

Attitude and Attribution in Mathematics:

Gender Factors with Low Achievers

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This research examined the attitude towards mathematics, motivation to do mathematics and the attribution of difficulties in mathematics of a group of low achieving students at a Brisbane metropolitan high school. At this school, boys comprise the majority of students in remedial and special needs classes. The group selected consisted of low achieving students in years eight and nine who were receiving support in the form of one-on-one help in a withdrawal situation, in-class support and a modified curriculum.

Gender Issues in Mathematics Education

Gender differences in mathematics generally relate to differing performance or achievement, participation rates in different courses, and differences in attitude, motivation and attribution of success or failure. The present study focuses on the last of these three categories of differences.

Differences in Mathematical Achievement and Participation

Since the early 1970's there has been a global concern about gender differences in mathematics performance and participation in advanced mathematics courses in high school and college as well as the under-representation of women in maths-related careers. Subsequently there have been many reports in the literature of gender-related differences in achievement in mathematical topics in which the achievements of girls, has in general been below that of boys. (See for example Burton, 1986; Carroll, 1995; Clements, 1989; Fennema, 1985, 1990; and Leder, 1984, 1989). Willis (1990) found differences in performance on mathematical tasks, gender differences dependent upon task types, under-representation of girls in mathematics in the senior secondary school, and differences favouring males in high levels of mathematics achievement. Leder (1992) noted also that although achievements of males and females tend now not to show strong noticeable differences, more males continue to enrol in the "higher level" upper secondary courses and that performance difference in favour of males continue to be found on mathematical tasks that require high cognitive skills.

Differences in Attitude, Motivation and Attribution

The issues of attitude, motivation and attribution are complex and the aims and objectives of the present study were confined to the examination of the students' beliefs and the determination of whether observable differences were present. Girls' under achievement and low levels of participation in mathematics have been related to negative attitude. Bradberry (1989, p. 313) claimed that girls are "less likely to see mathematics as relevant and practical." Moss (1982) has suggested that intervention programs to promote greater female participation will need to address girls' attitudes towards mathematics and problem solving tasks.

According to McLeod (1992), gender differences in attributions also reflect differences in participation. Furthermore, he claimed that mathematical gender differences are influenced by confidence which in turn relates to enrolments. Leder (1984) reported that females tended to attribute failure to low ability, yet did not relate success to high

ability. Willis (1989) explained that girls more often than boys attribute their failure in mathematics to lack of ability by saying that their successes are due to external features such as luck, an easy test or hard work. Consequently, they doubt their capacity to avoid failure or achieve success. In a later study Willis (1990) denied that it is appropriate to say that girls

have lower self-esteem in mathematics than boys. Fennema (1989) identified differences in beliefs held by males and females. She reported that in general males tend to believe that their success in mathematics is due to their innate ability, whereas, by contrast, females tend to attribute failure to lack of ability.

Recent Developments in Gender Issues

There is now evidence to suggest that at the secondary level, not only have girls "caught up" with the boys, but are now achieving better. At the school chosen for the present study, for example, the principal (O'Dempsey, 1994) noted "At our Senior Awards Night, 71% of all awards (all types) went to girls ... This trend also replicated itself at the Junior Awards Night." Leder (1992) now believes the performance gap for males and females is narrowing, with little differences being found in many areas. At the lower end of the achievement scale we have evidence that males outnumber females in remedial and special needs mathematics classes and there is growing concern about "underachieving" males (Koopman & Langan, 1995).

Aims of the Research

From the above considerations, research questions were formulated: What are the attitudes to mathematics and the motivation to learn mathematics of a group of low achieving male and female secondary school students who are in a special needs support program? Are there any differences between the male and female members of the group of low achieving students in their attitudes to mathematics, their motivation to learn mathematics, and the factors to which they attribute their achievement?

The answers to these research questions are expected to generate further questions for discussion and possible research. For example, do these attitudes held by students involved in a special needs support program differ markedly from other low achieving students who do not receive any such support?

Qualitative Methodology

Since the questions called for research into attitudes, motivation and attribution, it was recognised from the outset that the data needed for the study should be qualitative in nature, and therefore it was decided that qualitative research methods would be employed. Generally speaking, qualitative research data are not suited to statistical analysis and it was not the intent of the present investigation to make inferences regarding the populations from which the samples were selected. Nevertheless care in the identification of the population and the description of the sample was made since the study is expected to generate hypotheses which, in later studies might be tested for their validity and degree of possible generalisation to the population from which the samples were selected. Any observed differences in attitudes, motivation and attributes between the two groups may reasonably be expected to be representative of other similar groups throughout the state.

The Parent Population: The school involved in the present study is an outer Brisbane region metropolitan high school drawing a population of mixed socio-economic background but predominantly lower socio-economic background. It has been described in the Australian Bureau of Statistics Data for School Profiles (1995) as being of low family income and high unemployment.

The Sample: The low achieving group were a group of students from mixed grades (8 and 9) who were receiving support from the special needs support group at the school. These students all had been identified as low achievers in mathematics requiring high support needs. The students' needs were being met through partial withdrawal from class, in class support and the provision of a modified curriculum. As noted previously,

the proportion of males in special needs and support classes at the school is greater than females and in the group for the present study there were 10 males and 7 females.

Data Gathering

Each of the 17 subjects identified for inclusion in the sample was interviewed using a structured clinical interview schedule in which a predetermined set of questions relating to attitude, motivation and attribution were asked. The verbal responses to these questions were recorded and the verbal protocols so obtained were categorised for analysis. Some of the questions were drawn from the literature, others were composed by the present writers, based on experience in mathematics education and in special needs support teaching.

Results and Discussion (Selected Questions)

The results of those questions yielding relevant data for discussion are presented. These are listed by category:

Questions Relating to Attitude

Do you like / dislike maths?

Five students, three males and two females, stated that they liked the subject. It has been well documented in the literature that students who have a history of failure such as these students, rarely express a liking for the subject. In view of this it may be surprising that as many as five of the 17 expressed a liking for the subject. There were no noticeable gender differences in the responses to this question.

Do you like learning new mathematical skills?

Fourteen, five girls and nine boys, of the seventeen answered "Yes" to this question. It would appear that despite a general dislike of the subject, the majority of students nevertheless enjoy it when they experience some measure of success.

How do you feel when you do maths?

The responses to this question were categorised and presented in Table 1

Table 1: *Feelings when doing mathematics*

	Male	Female	Total
Negative			
Bored	4	3	7
Frustrated	4	0	4
Other	2	1	3
Total negative	10	4	14
Neutral			
Alright	0	3	3
Total	10	7	17

Not surprisingly, 14 of the 17 students expressed negative feelings when doing mathematics. However, of the ten males, all expressed negative attitudes whereas the responses of the females were evenly divided between negative and neutral. Not unexpectedly, no positive feelings such as "good" were observed. Two of the three females who responded positively to this question also answered that they enjoyed the subject. One female made a somewhat contradictory response that she "disliked" the subject, but felt "alright" when doing it. Somewhat more contradictory were the response of three of the males who reported liking the subject but felt "bored". Digressing interview questions

revealed that they were "used to being bored" with most of their school work and saw no reason for mathematics to be different.

*Do you think maths is important? Do you think maths is a useful subject?
Why or why not?*

Sixteen of the seventeen students answered "Yes" to both of these questions. One student, a male answered "No" to both. Clearly the vast majority of students viewed mathematics as important and useful. Most responses to the first part gave a reason relating to mathematics and job prospects. This result is not totally unexpected since many of these students would be contemplating leaving school at the end of year 10 to seek employment. However, the perception of importance and usefulness by such a high proportion of the students, especially all of the girls is encouraging in view of the overall claim that girls are "less likely to see mathematics as relevant and practical" (Bradberry, 1989, p. 313).

Do you think that it is more important for males to study mathematics than females? Why or why not?

Only two students, one male and one female, answered "Yes" to this question. The remaining students all commented to the effect that mathematics is equally important to both males and females. Clearly, the vast majority of these low achieving students recognised the importance of mathematics for both males and females.

Do you feel confident doing mathematical tasks in class?

Only six students, two girls and four boys responded "Yes" to this question. Five students, two girls and three boys answered "Sometimes", while the rest answered "No". Only two of the seven girls responded "Yes" to this question. Fabricant (1990) found that confidence when doing mathematics was a crucial elements in girls' choices to continue with mathematics. Nevertheless, the proportion of boys who responded "Yes" to this question (four of the ten) was no higher.

Questions Relating to Motivation

Do you care whether you do well at maths? Do you want to improve in maths?

Only two students, one male and one female answered "No" to both these questions. Eight, three females and five males answered "Yes" to both, and seven, four males and three females answered "No" to the first and "Yes" to the second. There were no noticeable gender differences in the responses to these questions.

Other data relating to an aspect of motivation, that of willingness to seek help and spend time studying, were obtained from the responses to several other questions. Responses were classified as being "well motivated", "motivated" or "unmotivated". Only two students, one male and one female, were considered as unmotivated and three were well motivated. Surprisingly, the majority of students indicated some positive motivation in their willingness to either seek help, spend extra time, and attempt homework. Again this is encouraging. Furthermore, no gender related differences were observed.

Questions Relating to Attribution

Have you always had poor results in mathematics?

Do you think that maths is too difficult a subject for you?

If or when you did not do well in a test, would you think that it was because

(a) the content was too difficult, or

(b) you didn't study or put little effort in

Fifteen of the 17 students, including all of the females, answered "Yes" to both of the first two questions. The responses to the third question in this group are presented in Table 2

Table 2: *Attribution of difficulty*

Attribute	Male	Female	Total
Too difficult	3	4	7
Didn't try hard	7	3	10
Total	10	7	17

All of the females and most of the males reported finding the subject difficult. However most of the males attributed this difficulty to lack of effort rather than inability, while the females were more evenly divided in their attribution between lack of effort and the subject being too hard for them. These results are consistent with, though not as marked as, those reported in the literature by Willis (1989), Fennema (1989), and Leder (1984).

Do you think you could you do better at maths? Why or why not?

The results for this question are presented in Table 3.

Table 3: *Question 19 responses*

	Male	Female	Total
Yes	8	4	12
No	2	3	5
Total	10	7	17

Three of the girls who answered "No" to this question stated that they were "trying as hard as I can". None of the boys gave this response. Four girls who answered "yes" said that they could try harder, listen more, or make more effort. Eight boys answered "yes, by working harder etc." The two boys who answered "No" attributed their lack of success to their own inability. These results are consistent with though not as pronounced as, those reported in the literature.

If or when you did well on a test, would you think that it was because

(a) *the test was easy*

(b) *you "fluked it"*

(c) *you had studied & put more effort in*

The responses to this question are presented in Table 4.

Table 4: *Attribution of success*

Attribute	Male	Female	Total
Easy Content	2	2	4
Chance/luck	4	0	4
Self	4	5	9
Total	10	7	17

The group was evenly divided in their attribution of success to either content or self (i.e. hard work). However, four boys attributed their success to luck, while no girls made this attribution. This is contrary to earlier findings reported in the literature. However, it should be noted that these previous studies were of females who largely had experienced some measures of success in mathematics in order to determine to what they attributed such success. The girls in the present study had rarely experienced success in mathematics and for them the question was somewhat hypothetical. Nevertheless, it is noted that if and when success is experienced by the girls, the majority attribute their performance to their own ability.

Summary and Conclusions

Clearly most of the students disliked the subject and experienced negative feelings about it. However, they nevertheless cared about their performance, expressed a desire to do better, and viewed the subject as important and useful. Nearly all lacked confidence when doing mathematics, and though not overall highly motivated, expressed a willingness to spend extra time and seek help with the subject.

There were no pronounced differences between male and female attitudes, liking of the subject, or desire to improve. Importance and usefulness were seen by all. In particular the vast majority of the low achieving females recognised the importance of mathematics for both males and females. Overall, the females' attitudes were no worse than those of the males. From the point of view of the special needs teacher, these are encouraging results. However, further research to investigate the generalisability of this conclusion is recommended before we become too excited about it. It may be that this better than expected perception of the females is a direct result of the students' involvement in the special needs support program, or it may be that overall female perceptions of mathematics as a male domain are, in fact, finally changing.

Recommendations

Further research is recommended to determine whether the decline in the view of mathematics as a male domain shown by this group of students is now more widespread and whether the conclusions of the present research can be generalised to larger sections of the student population. Further research could test how teachers involved with special needs activities such as the withdrawal of students from regular classes and in-class assistance can best help students improve their attitude towards mathematics and motivate them to succeed in the study of the subject. It is also recommended that research continue to investigate the link between the over representation of boys in low achieving groups and their attribution of difficulties with mathematics.

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