a movement in at least some of the directions suggested above.

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