

Mathematics and examination anxiety in adult learners: Findings of surveys of GCSE Mathematics students in a UK Further Education college

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In a survey conducted at the start of my GCSE Maths courses around a third of approximately 70 adult learners describe themselves as anxious or very anxious about mathematics, and about half have the same responses for exams.

A further survey in April 2017 to look for patterns in confidence levels around age, gender, or nationality revealed that females of any age educated in Great Britain have a proportionally higher rate of anxiety about mathematics and exams than their non-GB educated or male peers.

Learners' comments included feeling stupid or humiliated in class, being unable to ask questions, and needing more explanation or time. Maths and exam anxiety were rarely linked, and there was little difference between the comments on exams of the maths anxious and non-maths anxious groups, most citing exam pressure.

Learners' views are becoming more positive as a result of their experiences in an adult classroom.

Keywords: adult learners; further education; mathematics anxiety; exam anxiety

Introduction

I teach adult learners in an FE college in the Midlands of the UK. These learners are between 16 and 70 years old, and they attend classes for many reasons, but 75% are in their 20s and 30s and usually looking for a career change, via Access courses and Higher Education (HE). They are working towards a GCSE qualification, which is the exam taken in school at 16 years of age; it is used as a marker for HE, so the grade is critical. Learners have a 3 hour lesson for 30 weeks, and are supported with a wide range of resources, such as computer and paper based materials.

At the start of each academic year I run a survey on the attitudes of the learners on mathematics and exams. This helps inform my teaching to target their needs. Around a third of the learners each year describe themselves as anxious or very anxious about mathematics, and up to a half have the same responses for exams, out of a cohort of approximately 70 learners, 20% of whom are not first language English speakers.

In this paper I share the results of a further survey in April 2017 to investigate whether there are any patterns in confidence levels around age, gender, or nationality, and whether learners identify any key moments or events that shaped their opinions.

Literature review

Maths anxiety has been written about for over 25 years, and publications range from those in education or mathematics journals, to those on psychology. I have drawn on material from the English speaking world for this paper.

There are a number of themes that emerge from the literature review: those which identify causes for maths anxiety, those which identify the effects of that anxiety, and lastly those which discuss interventions to reduce anxiety. A number of publications fall into more than one category.

It is interesting to note the lack of work specifically on exam anxiety, but it does feature as a sub-section of maths anxiety.

Causes of maths anxiety:

Timed testing is identified by a number of publications as a cause of maths anxiety (Ashcraft, 2002; Boaler, 2009, 2016; Tobias, 1993). The pressure to perform within a specified time frame can cause panic, and reduce the ability to think.

Another cause of maths anxiety is believed to be early streaming, which is particularly present in the UK and USA (Boaler, 2016), as it can induce a fixed mind-set, where those in lower sets believe they cannot do maths, and stop trying.

The need for many learners to vocalise in order to encourage, extend and consolidate knowledge is identified as another issue, as in many classrooms a quiet environment is preferred (Sfard, 2008; Tobias, 1993). This may particularly affect females if we believe that they “are more talkative by nature” (Tobias, 1993, p.78).

Unrealistic or irrelevant problems may not appeal, or even make sense, to maths students, and may lead to confusion and disengagement from mathematics (Boaler, 2009; Dalby, 2012).

The mathematics curriculum in the UK seems structured towards end of year or course exams, so there is a constant drive to move on, whether students have gained sufficient skills or not. Topics are revisited in a cycle, in the hope that more students may understand it at subsequent visits. This lack of time is identified by a number of authors as a factor in causing maths anxiety (Boaler, 2009; Swain, Newmarch, & Gormley, 2007). Success and confidence are closely linked, as are low attainment and disaffection (Dalby, 2012).

The relationship between students and teachers can be a critical factor in how well students are able to engage with mathematics in the classroom, and how they feel about the subject (Dalby, 2012; Tobias, 1993; Weil, 1989). Teacher attitudes are also critical, and 16+ learners in FE maths classes valued enthusiastic and committed teachers, who developed positive relationships with their students (Dalby, 2012), using resources that learners can see are useful and relevant to their lives (Barton & Stone, 2013; Dalby, 2012). The negative effect of maths anxiety amongst Primary school teachers on the children they teach has also been documented (Beilock & Willingham, 2014; Macrae, 2003).

The attitude of parents is another factor which can affect students, namely, if parents are dismissive of mathematics, or are themselves anxious about mathematics, this can affect the attitude and perception of the young person, and these beliefs are hard to change (Beilock & Willingham, 2014; Macrae, 2003).

The language of mathematics has also been identified as a contributory factor for anxiety, as many words have conflicting meanings in maths and ‘real life’ (Tobias, 1993), and mathematical meanings may be unfamiliar, and resulted in negative experiences in school classrooms (Woolley, 2013).

Effects of maths anxiety

There are a number of potential effects of maths anxiety, which can be present in many adults, including highly qualified ones, and which in extreme forms can verge

on math phobia (Macrae, 2003). It can particularly effect the self-efficacy and self-esteem of adults (Boylan & Povey, 2009; Dalby, 2012; Lewis, 2013).

The psychological and neurological effects of maths anxiety are seen by some as amounting to a disability, as changes in the brain can determine career choices, employment, and professional success (Young, Wu, & Menon, 2012).

Interventions

Interventions designed to reduce maths anxiety and increase the enjoyment and engagement of learners may come in two forms: either delivery content (Boaler, 2009, 2016; Swain, Newmarch, & Gormley, 2007), or delivery methods, which include encouraging discussion in the classroom and building relationships with learners (Sfard, 2008; Dalby, 2012; Tobias, 1993).

The importance of recognition of failure as necessary for growth in mathematics encourages learners to attempt questions, rather than reject engaging with them (Beilock & Willingham, 2014; Boaler, 2016)

However, no maths book, teacher training guidance, or CPD material has ever been written with the intention of causing anxiety in learners. They will all have been produced with the intention of informing, enlightening, and inspiring, whether they focus on maths anxiety or not.

Method and ethics

Every September since 2014 I have issued a survey form to the learners in my GCSE Maths classes, and asked them to grade their maths and exam anxiety separately on a Likert Scale, from 1 to 5, in response to what were clearly some very anxious learners. Learners have also had room to put comments about why they felt the way they did. Thus I could encourage them to believe that they could 'give' their fear to me and move on. Some learners covered both sides of the survey form in writing, but none of those comments are included here, as I did not have written permission to share them. I have included the statistical information, however, as it has always been clear to learners that it would be in the public domain.

Written approval for a second survey, with the intention of sharing learners' comments, was obtained from the college principal, who requested a guarantee of student anonymity.

Sampling for the study was completely non-random; anyone who was present on the days chosen was invited to take part. All learners were given a letter requesting consent, which included a tear off form to sign and return, a written guarantee of their anonymity, and a 14 day cooling off period, in which they were free to withdraw from the study.

In April 2017 I handed out a second questionnaire, asking learners if they could identify any general or specific events that led to their fear of maths or exams. I also asked if their views had changed, and if so, how they feel now. This was a longitudinal study, as the same learners had been surveyed in September 2016.

There are a number of surveys on maths anxiety in the public domain, but I chose to use one of my own, which was quite open in terms of what could be written, but hopefully avoided any suggestion of prompting for responses. There is no cross checking of responses, but for this small scale action research, designed to support my reflective practice, I felt that was appropriate.

There was one major change in the language used on the survey forms between 2014 and the other years, as discussions at a conference highlighted the need not to prompt for maths anxiety (Peskoff & Khazanov, 2015). The forms were changed to survey for confidence levels, using the same Likert scale of 1 to 5, where 1 is very confident, 2 is confident, 3 is neutral, 4 is anxious, and 5 is very anxious.

Findings

In September 2014 I surveyed 29 learners for maths and exam anxiety. The results for maths anxiety were: 21% described themselves as very anxious, 34% as anxious, 34% as neutral, and 10% as confident. No one described themselves as very confident. The results were the same for exam anxiety, except that two learners moved their responses from anxious to very anxious, changing the percentage points to 28 for each category.

In 2015 there were a number of differences. Firstly the wording was changed so that confidence always came first, and the survey form was entitled 'Maths and Exam Confidence', secondly the survey was conducted in the second week of the term, and lastly, there were 73 participants. Around a third of learners described themselves as anxious or very anxious about maths (34%), with 45% having concerns about exams. There were a few learners who feel very confident (approx. 5%).

The difference between 2014 and 2015 led to speculation about the reasons for the difference, that might not be based on the wording, but on the timing of the survey: has the work in Week 1 already had an effect on learners, or are Week 1 surveys negatively impacted by the anxiety of learners in a class, where the teacher, other students, format and timings are all new and unknown?

In 2016 there were 77 learners who completed the survey, all in Week 1 and almost half (47%) of them felt anxious or very anxious about maths, and almost 60% were anxious about exams (57%). Comparing 2015 with 2016, there is a difference of approximately 15% between the two years, which may be the effect of surveying in Week 1 rather than Week 2.

The second questionnaire was handed out in April to this cohort, and returned by 46 learners. An analysis of the original survey results for the respondents revealed that 12 of the 46 had no concerns about either maths or exams (26%), but 20 were anxious about both (44%). Of the remaining 14 who responded, eight were only anxious about maths, and six only anxious about exams.

The results of an analysis by gender and nationality showed that GB educated females seem to have a proportionally higher level of anxiety than their male, or non-GB educated peers, in this cohort (see Table 1).

A further analysis of learners by age seems to indicate that age is not a factor in anxiety levels (see Table 2).

Group of 46 respondents	Percentage of group	Maths % anxious or very anxious:	Exams % anxious or very anxious:
Whole group	100	59	57
Male	20	10	10
Female	80	90	90
GB	90	96	96
Non-GB	10	>4%	>4%

Table 1. April 2017 Survey Results- Number of Learners by Gender and Nationality

Age bands in years in September 2016	Number of learners out of 46	Maths % anxious or very anxious:	Exams % anxious or very anxious:
Up to 21	5	60	60
21 to 30	14	50	57
31 to 40	20	65	50
41 to 50	7	57	71

Table 2. April 2017 Survey Results- Number of Learners by Age with Anxiety

The April questionnaire was very open ended in terms of the responses that could be given but there were some patterns that emerged from the comments on maths anxiety. These included feeling stupid or humiliated in class, by teachers or other pupils (13 comments), issues around asking questions, needing more explanation or more time (11 comments), poor performance or loss of confidence (7 comments), clashes with staff (6 comments), disengaging from school/maths classes/coursework/maths exams (6 comments), streaming: disruptive lower classes (3), or too low a level (2), unenthusiastic teaching (2), over faced (2), time gap since school (2) and language issues (non-GB 2).

I split the comments about exam anxiety between those that were maths anxious (Group 1- 20 learners), and those that were not (Group 2- 6 learners), in case they were dissimilar, but there seems to be little difference between the two groups. In group 1 there were 22 comments on exam pressure (6), only/more anxious in maths exams (3), fear of failure (3), lack of experience (3), tension and fear (3), intimidated by others working away (2), too many people in the exam room (1) and the gap since last exam (1). In the second group there were 13 comments on exam pressure (7); tension and fear (3), fear of failure (1), too many people in the exam room (1) and lack of confidence in answers (1).

Those that had done Functional Skills in the year prior to GCSE were specifically asked if it had helped. Most of the learners said that it had, but one learner ignored the question.

When asked how they feel now, learners' comments included "I am no longer afraid of Maths, I rather enjoy it now", "relaxed and comfortable environment", "motivated fellow learners", "I'm a lot more positive about maths now", "It has helped a lot at work", "The teacher is understanding", "There is no pressure", "Willing to push myself", "I know it needs time", "I look forward to Maths", "Good when it clicks", "I know I need to work at it" and my favourite: "I love maths", which was written by two learners. There were no negative comments.

Conclusions

Whilst there is some agreement between the literature review and the learners' comments on the causes of math anxiety, namely lack of time, lack of trust, and perceived teacher attitudes, there are also some differences, such as early streaming, where it was not the streaming itself that was a problem, but issues around it (identified by five learners: three for disruptive classes, two for being put in too low a group), and realistic or relevant problems, which was not mentioned at all.

From the learners' points of view, with the benefit of hindsight, the relationship between staff and students seems to have been the critical factor for these learners, but timed testing, or exams, was linked for only three of the respondents, so

in this cohort timed testing was an issue, but rarely only a maths issue. GB educated females had a proportionally higher rate of maths and exam anxiety than their non-GB educated or male peers, but age does not seem to be a factor for anxiety levels.

These findings go some way towards understanding what learners might be feeling when they return to maths learning, and more research is now required to identify specific interventions that help overcome their anxiety.

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