Mathematics Anxiety of Pre-Service Primary School Teachers

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The construct "mathematics anxiety" is explored with a sample of first year primary education university students. Self reported measures of anxiety about needing to use mathematics, and anxiety about the prospect of teaching mathematics, are moderately and positively correlated. A scale, appropriate for measuring mathematics anxiety with these students is under development.

INTRODUCTION

The term "maths anxiety" has been used in the literature, in spite of quite differing notions of what actually constitutes "maths anxiety" (Aiken, 1976; Sovchik et al, 1981). Indeed, some researchers have come to the conclusion that no such distinct phenomenon exists, and that so-called "mathematics anxiety" is merely an expression of a more general anxiety (Olson and Gillingham, 1980). This difficulty is not restricted to maths anxiety, Sovchik et al (1981) pointed out that in the psychological literature, there was very little agreement on the exact nature of the more general construct "anxiety".

Whilst a rigorous description of maths anxiety is elusive, some of the definitions which have been used are worthy of consideration:

"...a fear of mathematics or an intense, negative emotional reaction to mathematics" (Sherard, 1981, p.107);

"...feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (Richardson and Suinn, 1972, p.551);

Lazarus (1974, p.16) introduced the term "mathophobia" which he defined as "...an irrational and impeditive dread of mathematics".

A population which has attracted particular attention from researchers of maths anxiety in the US is that of elementary school teachers, both before and after beginning service. These teachers correspond to primary teachers in Australia, in the sense that they tend to teach younger children and are non-specialists. Bulmahn and Young (1982) suggested that "... in general, the kind of person who is drawn to elementary school teaching is not necessarily the kind who enjoys mathematics in the broad sense - from its logical beauty to its real world applications".

Because early experiences of mathematics are likely to play an important part in the development of attitudes to the subject, the question of
whether, or not, maths anxiety is contagious has been canvassed (Bush, 1989; Wood, 1988; Kelly and Tomhave, 1985; Bulmahn and Young, 1982). In specifically addressing the question of whether or not maths anxious elementary teachers transmit their problem to their students, Bush (1989) found no significant relationship between teacher mathematics anxiety and student mathematics anxiety. However Bush did find "...a slight tendency for MA teachers to be more traditional in their teaching" (1989, p. 508).

The authors' interest in maths anxiety stems from experiences teaching pre-service primary teachers, many of whom express fears and attitudes consistent with the definitions of maths anxiety above. This is a preliminary study to begin the development of an appropriate instrument to measure maths anxiety. Further, we seek to gain some understanding of these future teachers' attitudes to and background in mathematics.

METHOD
THE SAMPLE
One hundred and thirteen survey forms were completed by first year students enrolled in a primary education course, 90 females, 22 males and one respondent who did not indicate sex (not all subjects completed all items). These 113 students formed the bulk of the first year cohort for that year. The questionnaires were completed during an orientation session at the beginning of the university year.

THE INSTRUMENT
Two sections of the questionnaire are reported here. The first section required the students to indicate their sex, age: less than 20, 20 to 25 or greater than 25 years, and highest level of mathematics studied. They were then asked to rate their ability to use mathematics in everyday life; choices were: very poor, quite poor, neutral, quite able and very able. The next three items required the students to, in general, rate how anxious each felt when in a situation where she or he needed to use mathematics; how anxious each felt about the prospect of teaching mathematics lessons to children, and how anxious each felt about the prospect of teaching non-mathematics lessons to children. The choices for these three items were: not at all, a little, a fair amount, much and very much.

The second section of the questionnaire consisted of 15 items, listing situations and asking respondents to indicate how anxious they would feel in each situation; choices were: not at all, a little, a fair amount, much, very much. It was originally intended to use a shortened version of Richardson and Suinn's (1972) Mathematics Anxiety Rating Scale (MARS), developed and validated by Plake and Parker (1982). However, these instruments were developed for general use with US college students and so, whilst the format of our 15 items is modelled on these instruments, they were designed to relate more specifically to the students in our sample. In addition to the questionnaire, students during the university year sat for a mathematics "competency test", a course requirement. The
The test used was the PAT 3A, designed to test achievement in mathematics in the range years 5 to year 8.

The Association Between General Anxiety About Needing to Use Mathematics and Anxiety About the Prospect of Teaching Mathematics

Correlations were calculated for the items of the first section of the questionnaire and the PAT score. The significance of each correlation was tested using a one-tailed test and the direction of the association was as anticipated in each case. The correlations are reported in table 1, with the exception of correlations with sex, all of which failed to reach any significance. Whilst some correlations reached significance, most indicated a weak association. Of some interest, however, is the moderately strong association between the students' ratings of how anxious they feel when in a situation where they need to use mathematics and how anxious they feel about the prospect of teaching mathematics lessons to children. These students completed the questionnaire before they had the experience of teaching mathematics. We intend to investigate to what degree the strength of this association is sustained after actual classroom experience. This could be worthwhile in identifying problems at an early stage. As Tischler pointed out: "Teachers are most knowledgeable and perform best in those areas which they enjoy". (1982, p. 40).

Mathematics Anxiety Scale

The fifteen items describing potential anxiety causing situations were subjected to a principal components analysis with varimax rotation. Two factors, which we named General Mathematics and Mathematics Evaluation Anxiety, were isolated with eigenvalues 7.3 and 1.8 and accounting for 49 and 12 percent of the variance respectively. The 13 items comprising these factors, with factor loadings and the percentage of students who responded in the two most extreme categories, are shown in table 2. These two factors are consistent with the factor structure of the 98 item MARS (Rounds and Hendel. 1980) and Plake and Parker's (1982) 24 item revised MARS. The percentage of students responding in the two extreme categories of "much" and "very much" anxiety is quite low for each item. However, it has to be a source of some concern, that these percentages are as high as they are, considering the level of difficulty of the mathematical situations described. The reason we chose not to use the MARS, was that it makes references to senior high school or university level mathematics. The mathematics causing a high level of anxiety for this minority of our sample, is at the level or activity required for their chosen occupation; for example, estimating how much liquid a container can hold or explaining how you got an answer.

Conclusion

This has been a preliminary study, involving the construct of "mathematics anxiety", with a sample of beginning, primary education students. It was our purpose to begin to gain insight into these students' anxiety about the subject of mathematics. We now have an instrument which promises to give a measure of maths anxiety suitable for these students, albeit with a need for validation in the future. Also, this study found an association between
these students' self-reported anxiety about using mathematics and anxiety about teaching mathematics. These results justify further investigation.

REFERENCES


### Table 2

**Principal Components Analysis with Varimax Rotation of Mathematics Anxiety Items with Factor Loadings and (Rounded) Percentages of Responses in the Two Most Extreme Categories of Much and Very Much**

**Factor 1: General Mathematics Anxiety**

- Eigenvalue: 7.3, Variance: 49%

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening to a person explain how she figured out your expenses on a trip, including meals, transportation, housing etc.</td>
<td>.82</td>
</tr>
<tr>
<td>Adding up 596 + 777 on paper</td>
<td>.80</td>
</tr>
<tr>
<td>Reading and interpreting graphs and tables</td>
<td>.70</td>
</tr>
<tr>
<td>Listening to a salesman show you how you would save money by buying his higher priced product because it reduces long term expenses</td>
<td>.69</td>
</tr>
<tr>
<td>Estimating how much liquid a container can hold</td>
<td>.60</td>
</tr>
<tr>
<td>Explaining how you got an answer to a maths problem</td>
<td>.56</td>
</tr>
<tr>
<td>Solving a maths problem without any help</td>
<td>.56</td>
</tr>
</tbody>
</table>

**Factor 2: Mathematics Evaluation Anxiety**

- Eigenvalue: 1.8, Variance: 12%
<table>
<thead>
<tr>
<th>Activity</th>
<th>Probability</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting for a maths exam</td>
<td>.84</td>
<td>14</td>
</tr>
<tr>
<td>Doing a maths assignment</td>
<td>.80</td>
<td>5</td>
</tr>
<tr>
<td>Solving a square root problem</td>
<td>.76</td>
<td>5</td>
</tr>
<tr>
<td>Thinking about taking a basic maths competency test</td>
<td>.67</td>
<td>6</td>
</tr>
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