GENDER AND PERCEPTIONS OF MATHEMATICS ACHIEVEMENT AMONGST YEAR 2 STUDENTS

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This paper reports on the unexpected findings when a sample of year 2 students' perceptions of their abilities in mathematics were compared with their teachers' perceptions. No significant differences by student gender were found for teachers' assessments, but gender differences in favour of males were found for students' own perceptions. Notable was the finding that in all five classes, including some in which the teachers had rated the females' achievements higher than the males', male students rated themselves higher than the females. Another interesting trend noted was that where the number of males and females in a class was approximately the same, females generally rated themselves more highly than in classes where the females were greatly outnumbered.

INTRODUCTION

For some years concern has been expressed about females' lower participation rates in higher level mathematics courses and in their lower achievements in high cognitive level mathematics tasks. In addition to a range of broader societal factors (see Leder, 1990a, for an overview), a number of affective variables have been identified as possible contributors to both. Confidence in learning mathematics, or mathematical self-concept, is one of the most important of these affective variables (Reyes, 1984).

The literature reveals that relatively strong correlations have been found between confidence in learning mathematics and higher achievement levels (Reyes, 1984). When teacher comments about students' mathematics achievement were used, Leder (1984) found that "students who were considered to be good at mathematics had a higher self-concept than students considered to be poor at mathematics" (p.22). Fennema and Sherman (1977, 1978) found that at both middle and high school levels, gender differences in confidence levels were apparent whether or not gender differences in achievement were evident. Leder (1990b) and Leder and Forgasz (1991) found that, in the absence of gender differences in teachers' assessments of achievement in mathematics, gender differences in perceptions of achievement were evident amongst year 7 students; Leder (1989a) reports similar findings following interviews with year 3 and year 6 students. In co-educational classes, Gill (1992) reported that the vast majority of males ranked themselves in the top half of the class whilst an equal proportion of females ranked themselves in the bottom half. When compared to teacher rankings, girls ranked high by the teacher "seemed unaware of this, while boys so named by the teacher were sure of their position" (Gill, 1992, 4). Amongst year 10 students, Foon (1988) found that "males rated their achievements in traditional male dominated subjects (mathematics and science) higher than did females" (p.52) and that females' self-esteem was significantly lower than that of males.

Confidence in learning mathematics has also been linked to classroom processes (Reyes, 1984). Teachers have been found to interact more frequently with males in year 7 mathematics classes than with females (Leder, 1989b, 1990b); in this same study, a greater percentage of the boys than girls rated their achievements in mathematics above average. Koehler (1990), assuming "that differential treatment led to differential achievement" (p.131), outlined several studies at primary level in the United States which indicated that differential treatment was accorded students in mathematics classrooms according to their gender; boys received more attention than girls, received more higher level questions, initiated more contact with teachers and volunteered or called out more frequently in class. Parsons, Kaczala and Meece (1982) found that certain patterns of teacher/student interactions and past performance in mathematics were predictors of high confidence in mathematics.

Since mathematics self-concept would appear to be related to students' decisions about their future mathematics education, school-based factors contributing to any differences in confidence need to be identified. In Australia, there has been little work in this field with very young students.

The main purpose of the study reported here was to try out two instruments for later use in a larger study. Both instruments had been used in previous research studies but under different conditions. One had been used in the United States with year 2 students (Nicholls, Cobb, Yackel, Wood and Wheatley, 1990); the other was used with year 7 students in Australia (Leder and Forgasz, 1991). This article reports the findings of the trial of an adapted version of the latter of these two instruments. Students' perceptions of mathematics achievement were obtained and compared with teachers' perceptions of student achievements in mathematics.

THE STUDY

The sample

Eighty eight year 2 students in five classes at one large independent co-educational school situated on two campuses in the metropolitan area of Melbourne participated in the study. The students came from similar middle level socio-economic backgrounds. Their five teachers, all female, also participated. Table 1 shows the numbers of students and the gender composition of the five classes.

Table 1: Numbers of students and gender composition of year 2 classes

CLASS No	MALES (N=51)	FEMALES (N=37)	TOTAL (N=88)
1	7	6	13
2	11	6	17
3	10	10	20
4	13	6	19
5	10	9	19

The instrument and method

Students were asked to indicate their perceived rank in mathematics achievement within their own class. A vertical column of twenty faces (the anticipated number of students in each class), divided into five sections, was used; the top section was labelled "best in class at maths", the middle section was labelled "middle of the class" and the bottom section was labelled "worst in class at maths". By colouring in one face only, the students indicated their perceptions of their own achievement levels within the class. A 1-5 rating scale was used with a top rating of five being assigned to a response for which any of the four faces within the section labelled "best in class at maths" was coloured in.

The teachers were also asked to indicate each child's achievement level in mathematics on a five point scale.

Students were required to write their names on the questionnaires since comparisons were to be made between students' and teachers' perceptions of achievement levels in mathematics. With students also indicating their gender, analyses by student gender, as well as by class number, could be undertaken.

Results

The means and standard deviations of both teachers' and students' perceptions of mathematics achievement are shown in Table 2; also shown are the means and standard deviations by student gender.

Table 2: Means and standard deviations of teachers' and students' perceptions of mathematics achievement.

	TEACHERS' PERCEPTIONS			STUDENTS' PERCEPTIONS		
	All students	Males	Females	All students	Males	Females
MEAN	3.33	3.33	3.32	3.95	4.23	3.54
S.D.	1.15	1.18	1.12	1.13	1.03	1.15

Figure 1a. shows the frequency distribution of teachers' perceptions of all students' mathematics achievement. Figures 1b. and 1c. show the frequency distributions of teachers' perceptions of mathematics achievement for males and females respectively. Similarly, Figures 2a., b. and c. show the frequency distributions of all students', males' and females' perceptions of their achievement levels respectively. The similarity of the distributions for teachers' perceptions of females' achievement levels and the females' self-perceptions are noteworthy; the disparity between the comparable distributions for males is particularly striking.

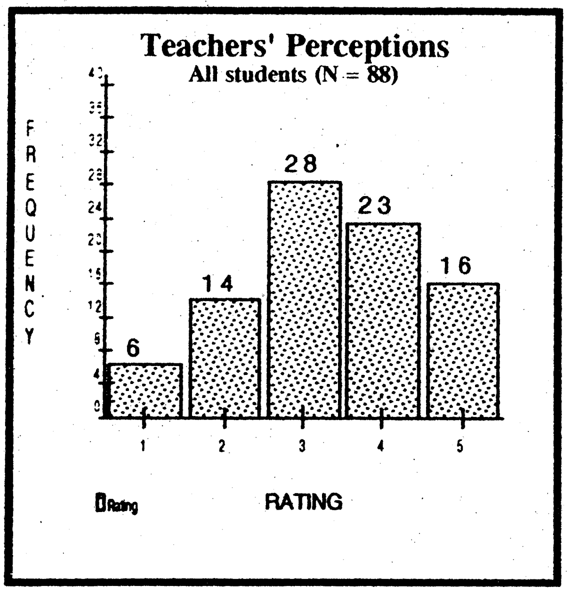

Figure 1a. Frequency distribution of teachers' perceptions of all students' mathematics achievement levels

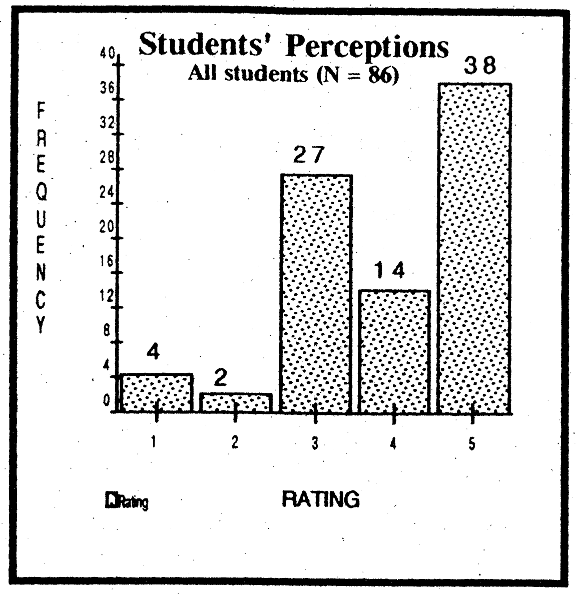

Figure 2a. Frequency distribution of all students' perceptions of their mathematics achievement levels

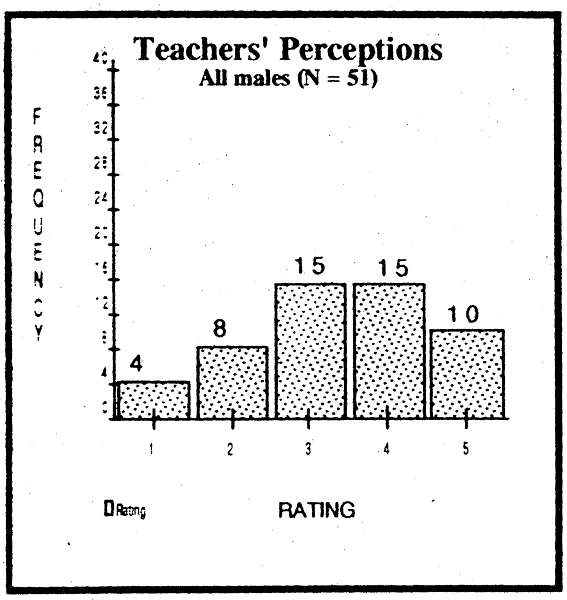

Figure 1b. Frequency distribution of teachers' perceptions of male students' mathematics achievement levels

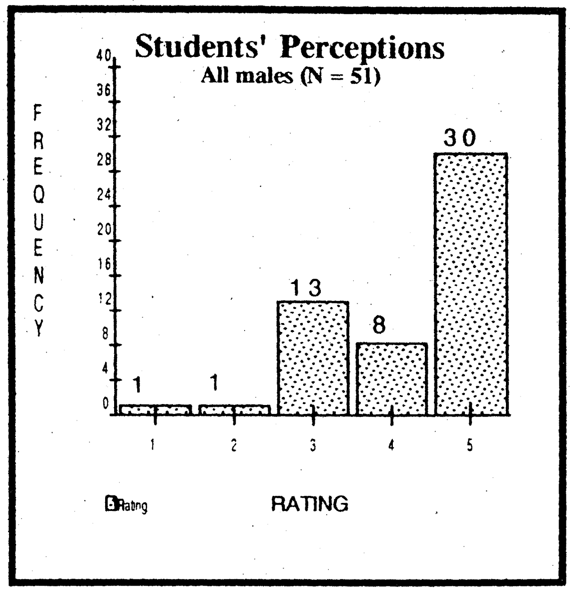

Figure 2b. Frequency distribution of male students' perceptions of their mathematics achievement levels

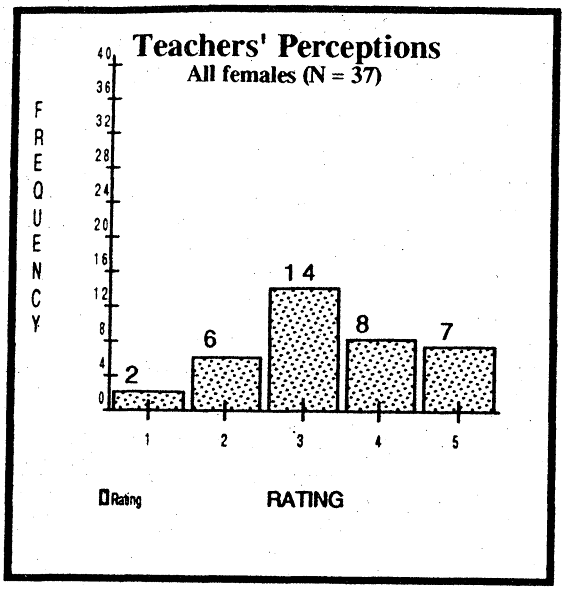

Figure 1c. Frequency distribution of teachers' perceptions of female students' mathematics achievement levels

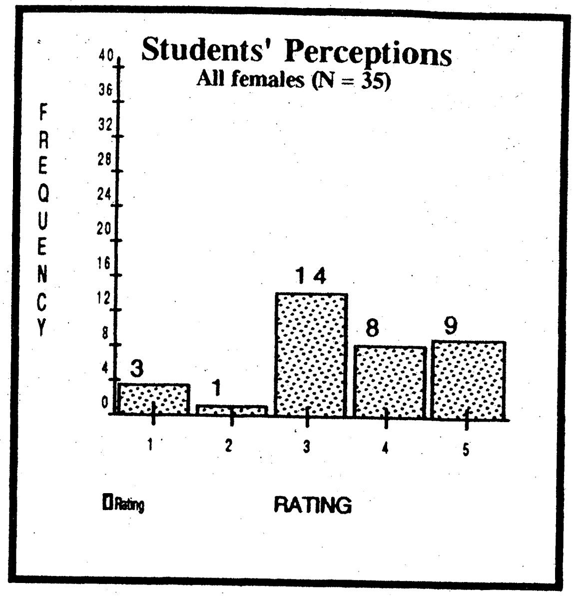

Figure 2c. Frequency distribution of female students' perceptions of their mathematics achievement levels

Pearson product-moment correlation co-efficients between teachers' and students' perceptions of achievement levels were also found. For the entire sample and for males the correlations were only moderate (r=.32 and r=.44 respectively); for females the correlation was low (r=.20). These are particularly interesting considering the frequency distribution patterns described above. It would appear that although, on average, females more closely paralleled their teachers' achievement perceptions, there was not close one-to-one correspondence between them.

Table 3: Pearson product-moment correlations for teachers' and students' perceptions of mathematical achievement levels by gender within class grouping.

Class Number				
1	2	3	4	5
.56	.72	.22	.45	.09
.65	.71	.11	.67	.26
.87	.73	.00	-.29	.05

When Pearson correlations were considered by class and gender within class (see Table 3), it can be seen that for Classes 1 and 2 teachers' and students' perceptions correlated highly whereas in Classes 3 and 5 the correlations were very low. In Class 4, however, the correlation is high for males but moderately negative for females. The reasons for these and the overall correlational differences can only be speculated. Are some teachers more aware of students' abilities than other teachers? Are students receiving differential feedback with regard to their abilities? What roles do societal expectations play? The small samples and the lack of further detail on the classes preclude any conclusions being drawn.

Paired t-tests indicated that the difference in means between teachers' and students' perceptions of achievement was significant for all students (3.33 compared with 3.95, n = 88, t = -4.19, p<.0001), and for males (3.33 compared with 4.23, n = 51, t = -5.50, p<.001) but not for females (3.32 compared with 3.54, n = 35 (two females did not indicate their achievement level), t = -.69). Overall, students have significantly over-estimated their achievement levels compared with their teachers' assessments; male students being the main contributors to this effect. Female students, on the other hand, have assessed themselves in line with their teachers' assessments of their achievement levels.

The mean scores for both teachers' and students' perceptions of achievement level by class number and student gender are shown on Table 4.

Table 4: Mean scores of teachers' and students' perceived achievement levels by class number and student gender

	TEACHERS' PERCEPTIONS		STUDENTS' PERCEPTIONS	
CLASS NUMBER	Males	Females	Males	Females
1 (M=7, F=6)	3.43	4.00	3.86	3.33
2 (M=11, F=6)	3.37	2.83	3.82	2.60 (N=5)
3 (M=10, F=10)	3.40	2.70	4.80	4.00 (N=9)
4 (M=13, F=6)	3.85	3.50	4.46	3.33
5 (M=10, F=10)	2.50	3.78	4.10	3.89

From Table 4 it can be seen that, on average, the teachers of classes 1 and 5 scored the females higher; in the other classes the males were scored higher. A two-way ANOVA for teachers' perceived student achievement levels by class number and student gender indicated that there were no significant differences in mean scores by either class number or student gender but there was a significant interaction effect (p<.05). That is, overall, the teachers did not rate male and female achievements differently, nor were ratings for all students significantly different for each class. However, the different pattern in mean scores for males and females across classes was significant.

Table 4 also reveals that, on average, males scored themselves higher than did the females in each of the five classes. A two-way ANOVA for students' perceived achievement levels by class number and student gender indicated that the differences in mean scores were significant by student gender (p<.05) and by class number (p<.05) but there was no significant interaction effect. That is, males and females rated themselves significantly differently, and students in various classes rated themselves significantly differently.

It is interesting to note that in classes 2 and 4, where the ratio of males to females is greatest (approx. 2:1 in each), the teachers have scored the males higher than the females and the differences in the students' own scores are largest in favour of males. In classes 1 and 5, where numbers of males and females are approximately the same, the teachers have scored the females higher than the males; despite the males scoring themselves higher than the females, the differences are smaller than in classes 2 and 4. These data might be interpreted as suggesting that the ratio of male to female students may have a bearing on the relative perceptions of both teachers and students on achievement levels.

It should be noted that class 3 lends only partial support to the previous suggestion. Here, as in Classes 1 and 5, there were equal numbers of males and females in the class. The female students have rated their own achievements higher than in any other class as too have the males, and the difference in male and female students' own ratings is again lower than in Classes 2 and 4. Yet, the teacher of this class has rated the females' achievements lower than the males and, in fact, lower than the teachers in other classes have of their female students. This would seem to imply that the females in this class are perhaps the weakest amongst all the five classes yet their perceptions of their own achievements are higher than those of the females in the other classes. Again, these data may imply that, irrespective of their actual achievement levels, when females are not in a minority their perceptions of their own achievement levels are not as greatly affected as when the males are in a majority. The higher self-perceptions of achievement levels, compared to others, of both males and females in this class may, in some part, be due to the teacher, perceived teacher quality or to the learning environment in that teacher's classroom.

DISCUSSION AND IMPLICATIONS OF FINDINGS

It is to be remembered that the intent of this study was to trial two instruments and to compare the findings with those reported when they had been used previously under different conditions. However, the somewhat unexpected nature of the results are noteworthy; their implications invite further in-depth investigation.

The lack of gender differences in the teachers' assessments of mathematics achievement at the year 2 level was an expected finding. Previous research has indicated that differences in achievement relate to high cognitive level mathematical tasks and, if evident, emerge in the later years of schooling.

The significant gender differences found in perceived mathematics achievement amongst these year 2 students replicate those reported by Leder and Forgasz (1991) for year 7 students and were not anticipated at the year 2 level. Perceived levels of mathematics achievement are reflections of students' beliefs about themselves, that is their mathematical self-concepts. From the significant differences found between the males and the females across all five classes, it would appear that these year 2 male students were more confident of their ability to learn mathematics than were the females. The invariability of this pattern, even in classes where the teachers considered the females' achievements to be higher than the males' achievements, is notable. A single measure of confidence, however, is insufficient to warrant an explicit conclusion; the consistent pattern across all five classes invites further investigation.

Maccoby and Jacklin (1975) point out that "girls are somewhat more willing than boys to disclose their weaknesses" (p.151) on self-esteem inventories, and that boys score higher on scales measuring how much "an individual disguises his actual evaluation of himself and attempts to present an entirely favorable picture of himself to the researcher" (p.151). The strongest gender differences in attention-seeking behaviour, including boasting, have been found for boys aged 7-11 years (Maccoby and Jacklin, 1975). The gender differences in perceived achievement levels may be partially attributable to the novelty of the research situation for the students or the lack of anonymity of student responses. Boys, more than the girls, may have been prompted to `show off' and disguise their true evaluations of themselves.

FINAL COMMENTS

The young age group for which gender differences in mathematics self-concept are reported here is of specific interest. The consistent pattern of the males' higher self-perception across all five classes is a particularly poignant finding. The smaller differences between males' and females' self-perceptions of mathematics achievement when the gender composition of classes is more evenly balanced is also worthy of note. For more definitive conclusions to be drawn, these issues need be explored in greater depth. A much richer source of information about the students, their teachers and the learning environment would be needed.

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