GENDERED PERCEPTIONS OF TALENT AND PLANNED PARTICIPATION IN MATHEMATICS

Helen Watt and Laurel Bornholt

An investigation of students' perceptions of talent in relation to mathematics showed that gender stereotyped perceptions of talent were a determining factor in their planned mathematics courses in senior high school. Furthermore perception of talent affected students' intended careers which also revealed gender imbalances in participation according to the level of mathematics required, as rated by six senior teacher educators from two universities in Sydney. The Year 10 students in Advanced and Intermediate courses were from coeducational government schools in an upper middle-class metropolitan area of Sydney. Actual performance on a standardised mathematics test was used to measure students' achievement, and perception of talent and predicted mathematics participation were ascertained through use of a questionnaire. Despite similar performance on the test, boys perceived themselves as more talented than girls, and also planned to participate in the higher levels of mathematics more than girls, both in the Higher School Certificate and their intended career.

It is a concern of many educators and researchers that girls are under-represented in the field of mathematics, and careers which require mathematics (Fennema, Wolleat, Pedro, & Becker, 1981; Leder, 1992; Sherman, 1982b; Willis, 1989). For some, the issue is one of social justice, since many girls do not share equally in the advantages of the mathematically well prepared. For others, the issue is the national need to advance technologically: girls should provide a higher mathematical yield for the country (Willis, 1989). Regardless of the perspective taken, there has been a growing acceptance in both educational circles and the wider society, that there is "a problem of girls and mathematics" (Willis, 1989).

Several theories have been put forward in an attempt to explain this gender imbalance in participation in mathematics courses and in careers related to mathematics. The four major social cognitive theories are self-concept theories, attribution theories, learned helplessness versus mastery orientation, and expectancy and subjective task value (Eccles, Adler, & Meece, 1984). This study is located within the first group of theories.

Self-concept of one's ability in mathematics has been identified as a significant factor affecting both achievement and participation in mathematics (Eccles & Jacobs, 1986). It has been posited that, if females have less favourable views than males about their abilities in mathematics, this may limit their choices in studying mathematics, which in turn may confine females to traditional jobs and roles (Jacobs & Eccles, 1992). This could preclude their entry to higher paying jobs which require mathematics (Eccles, 1987; Eccles & Hoffman, 1984). So far, such ideas of long-term 'behavioural confirmation' (Snyder, Tanke, & Berscheid, 1977) have been merely speculation. The present study aims to confirm such ideas through both ascertaining students' self-concept of ability in mathematics and also determining their plans regarding future participation in mathematics, since it has been found that student aspirations are a good predictor of future student outcomes (cited in Hossler & Stage, 1992, p. 433).

Within the self-concept theoretical perspective, recent Australian studies have looked at aspects of students' perceptions of achievement. These have included examination of perceived current and future performance, talent, effort and task difficulty (Bornholt, Goodnow, & Cooney, in press). Students' perceptions of talent were found to be central to their gender stereotyped self-concept in mathematics (Bornholt, 1991, 1993; Bornholt, Goodnow, & Cooney, in

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press; Watt, 1993), and consequently are central to this study. Students' performance in mathematics is also examined, in order to determine whether differential performance by males and females could account for both their perceptions of talent and their predicted participation in mathematics. New South Wales is an ideal location for the study, since mathematics is a compulsory subject until the end of Year 10, and so the mathematical experience of each of the participants can be ascertained (unlike studies in the United States and Britain, where course selection is made by the students).

MATHEMATICAL PERFORMANCE

Although there has been a great deal of research investigating gender differences in mathematical performance, it has not yielded any consistent trends. It has been claimed that females perform better than males in number and logic, whereas males outperform females on spatial tasks (Willis, 1989). However the format of the test used has been found to affect results, with females being favoured by essay type questions, males by multiple choice questions, and neither by structured papers (Eccles & Jacobs, 1986).

For some time, it was believed that gender differences in mathematical performance appeared with the onset of puberty (Carss, 1981), but more recently it was decided that males and females perform similarly until the end of Year 10 (Willis, 1989). It is at this time, however, that males and females self-select themselves into their chosen levels of mathematics, as streaming is for the first time not based entirely on assessment. This means that in any investigation of the numbers of males and females studying a highest level mathematics course, it is only the students who have elected to study at this level who are assessed. It is possible then that many talented females are not included in such samples.

An opposing view is held by Fennema and Sherman, who argue that there are no grounds either for believing males to perform better than females in overall achievement or spatial visualisation, and that there is no basis for the idea that sex differences in achievement increase with age or subject difficulty (Fennema & Sherman, 1977). They believe students' previous study of mathematics to be a more probable explanation than gender in cases where differences occur.

There have been instances where females have outperformed males, rather than the reverse. In either case, however, the differences are very small, and of statistical rather than educational significance (cited in Bornholt, 1991, p. 4). It is at least agreed that, when opportunity to learn is equal for males and females, so too are overall levels of achievement (Willis, 1989). It can be concluded that there is no specific stage at which the performance of females declines dramatically in comparison with the performance of males. Rather there is evidence to suggest that males and females will continue to perform similarly, as long as both continue to study comparable levels of mathematics. In New South Wales, the Higher School Certificate (HSC) is an external examination of all final-year high school students, assessing their knowledge in the subjects they have elected to study, at the level they have chosen to study them. This provides students with marks for each subject, as well as an overall state ranking, which is used in determining university entrance. Table 1 shows the HSC mathematics results for males and females in 1992 (as well as participation rates), which are indeed similar for both sexes studying at comparable levels of mathematics.

PERCEPTION OF TALENT

It would seem logical to suppose that perception of talent would be closely related to performance. It has been repeatedly found that there is no simple relationship between students' perceptions of achievement and their actual achievement (Fennema & Sherman, 1977; Walden & Walkerdine, 1985). However it has been frequently found that males believe themselves to be more talented at mathematics than females. This study aims to determine whether such (mis) perceptions of talent have any impact on students' participation in mathematics, in both their near and more distant future.

MATHEMATICS PARTICIPATION

Gender differences in participation in school mathematics are of great importance, since girls considerably decrease their career options by not participating in mathematics to the same extent as boys. During Years 7 to 10, mathematics is a compulsory subject in Australian schools, and so any gender differences in participation are difficult to identify. However enrolment trends in Years 11 and 12, when students select the level of mathematics they wish to study, reveal clear gender differences. Table 1 shows the 1992 participation rates of males and females in each of the Year 12 levels of mathematics. It is clear that, in New South Wales, females are dominating the least demanding mathematics courses (Maths in Practice, Maths in Society, and 2-unit), and males are dominating the more advanced 3- and 4-unit courses, despite similar levels of mathematical performance (Gagen, 1993, p. 58). This study was designed to investigate the influence of gender on the relation between students' academic performance in mathematics and their predicted future participation in this subject, both in the HSC and choice of career. The study also investigated students' perceptions of talent in mathematics, to determine whether this could explain any differences in predicted mathematics participation.

METHOD

Design

The present study was designed to investigate the influence of gender on students' perceptions of their mathematical talent, which may be at odds with their actual test

Table 1: Male and female mathematical performance and participation in the 1992 HSC

	Males			*Females*		
Level of maths	*M*	*n*	*%*	*M*	*n*	*%*
Maths in Practice	60.5	690	2.5	57.4	1067	3.6
Maths in Society	66.2	8935	33.1	66.0	11225	38.1
2-unit	52.7	9154	33.8	55.7	11016	37.4
3-unit	35.9	5496	20.3	37.2	4591	15.6
4-unit	52.6	2792	10.3	50.1	1591	5.3
Total		27067	100		29490	100

Source: Adapted from Gagen, 1993, p. 58

Table 2: Distribution of students by gender, level and school

	Male (n=121)		*Female (n=78)*	
Level	*Advanced*	*Intermediate*	*Advanced*	*Intermediate*
School 1	22	29	36	15
School 2	43	27	15	12
Total	65	56	51	27

performance. It also measured both the direct and indirect effects of gender and perception of talent on students' plans for the HSC, and subsequent plans for intended careers requiring mathematics.

Participants

The participants were from two coeducational government secondary schools in an upper middle-class northern metropolitan region of Sydney (based on socio-economic index for areas, Australian Bureau of Statistics, 1990). Approximately one-fifth (22.6%) of participants were of non-English-speaking background, which was found to have only minor effects, and so this variable was discarded for further analyses. Discrepancies between the responses of males and females, where they occur, could then be reliably attributed to gender.

Year 10 students were selected for participation in the study (N=199), because students up to Year 10 have no choice in the level of mathematics they study. That is, the students have not yet self-selected into their chosen levels of HSC mathematics. Students were selected from both the Advanced and Intermediate streams, but not the lowest (General) stream. It was decided not to include students from the General course for two reasons. First, it was considered unethical to subject these low-achieving students to the stress of the test section of the study, since they would find the test very difficult. Second, it was decided that these students' performance would preclude their participation in the higher levels of mathematics in Years 11 and 12, and careers related to these, in any case. Of the participating students, 78 were female (51 Advanced, 27 Intermediate), and 121 were male (65 Advanced, 56 Intermediate). Distribution of the students by gender, mathematics stream and school is shown in Table 2. The proportions of males and females are attributable to the existing class composition, which reflects the higher proportion of males in each school.

Materials

Mathematics achievement Students' academic performance in mathematics was measured on a standardised Progressive Achievement Test, Form 3B (ACER, 1984). Alternate items (i=28) related to spatial visualisation (6 items), computation (12 items), and problem solving (11 items). These were selected so that both the test and a questionnaire could be administered in a 50-minute lesson. Internal consistency and reliability for the 28-item test was Cronbach alpha .70 (Bornholt, 1991, p. 41), indicating that the mathematics test was sufficiently reliable for research purposes.

Perception of talent Students' perceptions of talent were ascertained as part of a questionnaire investigating more general perceptions of achievement in mathematics, including talent, expected success, effort, subject difficulty, usefulness and interest. Possible influential factors on these perceptions were also examined, consisting of students' past mathematical performance, parents and other family members, teachers, perceived cleverness at mathematics, friends, the media, and career advisers. Students were also required to predict which mathematics course they planned to study in senior high school and what career they intended to choose (Watt, 1993).

The questionnaire was selected as the most appropriate method of data collection for several reasons. First, this was the method of data collection best suited to the school timetable, and also the method to

which school staff were most amenable. Second, the questionnaire was piloted at a secondary school in the eastern metropolitan area of Sydney whose participants (*N*=44) comprised 22 males (13 Advanced, 9 Intermediate) and 22 females (12 Advanced, 10 Intermediate). The pilot study showed that the questionnaire was unambiguous, and established the amount of time required for completion of both the test and questionnaire. Finally, the researcher was present in the administration of both the test and the questionnaire for each participating class of students, to clarify any misunderstandings. It is believed, because of these measures, that the information gained from the questionnaire is reliable.

The questionnaire was developed in the following manner. First, personal details were required so that test results could be matched with questionnaire responses for each participant. Students were permitted to use false names if desired, so that they would feel comfortable about answering questions honestly. Second, students were asked what level of mathematics they planned to study for the HSC and what career they were considering for the future, in order that their likely future levels of participation in mathematics could be determined. Finally, students rated their general perceptions of talent in relation to mathematics on a 7-point Likert-type scale, where 1 indicated a low and 7 a high response to each item. The five items comprising the scale were: "Would you consider yourself to be naturally talented at maths?" from 1 (not at all) to 7 (quite a lot); "What ability do you think you have at maths?" from 1 (quite low) to 7 (very high); "Do you think you have a flair for maths?" from 1 (none) to 7 (a lot); "Compared with girls your age, how talented at maths do you think you are?" from 1 (not al all) to 7 (quite a lot); and "Compared with boys your age, how talented at maths do you think you are?" from 1 (not at all) to 7 (quite a lot).

Planned mathematics participation Students' predicted levels of participation in HSC mathematics were ascertained as part of the larger study referred to in the section above (Watt, 1993). Participation in mathematics in students' intended careers was determined by first asking the students what career they were considering for the future, as part of the questionnaire described above. Second, these responses were coded for the level of mathematics needed in each, according to the ratings of six teacher educators from two universities in Sydney. This information was obtained by distributing questionnaires to the teacher educators, in which they were requested to rate the extent to which mathematics was required for each of the career choices mentioned by the students, on an 11-point Likert-type scale ranging from 0 (no maths required) to 10 (extremely high degree of maths required).

Procedure

Two weeks before the survey was due to be conducted, information and consent forms were sent to the teachers of each participating class. Parents were requested to complete these and return them to the school two days before the survey date. The researcher briefed all the regular teachers of the classes being surveyed before the survey was carried out, and was present for most of the time during the survey, to clarify and explain any questions.

Students were asked to complete the questionnaire before being given the achievement test, in order that their internalised beliefs be reflected, rather than their short-term reaction to the test. Students were not permitted to talk while completing questionnaires, so that they would feel free to write their own private responses.

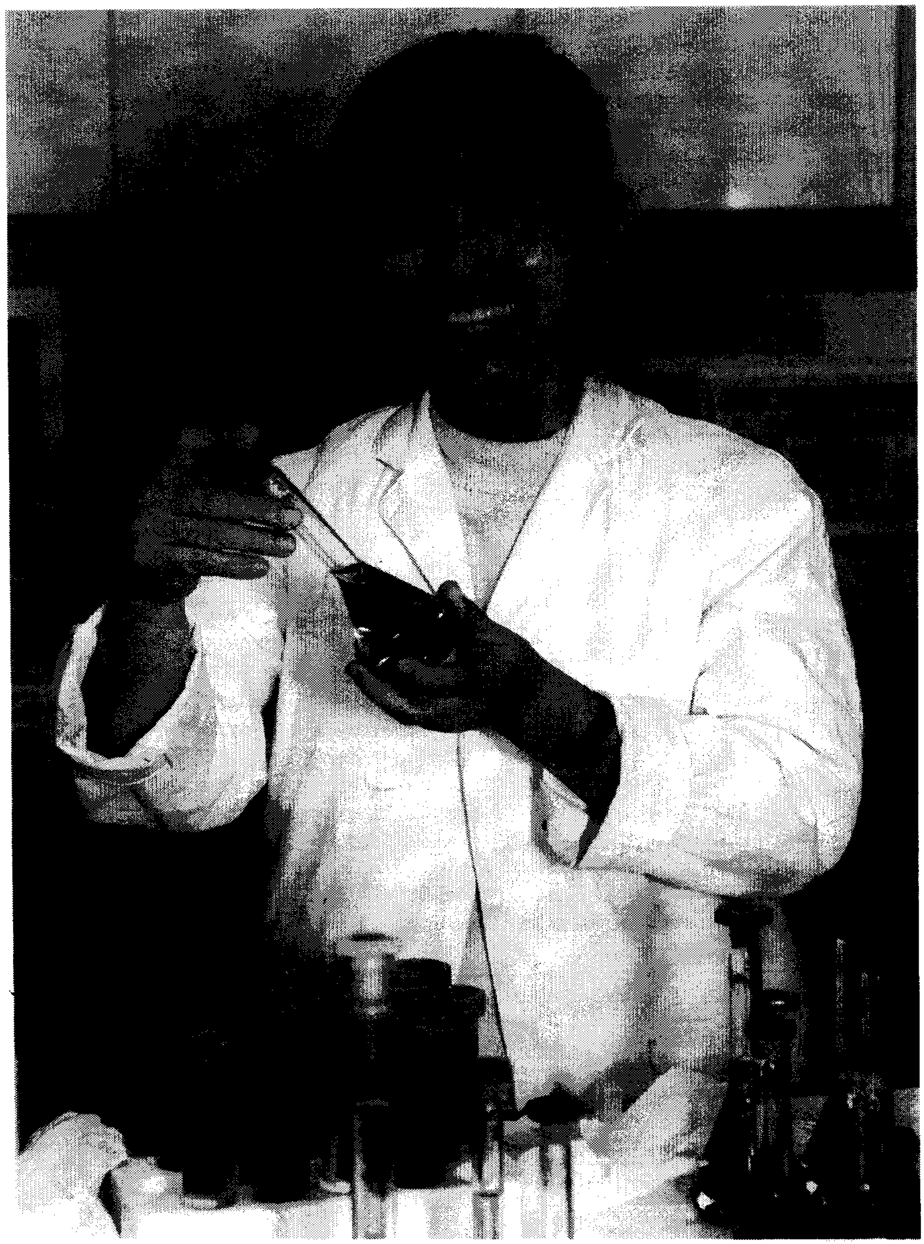

Photo: Terry Young, Swinburne University of Technology.

After 15 minutes, the questionnaires were collected so that students would not change any of their responses on the basis of their feelings after the test, and the test with its accompanying answer sheet was distributed. Students had 30 minutes to complete the 28-item multiple choice test. Tests and answer sheets were then collected, and students were invited to ask any questions they might have about the study in the remaining lesson time.

Analyses

The study was designed to compare males and females. Descriptive statistics such as means, standard deviations, range and frequency distributions were derived from the statistical package SPSS/PC for students' test scores and questionnaire item ratings. All inferential statistics were found with the same package, through the use of Multivariate Analyses of Variance (MANOVA) and *t*-tests. Multiple regressions were used to measure the direct and indirect effects of gender and perception of talent on students' plans for the HSC, and further plans for intended careers requiring mathematics.

Students' future participation in HSC mathematics was examined on the basis of the percentages of males and females intending to study each of the possible course levels. Students' participation in mathematics in their future careers was assessed by comparing the percentages of males and females planning to choose careers involving varying degrees of mathematics, as rated by six senior teacher educators from two universities in Sydney.

There were disparate numbers of males and females within each of the Advanced and Intermediate streams, meaning that the female responses were greatly biased towards those of the Advanced group. It has been suggested that it is not necessary to select samples systematically so that they are representative of the whole population (Kerlinger, 1988), since a random sample is more likely to include the characteristics typical of the population if the characteristics are frequent in the population. It will be of tremendous concern if females intend to participate less, or have lower perceptions of talent in mathematics than males, since this is a group of whom two-thirds are high achievers as compared with only half the males being high achievers.

Not every item was completed by each student, although the missing data were not systematic for students or for particular items. It was therefore decided not to discard any of the data.

RESULTS

The results are presented in four parts. The first shows that the mathematical performance of males and females is similar, both for overall scores and the three spatial, estimation and computation, and problem-solving scales. Second, the differential perceptions of talent for males and females are presented, with males perceiving themselves as more talented than females. Third, it is found that males intend to participate in the higher levels of HSC mathematics to a greater extent than females. The gender imbalance in planned mathematics participation evident for the HSC was reflected in students' intended careers. Finally, a model showing the effects of gender and perception of talent on students' HSC and career plans is presented, showing that perception of talent is indeed an important determinant of students' plans in both these domains.

Results are collapsed over the two schools, since school had an effect in only one instance, which can be explained by the composition of the sample group and is independent of the school attended. It was found that students from school 2 performed significantly better than students from school 1 on the achievement test by 7.8 per cent (school 1 *M* 62.8%, *SD* 20.7%; school 2 *M* 70.6%, *SD* 21.2%). This can be explained because there were similar numbers of Advanced and Intermediate students in school 1 (37 Advanced, 40 Intermediate), but twice as many Advanced as Intermediate students in school 2 (79 Advanced, 43 Intermediate). This means that test results of students from school 2 are biased towards the achievement of the Advanced students, inflating the mean performance of these students. To determine comparability of student performance from the two schools, separate analyses of the performance of Advanced and Intermediate students from both schools were compared. It was found that the performance of students from each course level was similar across both schools. School had no other effects, and so for subsequent analyses the results were collapsed across schools.

Mathematical performance

Students' performance was measured by their marks on the achievement test. The test was divided into three scales to facilitate comparison of male and female performance on different mathematical domains. These scales were Spatial tasks, Estimation and Computation, and Problem-Solving tasks, with α reliabilities of .62, .73 and .75. Marks for the test as a whole, and also for each scale, are presented as percentages.

Male and female performance over the whole test, and also on each of these three scales, is shown in Table 3. The difference between male and female overall scores was not significant, and neither were any differences on the three test scales.

The test clearly differentiated between the two levels of mathematics, since level had a highly significant effect on students' scores, with Advanced students scoring 29.6 per cent higher than Intermediate students (Advanced *M* 80.0%, *SD* 13.9%; Intermediate *M* 50.3%, *SD* 17.4%). In order to

Table 3: Male and female mathematical performance as a percentage

	Males		Females			
	M	*n*	*M*	*n*	*F(1,159)*	*p*
Overall result	65.9 (*SD* 22.6)	121	70.3 (*SD* 18.9)	78	-1.45	.149
Spatial tasks	67.4 (*SD* 27.2)	111	69.3 (*SD* 29.1)	75	0.6	.430
Estimation and computation	73.8 (*SD* 22.5)	110	76.2 (*SD* 18.8)	75	0.2	.675
Problem Solving	62.8 (*SD* 26.7)	105	65.0 (*SD*. 22.0)	71	0.8	.382

confirm similar performance by males and females, test results were compared for males and females in each of the Advanced and Intermediate streams, in case the mean female performance was inflated because of its predominance of Advanced students. In comparisons within the Advanced and Intermediate streams, no gender differences were found on either overall scores, or on any of the three test scales. This means that males and females are performing equally well in mathematics, and are performing similarly in the three domains of spatial, estimation and computation, and problem-solving tasks.

Perception of talent

Five items in the questionnaire were designed to measure students' perceptions of talent in relation to mathematics. This variable was reliable (α=.90), with the high reliability indicating some redundancy in the items comprising it, but otherwise suitable for analysis (Kline, 1976). Males and females were compared on the basis of their responses to this factor, the frequency distributions for which were roughly normal. It was found that males perceived themselves as being significantly more talented than females (male *M* 4.11, *SD* 1.29; female *M* 3.75, *SD* 3.75).

Mathematics participation

HSC mathematics The predicted levels of mathematics which males and females plan to study for the HSC are illustrated in Table 4. Approximately 11 per cent more females than males plan to study the lowest Maths in Society option, and 7 per cent more males than females plan to participate in mathematics at the highest 4-unit level.

Table 4: Male and female intended levels of HSC mathematics (%)

	Males	Females
No maths	1.5	0
Maths in Society	6.5	17.1
2-unit	43.1	36.9
3-unit	31.2	35.5
4-unit	17.7	10.5

Mathematics required for intended career Participants' responses about the career they were considering for the future were grouped into careers requiring no mathematics, up to careers requiring an extremely high level of mathematics, based on the 11-point ratings made by teacher educators. Mean ratings for the degree of mathematics required in each of the careers being considered by the students are shown in Table 5.

Table 5: The extent of mathematics required in students' career choices as rated by teacher educators[a]

Career	M	SD
Hairdressing	3.50	1.26
Drama	3.67	1.49
Journalism	4.00	1.53
Music	4.67	1.60
Fashion	4.67	1.97
Youth worker	4.67	2.69
Working with animals	4.67	1.97
Arts	4.67	2.21
Secretary	5.00	1.29
Photography	5.00	1.73
Housewife	5.20	1.33
Hospitality	5.33	1.25
Police	5.50	0.96
Horticulture	5.50	2.06
Customer service	5.67	1.37
Teacher of handicapped	5.67	2.56
Law	5.83	2.54
Armed Forces	6.17	1.21
Nursing	6.33	1.70
Pre-school teacher	6.33	1.70
Sport industry	6.33	1.11
Graphic design	6.50	2.36
Trade	6.67	1.37
Business	7.67	1.80
Medical-related	7.83	1.57
Primary teacher	7.83	0.90
Bank clerk	7.83	1.34
Architecture	8.67	0.75
Accounting	8.83	1.07
Pilot	9.00	1.00
Computer-related	9.42	1.10
Engineering	9.67	0.75
Maths teacher	10.00	0.00

[a] A rating made ranging from 0 to 10 was used.

The extent to which males and females plan to pursue careers requiring a degree of mathematics ranging from 0 to 10 is illustrated in Table 6. It is clear that more females than males plan to choose careers involving a relatively low level of mathematics, whereas more males than females intend pursuing a career which demands quite a high level of mathematics.

Table 6: Male and female intended careers according to level of mathematics required (%)

Level of mathematics	Males	Females
0	0	0
1	0	0
2	0	0
3	0	0
4	3.51	11.59
5	14.11	27.54
6	11.79	11.59
7	23.54	14.49
8	27.07	21.74
9	16.48	11.59
10	3.52	1.46

The effect of gender and perception of talent on students' HSC and career plans

The results reported so far have been for each of the variables considered separately: performance in mathematics, perception of talent, expected participation in HSC mathematics and in planned careers. Multiple regression analyses involving all of these variables were performed, to examine the complex ways in which the variables interact in explaining behaviour. In this study, the aim was to examine the effect of gender and perception of talent on students' plans for further study of mathematics, and participation in careers involving mathematics. Figure 1 presents the significant findings from the regression analyses.

In the diagram, only paths connected by arrows are statistically significant. The statistic on each arrow, known as a "beta weight", indicates the strength of the relationship between the variable pair connected by the arrow. For example, task performance predicts participation in HSC mathematics (beta=.40) more strongly than it predicts perceived talent (beta=.32). Gender was coded for femaleness, meaning that being female has a negative effect on perception of talent (beta= –.18) and participation in mathematics-related careers (beta= –.26).

It is clear that student gender, mathematical task performance and perceived talent are together good indicators of HSC mathematics plans. The R^2 statistic of .60 indicates that 60 per cent of the variance in planned participation in HSC mathematics can be explained by these antecedent variables.

Other features of the results shown in the diagram are that gender, although not directly predicting HSC plans, is related indirectly via perception of talent, showing that gendered perceptions of talent affect planned participation in HSC mathematics. There is also a slight indirect effect of gender on career plans, through perception of talent and HSC plans. As well as having a strong direct effect on expected participation in HSC mathematics, perception of talent has an indirect effect on career plans via HSC plans.

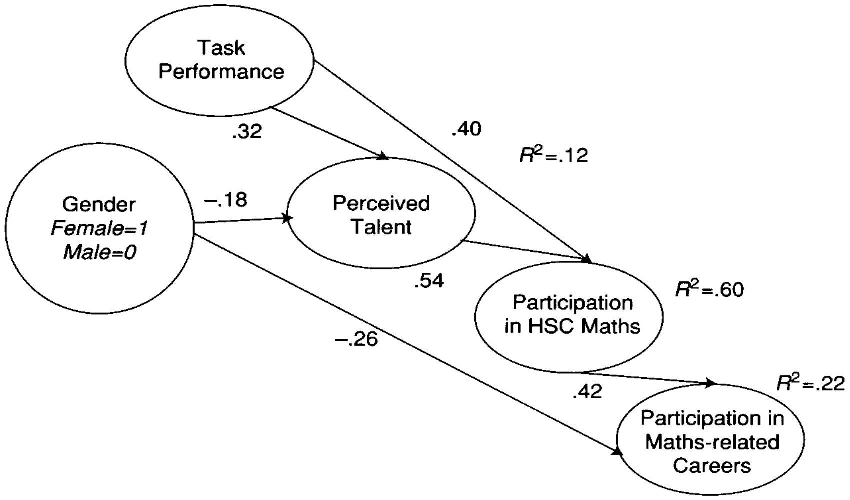

Figure 1: Effect of gender and perceived talent on students' HSC and career plans

Mathematical task performance is directly related both to perceived talent and to planned participation in HSC mathematics, and is also indirectly related to HSC plans through the mediating effects of perceived talent, to career plans mediated by HSC plans, and through the effects of perceived talent combined with HSC plans. Finally, HSC plans have a strong direct influence on students' career plans involving mathematics. All of these results can be traced on the diagram by following the paths of the arrows shown.

DISCUSSION

The hypotheses that females would perform similarly to males in mathematics, have lower perceptions of talent, and intend to participate to a lesser extent in the higher levels of mathematics, were all borne out by the data. Perception of talent was found to influence both HSC and career plans involving mathematics, as has been frequently assumed by researchers studying gendered perceptions of students' self-concept in mathematics. Approximately half of the male participants were from the Advanced and half from the Intermediate stream, but there were roughly twice as many females from the Advanced as from the Intermediate stream. This means that the results from overall comparisons of males and females in the study are of tremendous concern, since a group of females of whom two-thirds are high achievers still have less positive self-perceptions in relation to mathematics than do a group of males of whom only half are high achievers, and also intend to participate less in the higher levels of mathematics in both HSC and career plans.

Mathematical performance

The findings of this study support the claims that the mathematical performance of males and females is equal (Jacobs, 1991; Willis, 1989). Although the debate over differential male and female spatial abilities is beyond the scope of this study, male and female performance was also equal on the Spatial scale of the achievement test, contrary to the claims of some researchers (Benbow & Stanley, 1980; Linn & Petersen, 1986) that males have superior spatial abilities compared with females. It is recognised that the items comprising this test scale did not require highly specialised visuospatial abilities but, nonetheless, some ability was required. The fact that males and females perform equally in mathematics implies that students must be drawing their perceptions of talent from sources other than their mathematical performance. This lends support to the view that gender-differentiated messages may account for the formation of students' perceptions of talent.

Perception of talent

The finding that males perceive themselves as more talented in mathematics than females is supported by other studies (e.g. Bornholt & Cooney, 1993). This is of importance since perception of talent has been found to be central to students' self-concept in mathematics (Bornholt, 1991, 1993; Watt, 1993), which has in turn been suggested as a significant factor affecting both achievement and participation in mathematics (Eccles & Jacobs, 1986). This study supports the contention that the lower perception of talent by females has both direct and indirect effects on female participation in the higher levels of mathematics.

Mathematics participation

Students' predicted levels of participation in mathematics, in relation to the HSC and planned career, show that males aspire to a greater degree of participation in mathematics than females. For the HSC, there are more males than females planning to study the highest level, and more females than males planning to study the lowest level of mathematics. These tendencies are also reflected at the state level (Gagen, 1993). Since the

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proportions for female participation are derived from a group of predominantly high-achieving females, the situation becomes still more alarming.

These trends were reflected in the career aspirations of males and females, with more males than females aspiring to careers involving a high level of mathematics, and more females than males intending to select a career requiring quite a low level of mathematics. It is clear that males aspire to higher levels of participation in mathematics than females, both for the HSC and their future careers. These findings are substantiated by the claims of prior research that females are under-represented in the field of mathematics and careers which require mathematics (Fennema et al., 1981; Leder, 1992; Sherman, 1982b; Willis, 1989).

This study has established factors affecting students' HSC plans, namely gender, mathematical task performance and perception of talent. Future research should investigate factors other than gender and planned level of HSC mathematics influencing career choice. It is suggested that the perceived status of occupations may be a fruitful aspect to investigate.

CONCLUSIONS

In summary, students' perceptions of talent act as a mediator between their mathematical performance and their intention to participate in the higher levels of mathematics both in the Higher School Certificate and choice of career. Since females perceive themselves as less talented at mathematics than males, this explains the under-participation of females in the higher levels of mathematics and careers requiring such a level, although it is not clear whether females are under-estimating themselves, or males are over-estimating.

Whether one is concerned with social equity or the national need for technological advance, it is clear that the under-participation of females in mathematics-related careers is an important issue. This necessitates examination of students' plans regarding level of HSC mathematics, since failure to participate in the highest levels of HSC mathematics may preclude entry to many careers requiring mathematics. This study has shown that students' planned HSC mathematics levels can be determined by gender, perception of talent and mathematical task performance. Perceived talent was found to influence HSC plans over and above mathematical performance, implying that it is vital to examine students' gendered perceptions of talent.

Helen Watt, PhD candidate
School of Educational Psychology and Measurement
University of Sydney
New South Wales

Laurel Bornholt
Department of Psychology
University of Sydney
New South Wales

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