MATHEMATICAL ANXIETY AMONGST PRIMARY QTS STUDENTS.

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ABSTRACT

This paper investigates mathematical anxiety amongst some primary QTS students. Information for this study has been gathered from students through individual interviews and personal, written, reflections. Analysis of these information sources reveals a number of factors about the seeds of mathematical anxiety, the conditions which foster its growth and, significantly, the depth of emotional responses to mathematics displayed by some students.

If people believe firmly enough that they cannot do math, they will usually succeed in preventing themselves from doing whatever they recognize as math. The consequences of such self-sabotage is personal failure, and each failure reinforces the original belief. And such belieft may be most insidious when held not only by individuals, but by our entire culture Papert, 1980, p42.

DEFINING MATHEMATICAL ANXIETY

Mathematical Anxiety describes states of mind developed through personal experience, and individual emotional responses to these experiences. Negative feelings towards learning school mathematics arise as a consequence of a range of encounters relating to the way mathematics is presented, taught and learnt by individuals. We offer a definition which has developed from interviews with students. Viz.: *"a set of negative feelings towards mathematics arising from individuals' emotional responses to their experience of school mathematics".* The definition is closely aligned to Bessant, 1995, p327, *Mathematics anxiety has become a euphemismfor debilitating test stress, low self-confidence, fear and failure, and negative attitudes towards mathematics learning.*

BACKGROUND & LITERATURE

A consideration of emotional responses to learning mathematics is not new. FitzSimon, Jungwirth, MaaB, and Schloeglmann, 'suggest that *Findings show that adults' relationship to mathematics in school, particularly beyond elementary school, has often been emotionally strained, even that anxiety has become the dominant feeling.* 1996, p 768. Much work has been carried out by Skemp and Buxton about the problems some students have in making sense of and enjoying mathematics. This paper addresses research carried out amongst students from 4-year BSc and I-year PGCE, Primary Qualified Teacher Status (QTS) courses at St Martin's College,

Lancaster and Ambleside, and explores expressions of anxiety about mathematics voiced by a sample of these students.

Skemp, 1971, p127, describes the 'vicious circle' of anxiety, how a student's initial lack of understanding creates anxiety and how this anxiety grows and becomes selfdefeating. Buxton, 1981, p71 suggests that a failure to understand mathematics has wider consequences for the person as a whole:

Since 1997 the Teacher Training Agency (TTA) has set a minimum standard of mathematical competence for KS 1 and KS2 trainees to obtain, in order for them to gain qualified teacher status (QTS). This standard is equivalent to national curriculum level 8 or GCSE grade B. One outcome of this has been for initial teacher training institutions to find ways of seeking to ensure their trainees match this requirement.

METHODOLOGY

At St Martin's College (SMC) (Lancaster, Ambleside and Carlisle) trainees have been offered a variety of support mechanisms such as booklets, extra classes and individual tuition. Throughout engaging with these processes some students made negative unsolicited and spontaneous comments about mathematics, revealing their lack of confidence with the subject. Such comments helped form our intuitive sense of student anxiety with mathematics; we therefore sought to explore these intuitions in greater depth and in a more systematic way , to further inform our growing awareness of students' mathematical anxieties.

Our central aim is to examine the root causes of mathematical anxiety. If it is possible to understand how anxiety grows in students, then we can, perhaps, further develop awareness of how to avoid the growth of such anxiety through our teaching. The review of research into mathematical education prepared for the Cockcroft Committee of Inquiry into Teaching of Mathematics, and carried out by Bell, Costello and Kiichemann, provide a connection between student anxiety and , classroom experiences. *The arguments that the beginnings of anxiety can often be traced to negative classroom experiences seems particularly strong. .. ' Thus it is considered critical to examine classroom practice and establish whether the roots of mathematical anxiety may be in instructional methods and in the quality of mathematics teaching in elementary school.* Bell et aI., 1983, pp54-55.

Interviews were held with seven students who volunteered to take part in audio taped discussions. Three students volunteered to be interviewed in response to an open invitation to discuss feelings towards mathematics. Interviews with the other four students arose as a consequence of them sharing their feelings about mathematics whilst receiving individual mathematics support. Indeed, such was the counselling nature of these mathematics sessions that students appeared to wish to 'purge' themselves of their anxiety with mathematics during the early part of discussions.

Students were invited to describe the thoughts they have when they hear the word "mathematics". The interviewer then sought to develop the discussion based upon interviewees' responses to the initial question. There was no intention by the interviewer to 'lead' the discussion, rather to pick up on comments interviewees made and ask them to expand upon issues raised. All interviewees were keen to describe their early learning experiences with minimal prompting. Furthermore, as a result of describing to colleagues the work we have undertaken, it has been noticeable how many have been all too ready to share their own deep concerns about how they learnt mathematics. For some this proved a seemingly futile sequence of events whilst for others it has been a traumatic experience.

Students' writing followed a more structured approach. At the commencement of their first year in college they were asked to describe their mathematical experiences by Rita Thompson, a tutor at SMC. She asked them to write using the following headings:

- personal feelings towards mathematics;
- the approach used;
- the use of textbooks;
- the influence of the teacher; •

the use of equipment.

ANALYSIS OF ISSUES ARISING FROM INTERVIEWS & WRITING

It is important to recognise that whilst some consensus exists, in terms of the types of experiences students described which led to anxiety, responses could not be classified as positive or negative in absolute terms. So for example learning tables by rote was considered by different students to be both a positive and a negative learning experience. An analysis of students' responses, led us to construct the following general domains within which students described feelings towards mathematics.

- a set of recurring key words and phrases;
- attitudes to particular teaching/learning approaches and references to resources provided, in particular text books, and types of strategies used by teachers;
- statements that ~ndicate the need for devising survival strategies.

Clumping and classifying the key words used to describe mathematical anxiety We clumped together key words offered by students and classified them under three categories:

a) students' direct emotional responses to mathematics: *nightmarish, scared, panic, nervous, dread, hate.*
b) feelings engendered in students by mathematics: *hopeless, embarrassed, frustrated, confused.*

c) students' perceptions of mathematics: *struggle~ difficult, Hard,- complicated, something to be avoided, meaningless, monotonous, boring, uninteresting, repetitious.*

Each category is inter-linked, however, it has been necessary to separate them out in order to understand the implications of the different ways students describe feelings towards and feelings engendered by mathematics. Dealing ... *with adults' ideas of mathematics and their emotional relationship to mathematics. We hold the opinion that both aspects cannot be separated in the end, but we think it is useful to distinguish between them* ... FitzSimons, et al. 1996, p767

Learning approaches and teaching resources

Turning to students' recollections of the ways they learnt mathematics; students made reference to three main areas of their class room experience, which we categorise as: rote-learning, the use of practical equipment, and the use of textbooks.

Rote Learning

... we were learning tables, and during the maths lesson individuals were picked on to stand up and recite a particular table that you were meant to have learnt and for some reason [just didn't seem to be able, even when [*tried to learn them at home, [just could not remember the numbers*

All [*remember about junior school is chanting the nine times table ... [just remember ... the absolute dread of having that finger coming to point at you,*

... it was literally learning it (GCSE-Ievel) *parrot-fashion, like to spill it out at the exam ... [would just remember a page with the formula on and get through that way.*

These students' recollections of the ways they learnt their times tables do not necessarily suggest that a rote learning model cannot be used as an effective approach to learning. However, it is important to acknowledge the effect such pressure can have upon performance, regardless of context. The now' famous' Radio 4 interviews with Steven Byers (7x8 = 54) and David Blunkett (asked to work out 12x9), serve as examples. Indeed such was the pressure felt by Mr Blunkett that he later remarked: *'My mind went blank and Steve Byers revolved in my head. [thought: for God's sake get this right,'* Carvel, J., 1999.

Practical

... there was never any practical maths, like we never really got to get our hands on anything and really experiment for ourselves - it was always from a book or on a piece of paper or off the board.

No hands-on practical stuff or anything like that, just sitting at a table and writing all the time

At primary school maths had a much more hands-on approach which made it a lot more interesting. At high school the approach was much more focused on written work which made it boring.

The absence of hands-on practical work, particularly in secondary school, is a recurrent theme. It is perhaps worth asking why the use of manipulatives such as Cuisenaire Rods, Multi-link Cubes and Geoboards may not be deemed to be the kinds of resources that are suitable for adolescents, particularly from YIO and upwards?

Text Books

SMP booklets - worked at own speed.

In secondary school I can only remember blackboards and textbooks.

In this third category some comments mention a predominantly text based approach directly whilst others refer indirectly to this style. For example one student wrote about the *regimented* approach leaving *no room for surprise.* If mathematics is seen, by some students, as a *regimented, traditional* discipline, learnt from the pages of a textbook, lacking practical approaches or surprises, then it is perhaps understandable that they are not going to gain very much interest from learning mathematics.

Strategies for survival

Students described strategies they used at school by which they were able to conceal their lack of understanding, and what they had to do in order to gain the passport ofa grade .

... I always write in pencil because I can rub it out if I've got it wrong

I felt so scared about it and everything, there were so many times when I just used to cheat, or ask somebody next to me what the answer to the question was. I would rather not understand how to do it but not get humiliated in front of a class full of children.

Comments such as these raise issues about how some students are prepared to learn avoidance strategies, and put them into practice to prevent their lack of understanding being identified: There are implications here about understanding being forfeited at the expense for some students of achieving the desired result of hiding insecurities.

DISCUSSION & CONCLUSIONS

Our work to date indicates that student mathematical anxiety is revealed in a number of related ways and expressed through various emotional responses. The value of teaching and learning mathematics in ways that acknowledge the importance of students' emotional responses cannot be understated. Words expressing fear and boredom occur frequently. How is it that mathematics, a subject considered so important, and described in national curriculum non-statutory guidance as providing:

... opportunities to explore and appreciate the structure of mathematics itself .. Mathematics is not only taught because it is useful. It should also be a source of delight and wonder, offering pupils intellectual excitement and an appreciation of its essential creativity, DES, 1989, engenders such negative feelings?

Although our sample size is limited to 7 interviewees and 21 written responses, there are recurrent themes. In the main our findings suggest this non-statutory advice has not been fully heeded, in some mathematics classrooms, and a culture based on creativity and excitement does not prevail. Instead it appears an approach described by its exponents as 'traditional' or 'reliant on basics' has, in many cases, led to a pupils experiencing mathematics which is centred on fixed rules, procedures and repetitive examples, learnt predominantly from textbooks .... *most teaching continues to rely on published schemes which provide sequencing in excessive detail and can damage teachers' confidence in their ability to make their own decision,* Ofsted, 1994, p 16.

Our research raises general issues about the culture of teaching and learning mathematics. When this culture is based upon, a passive process through which pupils are asked to engage without regard to creativity, specific contexts designed to simulate 'real-life' formats that ultimately trivialises reality, it appears that the seeds of students mathematical anxiety, are sown.

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